for the people | for the planet | for the future

Friends of the Earth Europe

29 October 2010

Friends of the Earth Europe's response to the EU consultation on Indirect Land Use Change from biofuels

Transport biofuels were introduced as a means of reducing greenhouse gas emissions from the road transport sector and under the Renewable Energy Directive they must meet minimum standards on emissions savings compared to fossil fuels.

However, there is an important loophole: emissions resulting from indirect land use change (ILUC) remain unaccounted for in the emissions calculations. This omission results in systemic miscalculation of GHG emissions from biofuels and encourages conversion of forests and other natural areas into cropland to replace those lost to biofuels production—the phenomenon called indirect land-use change or simply ILUC.

Numerous scientific publications and research papers —from the JRC, FAO, RFA and UNEP to name just a few—indicate that GHG emissions released through ILUC (hereinafter called "ILUC emissions") arising from biofuels production would be substantial and outweigh any savings from using biofuels. The studies published by the Commission for the purposes of its report confirmed previous existing scientific knowledge. All studies show that ILUC emissions are substantial and will lead to an increase of GHG emissions unless ILUC is appropriately accounted for and only biofuels that can truly reduce greenhouse gas emissions are encouraged.

Unless ILUC is addressed with solid legislative measures there is a serious threat that the Renewable Energy Directive and the Fuel Quality Directive will fail their primary policy target, increasing green house gas emissions from transport rather than reducing them.

It is therefore essential that ILUC is properly accounted in the GHG emissions calculations associated with biofuels feedstocks. The unavoidable conclusion from the Commission studies is that the presentation of a proposal to address ILUC is not only appropriate but of paramount importance to ensure compliance with EU climate policy. The studies also provide an indication of marginal GHG emissions from different biofuels feedstocks, which can guide the Commission, in drafting its proposal.

The Renewable Energy Directive and Fuel Quality Directive both contain a legislative mandate to the Commission to produce a proposal on ILUC to address known sources of unaccounted GHG emissions. The proposal must be based on the "*best available scientific evidence*," indicating that the unavailability of additional scientific evidence should not be used to justify Commission inaction or delay.

The Lisbon Treaty and international law contain methods for resolving scientific disputes or uncertainties in the environmental sector—the precautionary principle— which settles these issues in favour of protecting the environment against irreversible damage and providing periodic review and update.

Friends of the Earth Europe asbl Rue d'Edimbourg 26 | 1050 Brussels | Belgium
Tel. +32 2 893 10 00 | **Fax** +32 2 893 10 35 | info@foeeurope.org | **www.foeeurope.org**
Identification number in the lobbying transparency register: 9825553393-31

The European Union needs to take action and ensure that only biofuels that can truly reduce greenhouse gas emissions will be eligible for governmental support. We believe the only credible option in the immediate term, is for the introduction of a robust feedstock specific ILUC factor, in line with its risk of causing indirect land use change emissions.

It is not only on the climate that indirect land use change from biofuels will have negative impacts on. There are the widely reported impacts of biofuel expansion on biodiversity, land right conflicts and hunger, and the levels of land use change predicted by EU modelling show that millions of hectares of forests and grasslands will be lost.

According to the United Nations the rapid increase in palm oil plantation acreage is now the primary cause of permanent rainforest loss in Malaysia and Indonesia.

The World Bank asserted that biofuels contributed to up to 75% of the food price rises in 2008 and ActionAid estimates that up to 100 million more people could go hungry if the UK and Europe commit to increases in biofuels consumption in order to meet new European Union legislation.

It is clear that an ILUC emissions factor will not address these wider environmental and social impacts of indirect land use change caused by biofuel.

Feedstock specific ILUC emissions factors are therefore a minimum requirement keeping in mind that other indirect environmental and social impacts of biofuel expansion are not yet being addressed.

In light of the IFPIR study’s finding that ILUC increases with the size of the overall demand the sustainability of national and European targets that increase the demand for biofuels must be urgently reviewed to reflect the reality of the impacts of biofuel expansion on total emissions, biodiversity and communities. Priority must be given to energy efficiency and renewable electricity in trains and cars to contribute to the EU’s renewable target in transport.

PART 1

THE ANALYTICAL WORK PRODUCED BY THE COMMISSION CONSTITUTES THE BEST AVAILABLE SCIENTIFIC EVIDENCE FOR DETERMINING FEEDSTOCK-BASED ILUC FACTORS

According to the mandate in the RED and FQD, any proposal must be based on the "best available scientific evidence." This indicates that the unavailability of additional scientific evidence should not be used to justify Commission inaction or delay. The analytical work produced by the Commission to date underscores the need for legislative action on this pressing issue. And, as the best scientific evidence available on the impacts of EU biofuel policies, it should form the basis for the legislative proposal described *infra* in Part 2.

The Commission's analytical work shows that the expected land-use conversion resulting from the policy is very significant. Importantly, none of the studies comes out with zero or negative ILUC emissions for any land-using biofuel feedstock.[1] Nor does any study show that moving from today's levels of biofuels use to levels expected by 2020 would, without additional safeguards, result in net GHG emission reductions. As a result, there is a clear need for corrective action.

Despite some variation in the assumptions underlying the studies and differences between models, similar conclusions can be drawn. The Commission studies give enough indication to be able to draw conclusions on two issues relevant for policymakers:

- the aggregate impact of the policy by 2020 based on Member States' predicted use of biofuels in their NREAPs (which will lead to an upfront "carbon debt" that is currently unaccounted for); and
- the marginal GHG emissions for different biofuel feedstocks under different studies that indicate those biofuels leading to GHG emissions increases and those that still meet the GHG-savings threshold (the basis for differentiated "ILUC factors").

In this vein, we first review the aggregate impact of the policy as a whole. Aggregate emissions underscore that propping up an artificial biofuel market with a 10% target without further legislative action is ill-advised, compelling serious reconsideration of the policy as a whole. Next, we review the marginal ILUC impacts of individual biofuel feedstocks, which is what the Commission must resolve to ensure compliance with the GHG-saving criterion in Article 17(2) of RED. Marginal ILUC impacts therefore get at a primary purpose of this consultation. As will be shown below, action should be based on incorporating these marginal impacts for each biofuel feedstock into the accounting system currently in place through the introduction of ILUC factors thereby encouraging greater use of some categories of biofuels and discouraging the use of other categories of biofuels.

The Commission has published several studies for the purpose of producing the report referred to in the legislation. Three of these studies yielded quantitative results on ILUC emissions. The three studies are:

ISPRA for DG CLIMATE
FULL TITLE: Indirect Land Use Change from increased biofuels demand - comparison of models and results for marginal biofuels production from different feedstocks. Joint Research Centre, Institute for Energy, Ispra, July 2010, commissioned by DG ENV/CLIMA, July 2010 (referred to as "ISPRA study");

[1] This is not the case with dedicated energy crops, which were not studied in the Commission's studies, despite the fact that they also use (sometimes fertile) land. ILUC impacts of energy crops could also be substantial and should be further studied.

IFPRI for DG TRADE
FULL TITLE: Global Trade and Environmental Impact Study of the EU Biofuels Mandate, Final Draft Report, March 2010. International Food Policy Research Institute (IFPRI), March 2010, commissioned by DG TRADE, (referred to as "IFPRI study");

JRC ISPRA report quantifying DG AGRI IPTS and IFPRI
FULL TITLE: Biofuels: a New Methodology to Estimate GHG Emissions Due to Global Land Use Change. A methodology involving spatial allocation of agricultural land demand, calculation of carbon stocks and estimation of N2O emissions" by R. Hiederer, F. Ramos, C. Capitani, , R. Koeble, V. Blujdea, O. Gomez, D. Mulligan and L. Marelli. EU Report 24483, 2010 (referred to as "ISPRA study 2").

The results of these three studies, taken in tandem with predicted biofuel usage in NREAPs, indicate the scale of ILUC.
Two other studies were also released:

IPTS for DG AGRI
FULL TITLE: Impacts of the EU biofuel target on agricultural markets and land use: a comparative modelling assessment. Joint Research Centre, Institute for Prospective Technological studies, Seville, July 2010, commissioned by DG AGRI of the European Commission (referred to as "IPTS study ");[2] and

DG Energy Literature Review
FULL TITLE: The Impact of Land Use Change on Greenhouse Gas Emissions from Biofuels and Bioliquids. DG Energy, July 2010.[3]

These two additional studies, however, do not reveal quantitative information on GHG effects of ILUC.

Taken together, these studies represent the best available scientific evidence to date on ILUC impacts of EU biofuel policies upon which the legislative proposal should be based. In reviewing these studies, two important conclusions can be drawn. First, there are calculations for aggregate impacts of the biofuel policies and marginal GHG emissions for different biofuels feedstocks. Second, there is a range of GHG emissions from different biofuels that the ILUC factor must fall within. Each is addressed in turn.

[2] This study stops at analysing land use change impacts but does not translate these impacts into GHG effects. The JRC ISPRA report quantifying DG AGRI IPTS and IFPRI, listed above, translates the land-use change from this study to marginal GHG emissions from biofuels.

[3] DG Energy, which has traditionally driven the EU's biofuel policy and is responsible for RED, decided not to commission an external study. Instead its staff made a literature review that, despite its title, does not draw any quantitative conclusion on ILUC emissions. Therefore, we have chosen not to consider this paper here. We refer to the ICCT review of the literature review for the critical assessment of this work, enclosed herewith.

I. AGGREGATE EMISSIONS IMPACT OF THE POLICY AS A WHOLE

The landscape for this analysis has become much clearer with the submission of the majority of NREAPs in which EU countries project what shares of biofuels they will use. The 23 Member States that submitted their plans by late September include the big countries and therefore give an almost complete picture of the EU's transport fuel market over the next decade. It is now possible to calculate aggregate ILUC impacts based on actual predicted biofuel usage rather than fictitious assumptions.

According to the analysis of the NREAPs,[4] Member States plan to use an additional 15 Mtoe of first generation land-using biofuels by 2020 and 5.4 Mtoe bioliquids.[5] The split between biodiesel and ethanol is approximately 73% in favour of biodiesel. Biofuels are expected to have a 9.5% of the market of fuel for surface transport and first-generation biofuels will constitute more than 92% of this share.[6] The use of bioliquids in electricity and heat sectors will add an additional 2% to this total. Although the figures from the NREAPs analysis differ from assumptions used in the studies, it is nevertheless possible to calculate aggregate ILUC impacts of increases in biofuel consumption using the ISPRA study with the updated numbers. This gives us the best approximation of the actual ILUC impacts due to EU biofuel policy.

Table 1: Estimated Land-Use Change Due to ILUC from biofuels and bioliquids

Table 1	**Increase in production from 2008 to 2020 from NREAPs (Ktoe)**	**Overall land increase to meet 2020 targets (thousand hectares)**	
		Minimum additional land	**Maximum additional land**
Ethanol	4250	1658	2210
Biodiesel	10797	2483	4319
Bio liquids	5462	1000	1892
Total	**20509**	**5141**	**8421**

As noted above, converting forests and other natural areas into croplands releases GHG emissions. Translating the hectares figure into emissions according to the IPCC figures, we come up with the one-off release of GHG emissions *resulting from increased use of biofuels* (excluding bioliquids) between 876 and 1459 Mt CO_2, as illustrated in Table 2. These emissions should be divided over 20 years as specified in RED. After incorporating approximate direct savings from the approximate aggregated use of biofuels due to displacement of fossil fuels, we still end up with a policy that will be a net emitter of 27 to 56 Mt CO_2 per year. This is the equivalent of adding an extra 12 to 26 million cars on European roads by 2020.

[4] We are including the analysis of 23 out of 27 NREAPs.

[5] Bioliquids consumed in the electricity and heat sector are subject to the same sustainability criteria as biofuels in transport and have the same impacts on land use change. However, we did not manage to find, what is the levels of their current use or the so-called baseline. For this reason, we assumed that the baseline was zero.

[6] Includes road, rail and inland waterway transport, excludes maritime and air transport. For simplicity reasons when the rest of this paper talks of 'transport' we mean 'surface transport'.

Table 2: Emissions from Land-Use Change from biofuels (excluding bioliquids)[7]

Table 2	Emissions from land use change		
	One-off ILUC emissions	ILUC emissions on the annual basis (divided over 20 years as specified in RED)	ILUC emissions including GHG savings from biofuels use (divided over 20 years)
	Mt CO2eq	Mt CO2 eq	Mt CO2 eq
Minimum	876	44	27
Maximum	1459	73	56

The IPTS study came up with similar results. According to the JRC report, which calculated GHG impacts of the IPTS study, increasing biofuels from current shares to 7% would lead to estimated one-off GHG emissions of 1.092 Mt CO_2-eq.[8] Averaging this over a 20-year timeframe would yield around 54.6 Mt CO_2 per year.

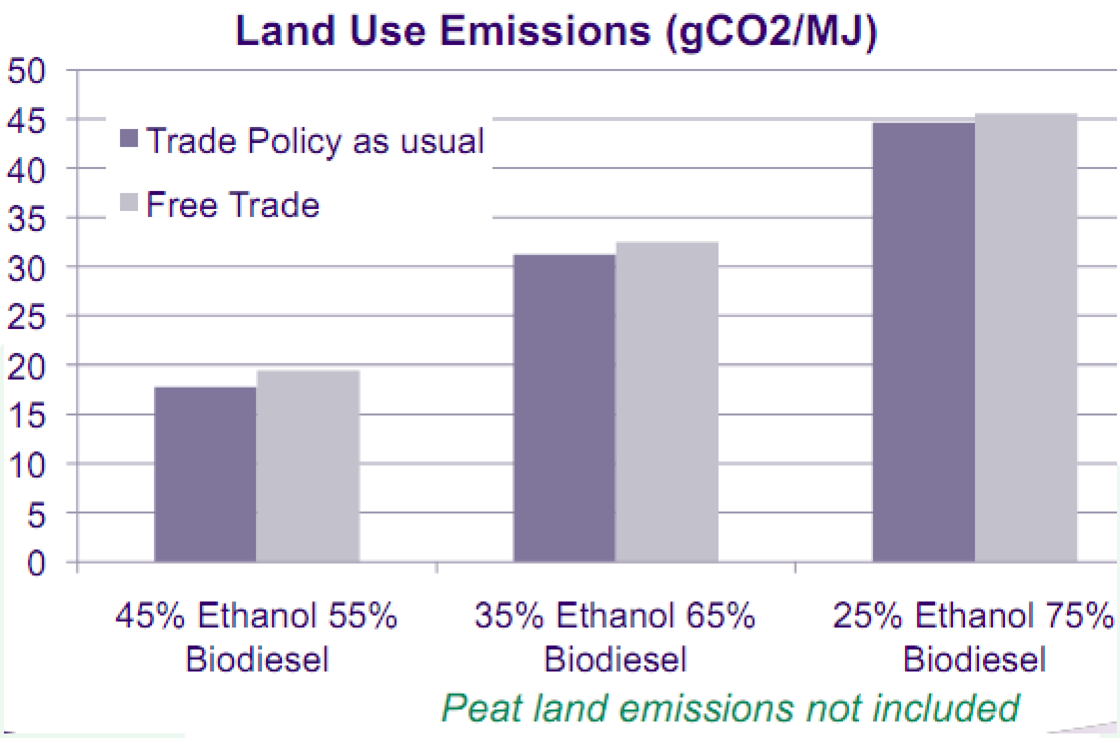
There is one Commission study that came up with net GHG savings from the policy as a whole: the IFPRI study. Its main outcome is that there is a global net balance of nearly 13 Mt CO_2 savings per year, over a 20-year horizon, due to an increase of biofuels from 3.3% to 5.6%. Under the 5.6% scenario, direct emission savings from biofuels are estimated at 18 Mt CO_2 with additional ILUC emissions at 5.3 Mt CO_2 (mostly in Brazil), resulting in a global net balance of nearly 13 Mt CO_2 savings per year over a 20-year horizon.[9] This equates to roughly 32 gCO2eq/MJ.

But there are several reasons why this outcome is too optimistic; we name three.

First, as noted above, the NREAPs indicate that predicted biofuel usage will be much higher than 5.6% and the biodiesel/ethanol split will be hugely skewed toward biodiesel (while the study looks at an almost even split), making the projections based on this assumption irrelevant for our purposes.
IFPRI later made a new assessment correcting for the 45/55 split, but not for the 5.6% overall volume. Its results are in the graph on the next page.

[7] The use of bioliquids would result in additional one-off emissions in the range of 210 – 400 Mt CO2.
[8] Marelli et al. 2010.
[9] JRC ISPRA later recalculated GHG emissions from IFPRI study on the most likely land use changes occurring around the world. For the BAU scenario total GHG emissions from ILUC are estimated at 201 Mt COeq (BAU) and 248 Mt CO eq (FT) over a period of 20 years. This means that net emissions from ILUC would be between 2 and 7 MT CO2 eq over a 20 year period.

Graph 1: the impact of a better biodiesel / bioethanol split in the IFPRI study.
http://www.theicct.org/workshops/iluc_sep10/ICCT_ILUC_workshop_IFPRI_Sep2010.pdf



This graph shows that correcting the biodiesel/ bioethanol split to better reflect reality (i.e. the 25/75% split in the right two columns) increases emissions from land use change by 26 g CO2eq/MJ (from around 19 g CO2eq/MJ to around 45 gCO2eq/MJ). That reduces the benefit estimated in the IFPRI report from 32 to 6 g CO2eq/MJ.

Second, the study virtually ignores emissions from peatlands. According to the ISPRA study these are, depending on where biodiesel is sourced, between 15 (for EU-sourced biofuels) up to 250 g CO2eq/MJ (for Indonesia-sourced biodiesel). This wipes out the remaining 6 g CO2eq/MJ benefit.

Third, the IFPRI study's MIRAGE model turns out to be the model predicting the lowest levels of land use changes of all models analysed in the ISPRA study. Other studies arrive typically at 2 to 4 times higher values.

This means that two conditions under which the 10% target for renewables in transport was adopted will not be met. These conditions were:

1. that biofuels have to be environmentally and socially sustainable. However, the studies show that the target will end up increasing, not decreasing, carbon emissions from the transport sector and have negative impacts on forests, other natural areas, and biodiversity.
2. that "second-generation" biofuels will be commercially available. This studies show, however, that the share of second-generation biofuels will be less than 10% of overall biofuels use.

Both conditions are not met. Therefore, not only should sustainability criteria be reviewed, but so should the 10% target itself.

II. MARGINAL GHG EMISSIONS OF DIFFERENT BIOFUELS

The studies also provide the information needed to address the legislative mandate in RED and FQD. The information required is "annualised emissions from carbon stock losses from indirect land-use change" and would be based on a methodology similar to the approach taken for the other factors. This will be based on modeling, which produces reliable—if not conservative—values down to the feedstock level. There are two ways to calculate marginal ILUC emissions. On the one hand, we can extrapolate emissions per unit of fuel from aggregate emissions of the policy.[10] This would yield a feedstock-neutral ILUC factor applicable across the board. On the other hand, models can extrapolate marginal ILUC emissions for small increases in consumption of specific biofuel feedstocks. This would yield a feedstock-specific ILUC factors, which is the preferred alternative because it better reflects actual differences in feedstock emissions.

For calculating feedstock-specific ILUC factors, the IFPRI study represents the best available information produced to date for EU biofuel policies (see table 4). Despite being a very conservative estimate compared to other studies (see Annex I), it could serve as a basis for the first set of ILUC factors until further research is completed. These should incorporate conservative assumptions about the conversion of peatlands. If the Commission feels that this is inadequate, it can request JRC scientists to provide feedstock-specific values based on their existing modelling comparison study in the ISPRA study. Gathering additional information should not be used as pretext for delaying a legislative proposal. This conclusion is further compelled in that all studies confirm that marginal ILUC impacts of land-using biofuels are substantial and, in most cases, increase emissions of biofuels compared to fossil fuels.

From the table in Annex I of this submission, it can be seen that ILUC emissions range between 16 g CO_2/MJ (IFPRI study for sugar beet under BAU scenario) to 352 g CO_2/MJ (LEITAP for EU biodiesel scenario).

Adding marginal ILUC emissions on top of direct emissions of producing biofuels (cultivation, transport and processing), means that the GHG emissions of most biofuels feedstocks increase compared to fossil fuels. The range is also due to the fact that the studies that we summarize have used two different methodologies, as mentioned above.

The use of additional biofuels up to 2020 as reported in the NREAPS would lead to between 80% and 167% more GHG emissions than meeting the same need through fossil fuel use.

Table 3: IFPRI Study marginal ILUC Factors

Table 12 Marginal Indirect Land Use emissions, gCO2/MJ per annum. 20 years life cycle.

	MEU_BAU		MEU_FT	
	Without Peatland effects	With Peatland effect	Without Peatland effect	With Peatland effect
Ethanol	*17.74*	*17.74*	*19.16*	*19.18*
Ethanol SugarBeet	16.07	16.08	65.48	65.47
Ethanol SugarCane	17.78	17.78	18.86	18.86
Ethanol Maize	54.11	54.12	79.10	79.15
Ethanol Wheat	37.26	37.27	16.04	16.12
Biodiesel	*58.67*	*59.78*	*54.69*	*55.76*
Palm Oil	46.40	50.13	44.63	48.31
Rapeseed Oil	53.01	53.68	50.60	51.24
Soybean Oil	74.51	75.40	67.01	67.86
Sunflower Oil	59.87	60.53	56.27	56.89

Source: Authors' calculations
Note:The marginal coefficient is computed in 2020 after the implementation of the 5.6% mandate.

[10] If we calculate marginal GHG impacts of biofuels on the basis of the assumed use and split of biofuels according to NREAPs and marginal land-use change from ISPRA study, we also come up with the range for an ILUC factor between 38 and 201 g CO2/MJ, as illustrated in Annex II.

III. CONCLUSION

The policy conclusion is that differentiated ILUC factors would have to be initially based upon the ranges provided in the studies to date, which represent the best available science, following the precautionary principle. These values should, however, be regularly updated as science progresses and the Commission should set up a transparent and independent process for doing this. It is also clear that, without legislative action, ILUC emissions will erase any GHG benefits from EU biofuel policies. This means that, under the existing legal framework, Member States will be mandating and subsidising harmful biofuels that actually increase GHG emissions compared to fossil fuels. We therefore have a clear answer to the second question posed by the Commission: yes, from the accumulated scientific evidence, including the Commission's own studies, EU must take action to address ILUC. A contrary conclusion is scientifically indefensible and inappropriate.

PART 2

THE COMMISSION MUST INCLUDE ILUC EMISSIONS WHEN CALCULATING TOTAL EMISSIONS FROM EACH BIOFUEL FOR DETERMINING COMPLIANCE WITH ARTICLE 17(2)

In this section, we will address the third and fourth question from the public consultation regarding the appropriate course of action on ILUC based on the best available scientific evidence. The starting point for this discussion on the form of the response to ILUC must be the mandate to the Commission in Article 19(6) under which this consultation is taking place. Article 19(6) has been subject to an extensive legal analysis, as noted above and enclosed herewith, and is incorporated by reference. For the convenience of the Commission, however, we provide a brief overview here.

In Article 19(6), the EU legislature sets forth in explicit terms its ILUC mandate to the Commission. In addition to reporting and submitting a proposal, if appropriate, the EU legislature stipulates statutory requirements on any proposal. A proposal that fails to meet these requirements should be considered as in violation of clear RED and FQD requirements:

> "The Commission shall, by 31 December 2010, submit a report to the European Parliament and to the Council reviewing the impact of indirect land-use change on greenhouse gas emissions and addressing ways to minimise that impact. The report shall, if appropriate, be accompanied by a proposal, based on the best available scientific evidence, containing a concrete methodology for emissions from carbon stock changes caused by indirect land-use changes, ensuring compliance with this Directive, in particular Article 17(2).
>
> Such a proposal shall include the necessary safeguards to provide certainty for investment undertaken before that methodology is applied. With respect to installations that produced biofuels before the end of 2013, the application of the measures referred to in the first subparagraph shall not, until 31 December 2017, lead to biofuels produced by those installations being deemed to have failed to comply with the sustainability requirements of this Directive if they would otherwise have done so, provided that those biofuels achieve a greenhouse gas emission saving of at least 45%. This shall apply to the capacities of the installations of biofuels at the end of 2012.
>
> The European Parliament and the Council shall endeavour to decide, by 31 December 2012, on any such proposals submitted by the Commission".[11]

Under a plain reading of Article 19(6), the Commission is afforded only two possible options: do nothing or develop a methodology to account for emissions from carbon stock changes caused by ILUC. There is no other option to consider. It further requires that the methodology ensure compliance with the GHG-saving criterion in Article 17(2). This provision renders other actions, such as extending the use of bonuses, tangential to the core legislative mandate.[12] Together, Recital 85 and Article 19(6) make clear that the EU legislature envisioned the Commission developing a methodology with the primary objective of introducing ILUC factor. That is because compliance with the GHG-saving criterion is a biofuel-specific question, which will encourage the use of some biofuel feedstocks, namely those with higher GHG savings, and discourage the use of others biofuel feedstocks, namely those that are destructive to climate and the environment. This dynamic is even more evident with the FQD, which encourages fuel suppliers to use biofuels with higher levels of GHG savings in order to meet the 6% GHG reduction target. The threshold question is therefore whether a proposal is appropriate. Previous chapters on the results of the Commission's studies have sufficiently demonstrated the appropriateness of the proposal.

[11] RED, Article 19(6); FQD, Article 7d(6).

[12] European Commission, Pre-consultation on Indirect Land-Use Change – Possible Elements of a Policy Approach – Preparatory Draft for Stakeholder/Expert Comments (Summer, 2009).

Once the appropriateness question is answered in the affirmative, RED stipulates four statutory requirements on the Commission in fulfilling its legislative mandate: (i) be based on the best available scientific evidence; (ii) include a concrete methodology for emissions from carbon stock changes caused by ILUC; (iii) ensure compliance with RED, particularly Article 17(2); and (iv) include safeguards to ensure certainty of investment. Only introduction of ILUC factors meets these requirements.[13] In tandem with ILUC factors, the Commission may decide to introduce a set of ILUC mitigation options that would incentivize certain practices, such as the use of wastes or residues and responsible use of degraded or marginal lands into productive systems. This approach is further set out below.

I. OVERALL METHODOLOGICAL FRAMEWORK IN THE RENEWABLE ENERGY DIRECTIVE AND ARTICLE 17(2)

Under Article 3(4) the EU legislature outlined the mandatory national overall targets for renewables in transport:

> Each Member State shall ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least 10% of the final consumption of energy in transport in that Member State.[14]

Under this system, Member States were required to adopt NREAPs setting out their national targets for the share of energy from renewable sources consumed in transport. NREAPs must also outline the measures to be taken to achieve those national targets.[15] Member States submit NREAPs to the Commission for evaluation and recommendations.[16] The method for demonstrating compliance with the 10% target in transport requires Member States to calculate the final consumption of energy from renewable sources in transport.[17] To do so, Member States require economic operators to show that biofuels comply with sustainability criteria,[18] likely placing the responsibility on the economic operator that pays the excise duty on the transport fuel.[19]

From the beginning, the Commission envisioned biofuels being the "primary" beneficiary of the 10% target in transport.[20] Early in the legislative process, the Commission minces no words when discussing the objectives of its proposal:

> [I]t is proposed that each Member State shall achieve at least a 10% share of renewable energy (primarily biofuels) in the transport sector by 2020. This is done for the following reasons: (1) the transport sector is the sector presenting the most rapid increase in greenhouse gas emissions of all sectors of the economy; (2) biofuels tackle the oil dependence of the transport sector, which is one of the most serious problems of insecurity in energy supply that the EU faces; (3) biofuels are currently more expensive to produce than other forms of renewable energy, which might mean that they would hardly be developed without a specific requirement.[21]

But not all biofuels are created equal. Some result in more GHG emissions than others and various factors are relevant, including emissions from extraction, cultivation, processing, transport, distribution, production, and use.[22] Also, if new land—forests, for example—is converted as a result of biofuels production, the emissions released during deforestation could far exceed those that would

[13] ClientEarth, Legal Briefing: Legislative Mandate to the Commission on Indirect Land-Use Change (August 2010).
[14] RED, Article 3(4).
[15] RED, Article 4(1).
[16] RED, Article 4(5).
[17] RED, Article 5(1)(c).
[18] RED, Article 18(1).
[19] Directive 2008/118/EC; Directive 2003/96/EC.
[20] COD/2008/0016.
[21] COD/2008/0016.
[22] RED, Annex V(C)(1).

otherwise be emitted using a conventional fossil fuel instead of that specific biofuel. This is because deforestation and forest degradation are significant sources of GHGs. The Intergovernmental Panel on Climate Change (IPCC) estimates that deforestation contributes up to 20% towards total carbon-dioxide emissions. Forest preservation and restoration of degraded forests, on the other hand, are significant carbon sinks. Standing forests contain about 50% of the global terrestrial biomass carbon stocks, and have the potential to contain much more.[23] Forests also harbour two-thirds of all terrestrial species and forest biodiversity provides a critical insurance policy against climate change.[24] And, in addition to their intrinsic and spiritual value, the destruction of forests and other natural areas also undermines the livelihood of local communities and is commonly preceded by land-tenure and human-rights abuses.[25] Increased demand for biofuels is one of the drivers to the destruction of forests and other natural ecosystems. These are very serious issues.

As a result, the EU legislature attempted to discourage reliance on certain biofuels and therefore put in place a set of sustainability criteria. The EU does not allow Member States to count toward their targets biofuels that do not fulfill the sustainability criteria set out in Articles 17(2) to (6).[26] These sustainability criteria apply "irrespective of whether the raw materials were cultivated inside or outside the territory of the Community."[27] Three of the criteria discourage certain direct land-use changes, namely Articles 17(3)-(5) which prohibit: (i) raw material obtained from land with high biodiverse value, such as primary forests, protected areas or certain grasslands;[28] (ii) raw material obtained from land with high carbon stock, such as wetlands and continuously forested areas;[29] and (iii) raw material obtained from peatland.[30] A fourth criterion upholds the rule of law by precluding raw material cultivated in violation of certain EU agricultural and environmental laws.[31] But none of these criteria reduce indirect conversion of forests and other natural areas, which is what happens when existing agricultural land is used for biofuels production. This was intended to be address through Article 17(2) on the basis of the report to be submitted in this consultation. Therefore, this is the sustainability criterion at issue here.

Article 17(2) requires biofuels to meet certain GHG savings compared to fossil fuels – also referred to as the "GHG-saving criterion." The GHG-saving criterion serves as a filter, promoting biofuels that achieve greater GHG savings over those that achieve less. This criterion could reduce ILUC impacts if associated GHG emissions are factored into the methodology. Under RED, the required GHG savings—or GHG-saving threshold—increases over time, starting at 35% in 2009 before ratcheting up to 50% in 2017 and to 60% in 2018 for new installations:

Article 17
Sustainability criteria for biofuels and bioliquids

* * *

2. The greenhouse gas emission saving from the use of biofuels and bioliquids... shall be at least 35%.

   With effect from 1 January 2017, the greenhouse gas emission saving from the use of biofuels and bioliquids... shall be at least 50%. From 1 January 2018 that greenhouse gas emission saving shall be at least 60% for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017.

---

[23] IPCC 2007, FAO 2000.

[24] Thompson, I., Mackey, B., McNulty, S., Mosseler, A. (2009). *Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems*. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series no. 43, 67 pages.

[25] *See, e.g.,* Rights and Resources 2009-2010, *The End of the Hinterland: Forests, Conflict and Climate Change*.

[26] RED, Article 5(1) and Article 17(1).

[27] RED, Article 17(1).

[28] RED, Article 17(3).

[29] RED, Article 17(4).

[30] RED, Article 17(5).

[31] RED, Article 17(6).

> The greenhouse gas emission saving from the use of biofuels and bioliquids shall be calculated in accordance with Article 19(1).[32]

The term "installation" refers to any processing installation used in the production process.[33] The rules on calculating GHG savings provided in Article 19(1) and, through incorporation by reference Annex V, govern compliance with the GHG-saving criterion. Annex V provides methodologies for calculating total emissions from biofuel use.[34] Those total emissions are then compared against average emissions from fossil fuels—called the fossil fuel comparator—to determine GHG savings. Unless ILUC is accounted for, a gaping loophole is created that will undermine the GHG-saving criterion and result in 10% target for renewables in transport resulting in the increase of emissions.

The sustainability criteria are intended as a filter. Member States are responsible for ensuring economic operators meet the sustainability criteria when the biofuel: (i) counts toward their renewable energy targets;[35] (ii) is used for compliance with renewable energy obligations;[36] (iii) receives financial support for their consumption under a national support scheme;[37] (iv) counts toward FQD target for reducing GHG emissions;[38] or (v) receives investment or operating aid under Community guidelines on state aid for environmental protection.[39] The GHG-saving criterion sends clear signals to guide public and private investment.

Reliable accounting of the GHG savings for biofuels is therefore critical. There are two approaches for determining GHG savings in Article 19(1) and Annex V, which are the provisions that Article 17(2) is premised on. The first approach relies on pre-calculated GHG savings for each biofuel: the "default GHG saving." It is the simplest option for economic operators and Member States. Rather than calculate the GHG savings themselves, economic operators simply cite the default values in Annex V tables. The default GHG savings are supposed to be conservative estimates. The second approach requires economic operators to calculate GHG savings themselves: the "actual/disaggregated values." Although more effort is required, the second approach allows economic operators to account for investments in clean technology that may render a biofuel more effective than the pre-calculated default GHG savings would otherwise do. We present below the general GHG-calculation methodology for biofuels.

Both approaches—the default GHG saving and the actual/disaggregate value—rely on the same formula, which is comprised of nine different "factors" that cover the lifecycle GHG emissions to yield "total emission from the use of the biofuel" or E_B:

$$E_{[B]} = e_{ec} + e_{[d]l} + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee},$$

where

$E_{[B]}$ = total emissions from the use of the biofuel;

e_{ec} = emissions from the extraction or cultivation of raw materials;

$e_{[d]l}$ = annualised emissions from carbon stock changes caused by [direct] land-use change;

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use;

---

[32] RED, Article 17(2).
[33] European Commission, Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on country rules for biofuels (leaked circa April 2010), p. 7.
[34] *See* RED, Annex V(C).
[35] RED, Article 17(1)(a).
[36] RED, Article 17(1)(b); see also RED, Article 2(l).
[37] RED, Article 17(1)(c).
[38] FQD, Article 7a.
[39] Notice OJ 2008/C 82/01.

e_{sca} = emission saving from soil carbon accumulation via improved agricultural management;

e_{ccs} = emission saving from carbon capture and geological storage;

e_{ccr} = emission saving from carbon capture and replacement; and

e_{ee} = emission saving from excess electricity from cogeneration.[40]

The total emissions from the use of the biofuel is determined by adding lifecycle GHG emissions from cultivation through use—i.e., extraction, cultivation, processing, direct land-use changes, transport and distribution, and fuel use—and then subtracting any GHG savings from soil carbon accumulation, carbon capture and geographical storage, carbon capture and replacement, and excess electricity from cogeneration. Once total emissions for the biofuel are calculated, E_B, it can be plugged into another formula that compares it against the fossil fuel comparator, E_F, to determine GHG savings:

> Greenhouse gas emission saving from biofuels and bioliquids shall be calculated as:
>
> $GHG\ SAVING = (E_F – E_B)/E_F$,
>
> where
>
> E_B = total emissions from the biofuel or bioliquid; and
>
> E_F = total emissions from the fossil fuel comparator.[41]

The fossil fuel comparator is reported under FQD and has a starting value of 83,8 gCO_{2eq}/MJ.[42] At present, this is the figure against which all biofuels are compared to determine GHG savings. This value will be superseded by the "latest actual average emissions from the fossil part of petrol and diesel in the Community" when that information becomes available from annual reports submitted under FQD – the first reporting taken place in 2011.[43] Under the starting value for the fossil fuel comparator of 83,8 gCO_{2eq}/MJ, in order to meet the GHG-saving threshold of 35%, a biofuel would have to emit 54,47 gCO_{2eq}/MJ or less, calculated as follows: $GHG\ SAVING$ = (83,8 – 54,47)/83,8 = 35%. The key variable affecting the GHG savings for any given biofuel is its total emissions from use or E_B.

This overall methodological framework has several advantages. It provides flexibility when calculating GHG savings, allowing the economic operators to use either the default GHG savings or to calculate the actual GHG savings themselves. In combination with the FQD, which incentivises higher levels of GHG savings, the approach is technology-forcing and rewards investments in clean technology. It is also adaptable to new entrants on the market. This if further demonstrated in the discussion in the Annex III, which shows how default and actual values work in practice.

II. Incorporating ILUC into the Methodological Framework in RED and Article 17(2)

Thus far, it can be seen that biofuels have substantial marginal GHG emissions that, according to the legislative mandate, should be addressed in the form of ILUC factors. Therefore, the Commission will need to introduce an ILUC factor, e_{iluc}, into the formula for calculating total emissions. We turn to the form to achieve this below.

An ILUC factor would represent "annualised emissions from carbon stock losses from indirect land-use change" and join the other factors covering lifecycle emissions: $E_{[B]} = e_{ec} + e_{[d]l} + e_{iluc} + e_p + e_{td} + e_u – e_{sca} – e_{ccs} – e_{ccr} – e_{ee}$. ILUC can be determined based on the modeling of predictable land use change as a result of increased demand for biofuels driven by the EU policies. The studies and underlying modeling produce reliable figures down to the feedstock level, as demonstrated in the

[40] RED, Annex V(C)(1).
[41] RED, Annex V(C)(4).
[42] FQD, Annex IV(C)(19); see also RED, Annex V(C)(19).
[43] FQD, Article 7a

IFPRI study and JRC report, which represent the best available scientific evidence.[44] Therefore, their results should serve as the basis for determining the values for differentiated ILUC factors for each feedstock.

In the face of uncertainty, the precautionary principle—a bedrock principle under international law and the Lisbon Treaty—dictates the use of figures based on the higher end of the spectrum.[45] Annex V(A), which contains the default GHG savings, should be regularly updated to reflect the scientific progress. Economic operators could adopt the default GHG savings for that biofuel listed in the table. A table would also be added to Annex V(D) and (E) with disaggregated values, which should list the feedstock-specific ILUC factors for when the economic operator elects to calculate actual emissions rather than rely on the default GHG savings. This would allow economic operators to rely on the disaggregated value when calculating total emissions, should that be the preferred route toward showing compliance with Article 17(2). In short, by simply updating the existing framework with amendments to include ILUC emissions, the EU can promote less-damaging biofuels. In addition, it is important that the Commission review these figures periodically, revising them as necessary in order to reflect the best available scientific evidence.

The practical effect of introducing ILUC factors is to promote biofuels that do not lead to the conversion of natural habitat and reduce GHG emissions compared to a fossil fuel comparator. It is imperative to avoid a policy that is based on names, i.e. promoting biofuels for the mere fact that they are produced from second-generation feedstocks. Those second-generation biofuels produced from dedicated energy crops, such as ligno-cellulosic materials, also require land and can cause ILUC.

In certain circumstances, it would be appropriate to provide economic operators with exemptions or reductions to the ILUC factor e.g. in cases of feedstocks that don't require land or biofuels from real waste materials. In order to avoid displacement effects and hence ILUC, 'waste' must be defined to only include substances without any economically viable functions or useful purposes. This is because, for wastes already used in other sectors, diversion to the biofuel market will likely result in their replacement with other substances with subsequent indirect impacts. One example is tallow that is currently used in heating in the meat processing sector. If this tallow is diverted to biofuel market, it is likely that fossil fuel will be used for heating purposes, which will lead to emissions increase. The definition should also be flexible enough to account for the fact that what is a waste today could change over time as new markets and technologies are created, leading to competition over the feedstock.

In all other instances where ILUC cannot be reduced or eliminated, the legislation must include feedstock specific ILUC factors, that are updated regularly taking the best available scientific evidence into account.

Together, these amendments would ensure a concrete and robust methodology for emissions from ILUC-induced carbon stock changes, fitting seamlessly within the overall methodological framework in RED. The Commission should update these figures as the science on ILUC progresses. This periodic review should be timed to coincide with the other reporting requirements.

---

[44] *See, e.g.,* IFPRI Study and JRC Study.

[45] ClientEarth, Legal Briefing: Legislative Mandate to the Commission on Indirect Land-Use Change (August 2010).

PART III

ILUC BEYOND CARBON

GHG emissions are not the only impact of ILUC. Biodiversity is also adversely affected by land conversion in the form of ecosystem degradation and habitat loss. Biodiversity and ecosystems—and the services they provide—are closely connected to each other and to the climate system. Biodiversity is crucial for both mitigation of and adaptation to climate change.

Often considered a bonus, biodiversity is essential for humankind's continued existence on this planet. Put simply, biodiversity forms ecosystems and ecosystems provide services, such as clean air and water supply. Without biodiversity many of the ecosystems and their services will probably collapse. Without these ecosystem services, the planet will become uninhabitable for many forms of life and in many regions. In fact, ecosystem-based adaptation has been highlighted as a win-win strategy because it "can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of biodiversity."[46] If ecosystems have been degraded or lost because of increased pressure from biofuel policies their assistance in adaptation is also lost. Therefore, the EU should refine its ILUC modeling to specifically protect biodiversity, not just carbon.

Furthermore, increased demand for biofuels also has social impacts. The latest OECD-FAO Agricultural Outlook concludes that food prices could rise by 40% by 2019, partly because of the increasing demand for biofuels. In 2019, 16% of the global production of vegetable oils would be used for biofuels, which is described as a conservative estimate.[47] With the demand for food also on the rise, conflicts over forests, land boundaries, and land-use will heat up. And indeed tensions are already rising: the World Bank recently warned that EU and US biofuel policies have already resulted in land-grabbing. The World Bank's recent inventory of large-scale land acquisitions[48] cites demand for biofuel feedstocks as a reflection of policies and mandates in key consuming countries a key factor underpinning the expansion of global cultivated land; with biofuels representing over a third of the so-called investments projects. Investors around the world have begun a land rush in African and other developing regions of the world, pushing out areas that had been previously used for food.

In this context, it is important to underscore an inconvenient, but not unsurprising, dilemma: modelling studies carried out for the Commission predict that increased biofuel demand leads to either substantial land-use change or substantial food-price increases. Economic theory shows that increased demand can be met either by increased supply (which leads to ILUC) or by higher prices. Commission analyses systematically ignore the fact that food price increases leading to lower consumption (which most models show) will not have an even effect but will hit hardest the most vulnerable and food insecure populations.

---

[46] SCBD Secretariat of the Convention on Biological Diversity. 2009. Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Montreal, Technical Series No. 41, 126 pages. http://www.cbd.int/doc/publications/cbd-ts-41-en.pdf

[47] http://www.agri-outlook.org/document/9/0,3343,en_36774715_36775671_45438665_1_1_1_1,00.html

[48] World Bank, September 2010: Rising Global Interest in Farmland, http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/0,,contentMDK:22694293~pagePK:64165401~piPK:64165026~theSitePK:469372,00.html (pg. 35)

CONCLUSION

The primary objective of RED is to combat climate change and increase use of energy from renewable sources.[49] The primary objective of FQD is to decrease the carbon intensity of transport fuels used in the EU. Yet without accounting for ILUC, GHG reductions on paper will not correspond to the reality which is that under current policies, increased demand for biofuels will increase, not reduce, GHG emissions. This erodes EU's political credibility on climate, biodiversity and development issues. These issues must therefore be taken very seriously and addressed by proposing a robust set of feedstock-differentiated ILUC factors before the end of this year as the legislation stipulates.

[49] RED, Recital 1.

Annex I: Marginal emissions from indirect land use change – Summary of Commission's modelling studies

This Annex provides an overview of the Commission modelling studies and how different biofuel feedstocks perform in terms of GHG emissions, when ILUC is added. The values provided are intended to provide an overview of marginal emissions from different modelling exercises. Note that different methodologies are used (i.e. marginal ILUC modelling in the case of JRC ISPRA and IFPRI and average ILUC factor in the case of IPTS report). Also note that in case GHG savings have negative values, it means that a specific biofuel will increase emissions compared to fossil fuels.

Scenario	ILUC emissions including emissions from peatlands	direct emissions from RED (default value)	GHG emissions from biofuels including ILUC	GHG savings (from the RED)	GHG savings (after ILUC is included)
LEITAP Biod EU-Deu*	352	44	396.2	47%	-373%
FAPRI Biod EU	99	44	143.3	47%	-71%
AGLINK Biod EU	40	44	84.2	47%	0%
AGLINK Biod US **	42	58	100.3	31%	-20%
GTAP Biod mix EU	73	44	117.2	47%	-40%
LEITAP Biod INDO***	326	29	355.1	65%	-324%
GTAP Biod Ind/Mal	79	29	107.7	65%	-28%
LEITAP Wht Eth EU-Fra	143	26	169.4	69%	-102%
FAPRI Wht Eth EU	69	26	95.0	69%	-13%
AGLINK Wht Eth EU	100	26	126.4	69%	-51%
IMPACT Wht Eth EU	39	26	65.0	69%	22%
GTAP Wht Eth EU	140	26	166.2	69%	-98%
IMPACT Wht Eth US	39	26	65.0	69%	22%
LEITAP Maize Eth US	151	43	194.0	49%	-131%
AGLINK Coarse Grain Eth US	89	43	132.2	49%	-58%
GTAP Coarse grains Eth US	37	43	79.6	49%	5%
IMPACT Maize Eth US	19	43	61.7	49%	26%
IMPACT Coarse Grains Eth EU	20	43	63.3	49%	24%
AGLINK Sugar cane Eth Bra	23	23	46.4	71%	45%
IFPRI BAU sugarbeet	16	40	56.1	52%	33%
IFPRI BAU sugar cane	18	23	40.8	71%	51%
IFPRI BAU maize	54	43	97.1	49%	-16%
IFPRI BAU wheat	37	26	63.3	69%	24%
IFPRI BAU palm oil	50	29	79.1	65%	6%
IFPRI BAU rapeseed	54	44	97.7	47%	-17%
IFPRI BAU soybean	75	58	133.4	31%	-59%
IFPRI BAU sun flower	61	41	101.5	51%	-21%
IFPRI BAU (JRC report)	34	21	65.0		22%
IFPRI FT (JRC report)	41	28	69.0		18%
IPTS AGLINK CG (JRC report)	63	48	111.0		-32%
IPTS AGLINK GM (JRC report)	64	48	112.0		-34%
Petrol (draft FQD)		85.8			
Diesel (draft FQD)		87.4			
Fossil fuel comparator in the RED		83.8			

** US biodiesel we assumed soy

*** Ind/Malay we assumed palm oil

Annex III: Discussion on the GHG calculation methodology of biofuels

Default Values for Biofuels

The default GHG saving is the simplest option. Economic operators claim the default GHG saving listed for each biofuel to determine compliance with the 10% target:

> [W]here a default value for greenhouse gas emission saving for the production pathway is laid down in part A or B of Annex V and where the e_l value for those biofuels or bioliquids calculated in accordance with point 7 of part C of Annex V is equal to or less than zero, [GHG savings may be calculated] by using that default value.[50]

In effect, economic operators claiming default GHG savings are relying on a typical calculation of total emissions from use of that specific biofuel, which then incorporates a margin of error before comparing it to the fossil-fuel comparator to determine its GHG savings. The GHG savings is pre-calculated and listed in an Annex V table. No other calculations are necessary. The table can be found in Annex V(A) of RED with default values for 24 different biofuel production pathways, ranging from a default value of 16% for "wheat ethanol (process fuel not specified)" to a default value of 83% for "waste vegetable oil biodiesel" (*abridged table set out for illustrative purposes*):

Typical and default values for biofuels if produced with no net carbon emissions from land-use change

Biofuel Production Pathway	***Typical GHG Saving***	***Default GHG Saving***
sugar beet ethanol	61%	52%
wheat ethanol (process fuel not specific)	32%	16%
wheat ethanol (straw as process fuel in CHP plant)	69%	69%
corn ethanol (natural gas as process fuel in CHP plant)	56%	49%
sugar cane ethanol	71%	71%
rape seed biodiesel	45%	38%
sunflower biodiesel	58%	51%
soybean diesel	40%	31%
palm oil biodiesel (process not specified)	36%	19%
palm oil biodiesel (process with methane capture at oil mill)	62%	56%
waste vegetable or animal oil biodiesel	83%	83%
hydrotreated vegetable oil from rape seed	51%	47%
hydrotreated vegetable oil from sunflower	40%	26%

For example, under the 35% GHG-saving threshold, economic operators relying on default GHG-saving values for "wheat ethanol (process fuel not specified)" would be precluded from counting that biofuel toward the 10% target because its GHG saving of 16% is under the 35% GHG-saving threshold. At a default value of 83%, however, "waste vegetable oil biodiesel" easily meets the 35% GHG-saving threshold and Member States may count the biofuel use toward their targets.

[50] RED, Article 19(1)(a).

The default GHG savings may only be used when *direct* land-use change is zero.[51] Direct land-use change is the conversion between six land categories used by the Intergovernmental Panel on Climate Change—forest land, grassland, cropland, wetlands, settlements, and other land—plus a seventh category of perennial crops, which are multi-annual crops whose stem is typically not harvested such as short-rotation coppice and oil palm.[52] Therefore, when the biofuel feedstock is grown directly on forests or other natural areas that have been converted for that purpose, the GHG emissions of the conversion must be included in its GHG saving. Since the default GHG saving does not consider direct land-use change, it is rendered inapplicable. RED contains methodologies for calculating direct land-use change that rely on the work of the Intergovernmental Panel on Climate Change for standard values for the reduction of carbon stocks after conversion.[53]

But direct land-use change is only half the land-use problem. ILUC, by contrast, occurs when the biofuel feedstock is grown on existing cropland. Unless the default is adjusted to account for ILUC emissions, the default GHG-savings values will chronically underreport emissions thereby incentivizing reliance on them to avoid having to account for GHG emissions from direct land-use change. For this reason, the default GHG-saving values must be adjusted to take this scenario into account.

Actual Values and Disaggregated Values for Biofuels

In lieu of the default GHG savings, economic operators may engage in more arithmetic to calculate the GHG saving for the biofuel.[54] Rather than rely on a typical calculation in the default GHG saving, economic operators may determine the GHG emissions for each factor themselves. The sum of these factors is then compared to the fossil fuel comparator to determine the GHG saving for the biofuel. Economic operators select between two alternatives to calculate the factors: the actual-value alternative or the disaggregated-value alternative. Each is addressed in turn.

The actual-value alternative uses "an actual value calculated in accordance with the methodology laid down in part C of Annex V." [55] Most factors have an Annex V(C) methodology. For example, the methodology for the factor on emissions from processing, e_p, considers the "emissions from the processing itself; from waste and leakages; and from the production of chemicals or products used in processing" with further provisions outlining how to account for electricity not produced through co-generation.[56] These methodologies provide extensive guidance to Member States and economic operators on the relevant considerations for each factor.

The disaggregated-value alternative uses "disaggregated default values in part D or E of Annex V."[57] An economic operator might use the disaggregated-default alternative when calculating the actual value is too burdensome or impossible for all factors. The disaggregated values are found in tables in Annex V(D) and (E), and represent typical GHG emissions and sometimes include a margin of error (*abridged table set out for illustrative purposes*):

[51] RED, Article 17(2)(a).
[52] European Commission, Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on country rules for biofuels (leaked circa April 2010), p. 15.
[53] RED, Recital 71.
[54] RED, Article 19(1)
[55] RED, Article 19(1).
[56] RED, Annex V(C)(11).
[57] RED, Article 19(1).

Disaggregated default values for cultivation: 'e_{ec}' as defined in part C of Annex V

Biofuel Production Pathway	***Typical GHG Saving (gCO_{2eq}/MJ)***	***Default GHG Saving (gCO_{2eq}/MJ)***
sugar beet ethanol	12	12
wheat ethanol	23	23
corn ethanol	20	20
sugar cane ethanol	14	14
rape seed biodiesel	29	29
sunflower biodiesel	18	18
soybean diesel	19	19
palm oil biodiesel	14	14
waste vegetable or animal oil biodiesel	0	0
hydrotreated vegetable oil from rape seed	30	30
hydrotreated vegetable oil from sunflower	18	18

Once each factor is determined—whether relying on its actual or disaggregated value—their sum yields the total emissions from use of the biofuel. For example, an economic operator using sunflower biodiesel may decide to use the disaggregated value for the cultivation factor (e_{ec} = 18 gCO_{2eq}/MJ) but choose to determine the actual values for the remaining factors according to the Annex V methodologies. The sum of all the factors will yield the total emissions from use of that biofuel, which is then compared to the fossil fuel comparator to determine its GHG saving. Because the disaggregated values are conservative estimates, calculating the actual values should produce a lower value for GHG emissions and make that biofuel more competitive. Economic operators are allowed to select among the two alternatives, subject to certain restrictions, in an effort to provide flexibility and reduce administrative burdens. Although there is a factor and methodology for direct land-use change, there is neither a factor nor a methodology for ILUC.