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Assessing the EC ILUC proposal

Dutch National Impact Assessment

- Confidential –

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Foreword

This report aims to support the Dutch ministry of Infrastructure and the Environment with a view to negotiations on EU biofuels policy and Indirect Land Use Change, which currently take place in EU context. Four years after the EU decided upon an ambitious biofuels policy with sustainability criteria, the European Commission intends to include measures to avoid negative indirect sustainability impacts of biofuels. This discussion concerns both future EU biofuels policy but also the sustainability of the entire global agricultural system, which is still a long way ahead.

Ecofys would like to thank the Ministry of Infrastructure and the Environment as well as NL Agency for enabling us to draft this report. In part, this report builds on earlier work by Ecofys and others. We aimed to correctly reference sources used. Any errors in the text are our responsibility. We would like to thank various biofuel industry stakeholders who we consulted when writing the report and who provided specific input on the EU biofuels market, technology and investments.

The EU needs sustainable biofuels in aviation, shipping and long-haul road transport if it wants to create a fully renewable energy system by 2050. Until the time that biofuels become cheaper than fossil fuels, their deployment depends on long-term political and societal support and will only be accepted if sustainable production is ensured. This includes direct as well as indirect sustainability. If a credible and durable solution can be found to address Indirect Land Use Change and smart incentives are introduced and maintained for sustainable biofuels; EU biofuels can have a bright future ahead.

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Table of contents

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1 Executive Summary

Members of the European Parliament and Council currently discuss the legislative proposal on Indirect Land Use Change (ILUC) which the European Commission published in October 2012 ILUC is the effect that when existing agricultural land producing food is used for biofuel feedstock production, food production is reduced and this reduction is partially compensated by the conversion of non-agricultural land into new cropland elsewhere. ILUC can have a negative impact on the GHG performance of biofuels and can lead to loss of biodiversity. ILUC, its quantification and possible policy measures have been debated in the EU since 2008.

The final legislative text to be negotiated on the basis of the ILUC proposal is likely to have a profound impact on the current EU biofuels market market but especially on its future development. This report assesses the legal soundness and factual basis of the proposal. It also assesses the policy risks, effectiveness of, and economic consequences resulting from the four most important proposed measures. Alternative scenarios are explored for each of the proposed measures. The report starts with a description of the Dutch biofuels market as the current situation and future perspective of this market is naturally of specific concern for Dutch negotiators in Brussels.

This report takes the IFPRI 2011 modelling study as a starting point when assessing the ILUC impacts of EU biofuels. This because the study is the best available modelling work on EU biofuels and is used by the European Commission as a starting point in assessing biofuels ILUC impacts. The IFPRI study modelling results assign high ILUC emissions to conventional biodiesel and assigns much lower ILUC emissions to conventional ethanol. The study does not model ILUC effects of advanced biofuels.

The Dutch biofuels market is dominated by biodiesel, of which a large share is double counting. Following the IFPRI 2011 ILUC modelling, this means that a high share of biofuels with a high ILUC risk are supplied to the market but also a high share of advanced, double counting biofuels with a low to medium ILUC risk. The Netherlands hosts a relatively large oilseed crushing and biofuel production industry, of which an important share consists of advanced biofuel production. This means the ILUC proposal probably has winners as well as losers in the Netherlands, with the future growth outlook of the crushing industry and conventional biofuel production being negatively impacted, while producers of advanced biofuels can have high hopes for the future.

The goals of the Commission proposal are to protect current investments in conventional installations, stimulate advanced biofuel production and most importantly: improve the overall GHG balance of biofuels by addressing ILUC. The proposal contains four policy measures:

1. A 5% cap in the RED for conventional biofuels;
2. Double and quadruple counting of advanced biofuels in the RED;
3. Bringing forward and extending the scope of the 60% GHG threshold in the RED and FQD;

4. Reporting of ILUC factors in the RED and FQD, factors are not used to assess whether biofuels meet the GHG threshold.

Legal basis of the ILUC proposal
It can be concluded that the proposal has a sound legal basis, being based on the same EU Treaty articles as the RED and FQD and taking the precautionary principle as a starting point, which is well established in the EU acquis. The proposed measures 2, 3 and 4 seem to be in line with WTO rules, either since they are a slight addition or amendment of the current RED and FQD sustainability criteria (as is the case for measures 2 and 3), or because the measure does not lead to the exclusion of certain types of biofuels (measure 4). Even if measure 4 would consist of mandatory ILUC factors the measure could still be in line with WTO rules as the rules allow certain trade restricting measures to mitigate climate change if they are predictable, transparent and implemented in a fair way. Most debate is possible on whether the 5% cap is in line with WTO rules, especially since no differentiation is made between medium ILUC risk ethanol feedstocks and high ILUC risk biodiesel feedstocks, a differentiation made in most ILUC quantification models.

Factual correctness of the Commission's Impact Assessment
Chapter 5 analyses the factual correctness of the underlying assumptions and justifications of the ILUC proposal as laid down in the Commission Impact Assessment. The Impact Assessment is a large document containing a wide range of statements and assessments of policy measures. It should be noted that the Impact Assessment does not analyse measure 2, the proposed quadruple counting of advanced biofuels. This stems from the fact that when the Impact Assessment was prepared, the Commission draft proposal did not include a cap nor quadruple counting. A chapter on the proposed cap was later inserted in the draft Impact Assessment but analysis of quadruple counting and the choice of feedstocks for the double and quadruple counting positive lists are lacking. The chapter contains a table with our judgement on a list of statements included in the Impact Assessment. A detailed assessment is included in Appendix I. Often we found the statements were backed up by robust data material but a disturbing number of statements contain errors or inconsistencies. One point that needs clarification is how to treat the ILUC emissions of the 2008 level of EU biofuels consumption, which was not modelled by IFPRI. Of course the single most important justification of the ILUC proposal is the IFPRI 2011 modelling study, which is the best piece of ILUC modelling available, but could still be further improved, for example by using more up-to-date datasets.

Effectiveness, policy risks, economic impacts and administrative burden
Chapters 6 to 9 assess the four proposed measures against their effectiveness in reducing overall biofuels GHG emissions, the policy risk of not meeting the RED and FQD targets, their impact on current investments for relevant actors in the supply chain and the extent to which they lead to additional administrative burden.

Effectiveness of the ILUC proposal
It can be concluded that the proposed cap is likely to improve the average GHG performance of biofuels since conventional biofuels in general have higher direct and indirect emissions compared to advanced biofuels. The cap does not distinguish between high ILUC risk biodiesel feedstocks and

medium ILUC risk ethanol feedstocks (according to IFPRI 2011 modelling). This non-differentiation does not undo the achieved decrease in emissions. However, if the cap would differentiate between conventional ethanol and biodiesel, the GHG reduction resulting from the proposed measure could be further increased.

Advanced biofuels have lower *direct* GHG savings compared to conventional biofuels but can in certain cases still lead to considerable indirect emissions. The potential indirect impacts of wastes and residues are recognised but have not been quantified for the EU. Because double and quadruple counting gives an incentive for the supply of these potentially better performing biofuels, average biofuels GHG savings could improve, but this should be studied in more detail. This possible overall reduction also depends on the quantity and types of biofuels supplied under the FQD.

The proposed tightening of the GHG-threshold might lead to a small increase in direct GHG emission savings, especially from imported biodiesel. The measure might lead to a very small decrease in indirect GHG emissions.

Proposed measure 4, reporting on ILUC factors, does not contribute to an improvement of the GHG performance of biofuels as the factors are for Member State reporting purposes only; it does not reduce the overall GHG performance of biofuels supplied in the EU either. The main purpose of this measure is to act as a warning sign for the biofuels sector to move away from conventional biofuels towards advanced biofuels.

Policy risk – meeting the RED and FQD targets

The proposed measures allow the RED and FQD targets to be reached. The role for conventional biofuels in meeting the RED target will be reduced but conventional biofuels could still supply the majority of biofuels necessary to meet the FQD target as the proposed 5% cap and double and quadruple counting are not included in the FQD. Because of this, a share of up to 7.2% conventional biofuels in the EU in 2020 would in theory still be feasible. The actual use of conventional biofuels to meet the FQD will depend on several factors, but notably on the role of non-biofuel options, such as flaring and venting.

The RED transport target can be met if a 5% cap is introduced since the necessary 'non capped' advanced biofuels can be shipped to the EU from across the globe. It will be more difficult however to produce the necessary volumes of these biofuels within the EU and without ILUC effects.

The proposed double and quadruple counting in the RED means effectively that the RED target is lowered, since a smaller quantity of renewables in transport is required to meet the target. From this perspective, the proposed measure helps to meet the RED target. The measure is not included in the FQD but increases the quantity of conventional biofuels needed to meet the FQD target in a biofuels-only scenario.

The counting rules in combination with the cap will lead to a surge in demand for advanced biofuels. This triggers the question whether it is possible to supply sufficient advanced biofuels to the EU market in a sustainable way. The answer is positive if imports from outside the EU are considered. Waste and residue feedstocks are currently already shipped in large quantities to the EU from, for example, the US and China. However, it is questionable if more overseas shipping of wastes and residues is a desirable outcome of the EU ILUC policy as this adds to transport emissions and poses a risk of fraud or a sustainability risk if the sustainable origin is not traced back all the way through the chain of custody to the point where the waste and residue materials are created. Advanced biofuels capacity will be sufficiently available. This because if need be, conventional biodiesel installations could be converted to produce biodiesel from waste oils. More interesting is the question whether the proposal does enough to trigger investments in advanced cellulosic ethanol production. At the moment advanced ethanol installations only cover 0.3% of total EU biofuel production capacity. It is doubtful whether this percentage will increase substantially if the ILUC proposal would become law. Investment costs for this type of biofuels are very high and, while cellulosic ethanol would count four times towards national transport targets, the available space beyond the proposed 5% cap could be filled entirely by much cheaper double counting biofuels produced from used cooking oils or animal fats.

The introduction of a 5% cap on conventional biofuels combined with double and quadruple counting of advanced biofuels leads to a situation where up to 7 Mtoe of advanced biofuels is required to meet the RED transport target. Currently, just over 1.3Mtoe of advanced biofuels (mainly produced from used cooking oils, animal fats and some crude glycerine) are consumed in the EU while in total 5-6 Mtoe of these biofuels might potentially be available within the EU in 2020. It can be concluded that the currently used waste and residue feedstocks are insufficiently available to produce the required quantity of advanced biofuels in 2020 from EU feedstocks. This ‘EU feedstock gap’ could be filled by the use of other EU waste and residue materials such as grape marc and wine lees, but this is questionable. Another option would be a substantial increase of (expensive) cellulosic ethanol production from straw. A more likely third option is the import of waste and residue feedstocks (or biofuels) from outside the EU. Unless the proposed measure leads to other wastes being used or unexpectedly leads to a surge in cellulosic ethanol production, it is unlikely that sufficient advanced biofuels can be produced from EU feedstocks to meet the RED target. This means a certain degree of feedstock imports will be necessary.

The proposed tightening of the GHG-threshold makes it only very slightly more difficult to meet the RED target and slightly reduces the quantity of biofuels needed to meet the FQD target. The mandatory reporting on ILUC factors has no impact on the fulfilment of the RED and FQD 2020 targets.

Economic consequences of the proposal for actors in the biofuel supply chain

The European Commission aims to address ILUC while protecting current investments in biofuels capacity. Combining these two policy goals is ambitious. Chronic overcapacity due to sometimes overly enthusiastic investments in EU biofuel production between 2005 and 2008 obstructs the profitability of the market. Some installations have filed bankruptcy in recent years; others operate at a relatively high utilisation rate. This situation is unrelated to the discussion on Indirect Land Use Change, as is the fact that some of the existing installations will never become profitable and a stronger consolidation is probably necessary to create a healthy market. When assessing the extent to which the ILUC proposal protects current investments, this report does not take the hopes and expectations of investors as starting point but is limited to the amortisation period of investments. This is the period during which investments are paid back to the bank or other financer. The amortisation period differs from the depreciation period, which is the (often legally maximised) period during which the asset is written off.

Of the policy measures proposed by the Commission, the proposed 5% cap has the largest impact on current investments. This also because, as said above, the ILUC factors for now are just a warning sign. The cap could in some cases lead to small income losses for European farmers, and has a limited negative impact on biofuel feedstock processors and a negative impact on biofuel producers because the cap prevents the anticipated growth in conventional biofuel production in the EU. Current investments are protected because the proposal does not lead to a lower demand for conventional biofuels in the EU. However, as the current EU biofuel production sector is not very profitable (a situation unrelated to the ILUC discussion), the cap will further depress earnings and margins and could lead to plant closures. The proposal, combined with the proposed double and quadruple counting, does provide a positive incentive for producers of advanced biofuels.

The proposed tightening of the 60% GHG threshold applies only to new installations and therefore does not affect current investments and employment.

The proposed reporting on ILUC factors does not have a negative impact on *current* investments as it does not introduce an additional requirement on biofuels produced from existing installations. The measure does however have a negative impact on *new* investments in conventional biodiesel production capacity in the EU given the suggested post-2020 aim to introduce mandatory ILUC factors. With the outlook of a possible future introduction of mandatory ILUC factors, no investments in new conventional biodiesel installations are expected. Investments in new conventional ethanol installations might still take place given the low ILUC values for ethanol included in the proposed new RED Annex VIII. However, these investments are likely to be small due to large current overcapacity combined with the proposed introduction of the 5% cap for conventional biofuels.

Looking at possible price effects of the proposal, the impact of the proposed 5% cap on conventional prices is estimated to be limited since feedstock prices are a very important part of biofuel prices and the biofuel market is too small to drive feedstock prices. The reliance on advanced biofuels to meet the RED transport target beyond the cap might lead to higher average biofuel costs since advanced biofuels could be more expensive. However, the double and quadruple counting leads to a de facto lowering of the RED target and therefore lowering the overall costs of the EU biofuels policy. The proposed change in the 60% threshold and reporting on ILUC factors is thought to have a very limited impact on prices.

Administrative burden for economic operators

The proposed measures do lead to some additional administrative burden for fuel suppliers as they would have to start reporting on the share of quadruple counting biofuels as well as on ILUC factors under the FQD. The proposals do not increase the administrative burden for other parties in the chain as no additional certification requirements are introduced.

2 A National Impact Assessment on ILUC

2.1 EU biofuels policy and sustainability

The European Union strategy to decarbonise transport emissions is a combination of increasing vehicle efficiency, promoting the use of renewable energy in transport as well as reducing the carbon intensity of fossil fuels. The main instruments to achieve the latter two are the EU Fuel Quality Directive (FQD) and Renewable Energy Directive (RED)[1].

The FQD, whose original focus was on air quality and technical quality aspects of fossil fuels, was amended in 2009 to include a binding 2020 target to reduce lifecycle greenhouse gas (GHG) emissions of fossil fuels by 6% in 2020 compared to 2010. Fuel suppliers can achieve this target by reducing fossil upstream emissions (exploration, production including flaring and venting) and downstream emissions (transportation, refining, distribution). Another possibility is the use of renewable energy (electricity or biofuels) in the transport fuel mix. The RED was introduced in 2009 and contains a binding 2020 target to achieve 10% renewable energy in road transport. As the FQD, this directive provides an incentive for the consumption of biofuels, with the important difference that the RED target is an energy content based target while the FQD target is a GHG-driven target. In theory, both the FQD and RED 2020 targets could be met by using 10% biofuels (by energy content) with a GHG saving of 60% on average.

Since both EU directives provide an incentive for the use of biofuels, the Union decided to introduce a nearly identical set of sustainability criteria in both directives in order to ensure that biofuels production does not lead to biodiversity or carbon stocks losses. These sustainability criteria currently prevent *direct* sustainability impacts (related to conserving biodiversity and carbon stocks) and do not prevent negative *indirect* impacts such as Indirect Land Use Change.

2.2 Indirect Land Use Change in the RED and FQD

Arguably the most complex and currently prominent aspect of biofuels sustainability is Indirect Land Use Change (ILUC), which currently dominates the EU debate on biofuels. ILUC is the effect that when existing cropland is used for biofuel feedstock production, the previous land use is displaced and as a result there is an increased risk that non-agricultural land is converted into cropland elsewhere. ILUC can therefore lead to higher GHG emissions and loss of biodiversity. ILUC, its quantification and possible policy measures have been debated in the EU since 2008.

The RED and FQD contain a provision which requires the European Commission (EC) to review the impact of ILUC on the GHG performance of biofuels, to report on this impact and on ways to minimise

[1] 2009/30/EC and 2009/28/EC respectively.

it and, if appropriate, to publish a legislative proposal.[2] In October 2012 the EC published a legislative proposal[3] aimed at introducing an ILUC policy measure in the RED and FQD. This would mean that the use of biofuels would be subjected to a more stringent sustainability regime. The main points of the proposal are:

- 5% cap of total biofuels consumption in 2020 for 1st generation biofuels (defined as those produced from cereals and other starch rich crops, sugar and oil crops);
- Promotion of biofuels from waste and residues by quadruple counting of biofuels produced from municipal solid waste, agricultural, aquacultural, fisheries and forestry residues and renewable fuels of non-biological origin;
- The 60% minimum required GHG threshold for biofuels from installations in operation after 1 January 2017, which in the current RED and FQD enters into force on 1 January 2018, is brought forward to include all installations in operation after 1 July 2014 and will take effect on the moment the amended directives enter into force (2014-2016);
- Introduction of feedstock type specific ILUC factors in the RED and FQD for Member State reporting purposes only (e.g. 55 gCO_2eq/MJ for oil crops); no ILUC factor applies for biofuels from waste and residues or if no direct land use change can be demonstrated.

2.3 National ILUC Impact Assessment

This report is a National Impact Assessment on ILUC in the Netherlands which we will assess the EC legislative proposal and accompanying Impact Assessment on the following four parameters:

(1) **Sound legal basis**. The proposed measures should be in line with the EU Treaty and acquis and in line with WTO regulations;
(2) **Factual correctness**. The proposed measures should be based on factually correct information. Both the legislative proposal and the EC Impact Assessment, which explains the justification for the legislative proposal, should not contain erroneous facts, figures or statements;
(3) **Policy risks and effectiveness**. The proposed measures should not endanger the fulfilment of the 2020 RED and FQD targets and should be sufficiently effective in mitigating ILUC that the future role for biofuels in transport beyond 2020 will not be endangered;
(4) **Financial-economic consequences or impact on administrative burden**. This refers to the economic impact of the proposal on the EU biofuels sector, the potential administrative costs of the proposed measures for obligated parties (fuel suppliers) and to the potential change in fuel costs for consumers.

After a description of the situation of biofuel production and supply in the Netherlands in chapter 3 of this report, the legal basis of the EC proposal is assessed in chapter 4. The factual correctness of the EC Impact Assessment document is discussed in chapter 5 on the basis of a table listing the most relevant facts and statements included in the EC Impact Assessment. Chapters 6 to 9 analyse the

[2] RED article 19(6), FQD article 7d(6).
[3] COM(2012)595.

policy risks and effectiveness of the proposed policy measures as well as their financial and economic consequences on the EU biofuels sector, impact on administrative burden for economic operators and the potential impact on fuel prices for consumers.

2.3.1 The role of ILUC quantification models

The discussion on Indirect Land Use Change has been dominated by the question: how can ILUC be quantified? It is generally accepted that ILUC cannot be measured or monitored but only modelled, either by causal-descriptive modelling[4] or by using general or partial agro-economical equilibrium models.[5] The Commission asked the International Food Policy Research Institute (IFPRI) to model the ILUC associated with eight biofuel feedstocks thought to play an important role in EU biofuel supply in 2020. IFPRI published a first study, using its IFPRI-MIRAGE general equilibrium model. An updated, improved version of the study was published in 2011. Results show high ILUC emissions for biofuels produced from oilseeds (palm oil, soybean oil, rapeseed oil and sunflower oil) and medium ILUC emissions associated with biofuels produced from cereal crops and sugars (wheat, maize, sugar beet and sugar cane). IFPRI did not model possible ILUC emissions associated with advanced biofuels.

Like most experts, the EC considers the IFPRI study to be the best piece of ILUC modelling work for EU biofuels available to date and uses it as the scientific basis for its Impact Assessment on ILUC and as the basis for its policy goal to incentivise the supply of advanced biofuels and limit conventional biofuels. The EC also states that ILUC modelling work could be further developed and improved and is currently not sufficiently robust to justify the introduction of mandatory ILUC factors. The list of shortcomings and suggestions for further research included in the IFPRI report shows that IFPRI itself seems to agree with this. The IFPRI quantification study can be further improved but absolute scientific certainty on the resulting ILUC values will never be achieved; modelling results will always be a projection of a possible or likely future situation, not an absolute truth. The role of modelling as a basis for policy making will be explored further in chapter 9.

Disclaimer on the use of IFPRI modelling results in this report

In this Dutch National ILUC Impact Assessment, the IFPRI modelling results are used to assess the impacts of the proposed policy measures on GHG emissions. This does not mean Ecofys considers the IFPRI modelling result to be sufficiently robust, but IFPRI does represent the best modelling of EU ILUC so far and the study is used by the European Commission as a basis for policy making. This makes it relevant to take the IFPRI results as a starting point when assessing the proposed policy measures. A possible update and further improvement of the IFPRI study could affect the analysis in this report.

[4] In this form of modelling no equilibrium model is used but rather a set of assumptions with the aim to avoid intransparent modelling. Through a bottom-up approach a causal chain of events is constructed which follows the assumed additional production of biofuels. Assumptions that lead to the steps of this chain of events are backed by historic data, projections for the future or expert opinions.

[5] These models include a large set of assumptions on how the world looks like in the future. The models assume a **baseline scenario** (for 2020) and a **'policy scenario'** or shock, additional quantity of biofuels needed for EU 2020-targets. ILUC is modeled by comparing the two.

2.3.2 Definitions

In this report some terms are used frequently. For reasons of clarity, definitions of these terms are provided in the textbox below.

Definitions

Advanced biofuels: biofuels produced from lignocellulose, non-food cellulose, wastes and residues.

Cellulosic biofuels: biofuels produced from cellulose or lignocellulose material, currently mainly ethanol produced from straw[6].

Conventional biofuels: biofuels produced from cereal, starch rich crops, sugars and oilseed crops (i.e. those that would be allowed to count towards the proposed 5% cap).

High ILUC risk biofuels: conventional biofuels with a high risk to cause Indirect Land Use Change. mainly biofuels produced from oilseeds, According to IFPRI modelling These include mainly biofuels produced from oilseeds.

Indirect Land Use Change (ILUC): the effect that when existing agricultural land is used for bioenergy production, the existing agricultural production for food/feed will be partially compensated by conversion of new land into agricultural land elsewhere. This can lead to biodiversity losses and additional GHG emissions.

Low ILUC or ILUC-free biofuels: advanced and conventional biofuels produced in such way to not causing Indirect Land Use Change. This is achieved not by the choice of feedstock but by producing additional quantities of feedstock in a sustainable way and without displacing current agricultural production. This can mean for example by biofuel feedstock production on unused land or by achieving yield increases.

Medium ILUC risk biofuels: conventional and advanced biofuels with a medium risk to cause Indirect Land Use Change. An example of medium ILUC risk biofuels is ethanol produced from cereal or sugars, according to IFPRI modelling.

Note that advanced biofuels are not necessarily ILUC-free biofuels and conventional biofuels are not necessarily high ILUC risk biofuels. This will be explained further in chapters 6 and 7.

[66] The EC Impact Assessment SWD(2012)343 uses the term 'advanced 2nd generation biofuels' to describe cellulosic biofuels.

3 Dutch biofuels baseline

This chapter gives an overview of the biofuels sector and market in the Netherlands. In subsequent chapters the EC ILUC proposal will be analysed including its possible effects on the Dutch biofuels market. It is useful therefore to start with an overview of the current state of play.
th

3.1 Biofuel consumption in the Netherlands

The Netherlands has had a biofuel mandate since 2007. In 2011, fuel suppliers in the Netherlands were obliged to supply 4.25% biofuels in their total fuel mix. The sixty fuel suppliers with an obligation supplied 3.78% ethanol and 4.62% biodiesel in 2011, leading to an overall biofuels consumption of 4.31%. This includes double counting biofuels.

The figure below shows a breakdown of biofuel types and whether single or double counting. In total, 20% of biofuels were eligible for double counting, representing a share of 40%, mainly consisting of biodiesel.[7] The figure is derived from statistics published by the Dutch Emission Authority (NEa), which is responsible for the administering of the biofuels mandate. It also shows that 92% of biofuels consumed consisted of single counting biodiesel, double counting biodiesel and single counting ethanol.

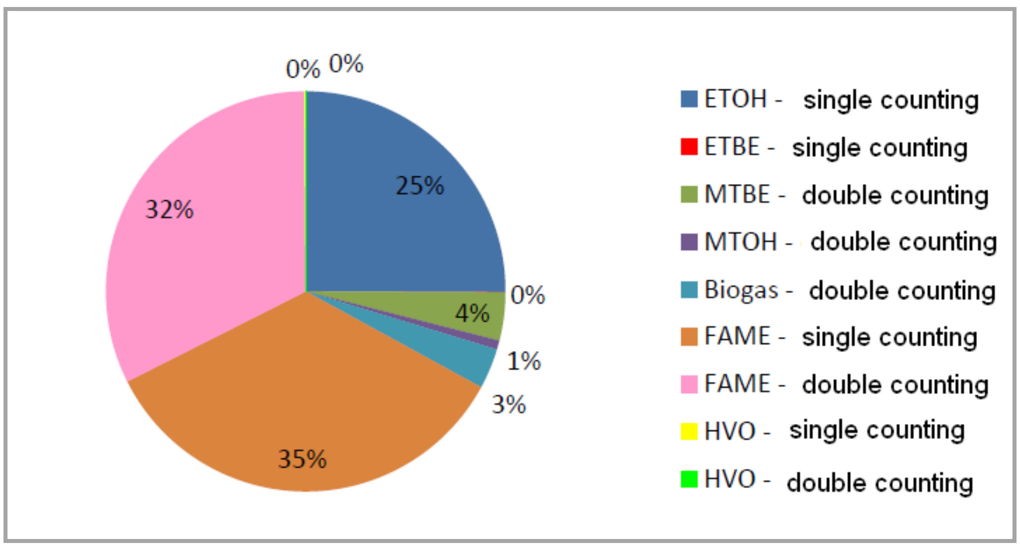

Figure 1 - Feedstock origin of biofuel consumption in the Netherlands in 2011 (energy content) based on NEa figure

[7] Netherlands emissions authority NEa, Naleving jaarverplichting 2011 hernieuwbare energie vervoer en verplichting biobrandstoffen luchtkwaliteit (June 2012), available at: https://www.emissieautoriteit.nl/mediatheek/biobrandstoffen/publicaties/20120606%20rapport%20DEFINITIEF.pdf

Looking at the feedstocks used, 24.6% of single counting biodiesel was produced from rapeseed[8], 90% of single counting ethanol was produced from maize and 36.4% of double counting biodiesel was produced from Tallow, 23.6% from used cooking oils (UCO) and 20.1% from other animal fats.[9] The overall share of different feedstocks used as a share of the total biofuel consumption in the Netherlands is provided in Table 1.

Table 1. Relative share of feedstocks used to produce biofuels consumed in the Netherlands in 2011.

Feedstock	Relative share
Maize	22.6%
Tallow	11.6%
Rapeseed oil	8.6%
UCO	7.6%
Non-tallow animal fats	6.4%
Crude glycerine	4.6%
Reported as *unknown*	12.6%
Other	26.0%
TOTAL	**100%**

[8] According to the NEa statistics 23.7% of single counting biodiesel feedstocks were reported as *unknown* and 47.9 fall in the *other* category meaning a mix of several smaller quantities of feedstocks.
[9] 56.5% of double counting biodiesel was produced from animal fats (tallow and animal fats combined).

3.2 Biofuel production in the Netherlands

The Netherlands has a considerable biofuel production capacity, mainly located in the Rotterdam and Amsterdam port areas. Estimates of the capacity and a breakdown per company is provided below.

Ethanol/ETBE/biomethanol capacity and actual production

The Netherlands had 421,600 tonnes of ethanol capacity in 2011, including 4,600 tonnes of ethanol which was not (yet) in operation and 200,000 tonnes of biomethanol. Actual ethanol production in The Netherlands stood at 275,000 tonnes in 2011. [10] This means that capacity utilisation stood at 65% of operational capacity in 2011.

Table 2. Overview of ethanol/ETBE/biomethanol production capacity in the Netherlands in 2011.

Producer	Location	Fuel produced	Feedstocks	Capacity (tonne/year)
Cargill	Bergen op Zoom	Ethanol		32,000
Abengoa Bioenergy	Rotterdam	Ethanol	Cereals, potatoes	385,000
BioMCN	Delfzijl	Biomethanol	Crude glycerine	200,000
Not in operation				
Maatschap Bosma	Zuidvelde	Ethanol	(waste) potatoes, sugar beet	4,600
Total ethanol				**421,600**
BioMCN	Delfzijl	Biomethanol	Crude glycerine	200,000
TOTAL				**621,600**

[10] ePURE statistics, available at: http://www.epure.org/theindustry/statistics

Biodiesel/HVO capacity and actual production

The Netherlands had 1261,000 tonnes of biodiesel production capacity in 2011, of which 650,000 tonnes was not in operation, plus 800,000 tonnes of HVO production. Actual biodiesel production stood at 368,000 tonnes in 2010, meaning that capacity utilisation stood at 29% of installed capacity and 60% of installed *operational* capacity in 2011.

Table 3. Overview of biodiesel/HVO production capacity in the Netherlands in 2011.

Biodiesel producer	Location	Fuel produced	Feedstocks	Capacity (tonne/year)
Biodiesel Kampen	Kampen	FAME	UCO	120,000
Biodiesel Amsterdam	Amsterdam	FAME	UCO	100,000
Sunoil Biodiesel	Emmen	FAME	UCO, animal fats	70,000
Ecoson (VION)	Son	FAME	Animal fats	5,000
Goes on Green	Sluiskil	FAME	Plant oil, rapeseed UCO, animal fats	250,000
Biovalue	Delfzijl	FAME		66,000
Not in operation	*Not in operation*	*Not in operation*	*Not in operation*	*Not in operation*
CleanerG	Zwijndrecht	FAME	rapeseed oil, soyabean oil and palm oil as feedstock	200,000
Vesta biofuels	Amsterdam	FAME	Rapeseed, canola, soy	200,000
Biopetrol Pernis	Pernis	FAME	Biopetrol Pernis	250,000
Total FAME				**1261,000**
Neste Oil	Rotterdam	HVO	Palm oil, waste oil	800,000
TOTAL				**2,061,000**

Oilseed crushing capacity in the Netherlands

Oilseed crushers operate both for food and biofuel markets. Crushers often have biodiesel capacity integrated with their crushing facilities. As stated in chapter 5, in the EU on average 38% of vegetable oil resulting from the crushing ends up in biodiesel, while non-oil components resulting from crushing end up as animal feed.

Table 4. Overview of oilseed crushing production capacity in the Netherlands in 2009

Crusher	Location	Feedstock	Capacity in tonnes
Cargill	Amsterdam	Soybean	1,200,000
ADM	Rotterdam	Multiseed	3,000,000
OIO/Loders Croklaan	Rotterdam	Palm oil	1,000,000
Cargill	Rotterdam	Palm oil	1,000,000
Wilmar/KOG	Rotterdam	Palm oil	500,000
TOTAL			**7,600,000**

3.3 Forecast of 2020 biofuels consumption

Under the Renewable Energy Directive[11], all EU Member States were obliged to submit a National Renewable Energy Action Plan (NREAP) to the European Commission in 2010. The NREAPs provide a forecast of renewable energy deployed in 2020 including the consumption of biofuels under the existing RED and FQD, not taking into account possible measures to address ILUC.

The Dutch NREAP forecasts 0.9 Mtoe of biofuel consumption in the Netherlands in 2020 (without double counting), with 0.83 Mtoe or 92% coming from biofuels and 8% from electricity in road and non-road transport. Within the share of biofuels, the biodiesel to ethanol split is 66/34%, which assumes a lower share of biodiesel compared to the EU average projection of 72/28%. Double counting biofuels make up 19% of the biofuels share, counting twice to 38%. In reality, the contribution of double counting biofuels stood at 40% already in 2011, as described in section 3.1 above. No contribution is expected from the use of biogas in transport.[12]

[11] 2009/29/EC
[12] The Netherlands National Renewable Energy Action Plan, p.108, available at: http://ec.europa.eu/energy/renewables/action_plan_en.htm

4 Legal soundness of the ILUC proposal

This chapter discusses the legal soundness of the Commission proposal. Firstly, the legal basis of the proposal in the EU Treaty will be described and subsequently, the compliance with WTO rules will be assessed.

4.1 Legal basis of the proposal within the EU Treaty

The European Commission's ILUC proposal is based on articles 192(1) and 114 of the Treaty on the Functioning of the European Union (TEC). Article 192 (1) contains provisions aimed to protect the environment while article 114 contains the rules for the functioning of the EU internal market. These articles form the legal basis for both the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD). It has to be noted that the RED and the FQD refer the former articles as the numbering in the TEC has been changed. Article 192(1) was formerly article 175 and the article 114 was formerly article 95. Treaty article 114 (former article 95 TEC) forms the legal basis of the sustainability criteria included in both directives, as well as for the verification of compliance with the criteria and the calculation of the GHG emission impact of biofuels. As the ILUC proposal amends the RED and FQD it makes sense that it is based on the same Treaty articles.

Precautionary principle

ClientEarth, an environmental law NGO, published a paper in August 2010[13] which examined the European Commission's legislative mandate relating to ILUC in the RED and FQD. The paper argues that the Commission should take a precautionary approach to ILUC – Lisbon Treaty, Article 191(2), as this approach is applicable to all EU policies and implies that any Commission proposal "shall aim at a high level of protection" and be based on "the precautionary principle and on the principles that preventive action should be taken". The fact that the proposal must be based on the "best available scientific evidence" indicates that a lack of additional scientific evidence relating to ILUC should not be used by the Commission to justify inaction. The Commission indeed decided to take action on ILUC based on the precautionary principle. In its 2010 Report on ILUC, the Commission explicitly stated that action on ILUC would be based on the 'precautionary approach', with which the precautionary principle is meant.[14] This is repeated in the EC Impact Assessment.[15]

It can be concluded that the Commission proposal has a sound EU legal basis in particular since the precautionary principle applies specifically to the nature of the ILUC issue, an issue which is widely recognised but for which the impact is difficult to quantify with a large degree of certainty. In this

[13] ClientEarth, Legal briefing: legislative mandate to the Commission on Indirect Land Use Change (2010).
[14] COM(2010)811, p. 14.
[15] SWD(2012)343, p. 6, 28, 29 and 68.

case, proportional legislative action based on the best available science can be taken to address the issue.

4.2 The EC proposal and WTO regulations

In addition to the proposal having a sound EU legal basis, it is also relevant to assess whether the proposed legislative measures comply with World Trade Organisation (WTO) agreements and rules in order to avoid complaints from non-EU WTO member countries. Under WTO agreements, all members must be treated equally and discrimination between trading partners is forbidden.[16] A second important principle is the equal treatment between imported and locally produced goods.[17]

The WTO agreements and the rules which follow from those agreements allow WTO member countries to impose trade restrictions or discriminatory measures in order to protect the environment[18], if a number of conditions are met. Importantly, measures should be predictable, transparent and implemented in a fair way. It helps if measures aim to tackle a globally recognised problem. Climate change is recognised by WTO as a global environmental problem and climate change mitigation measures may require certain trade restrictions. Loss of biodiversity is less straight forward since the global nature of its impacts could be discussed. Air, water and soil pollution related issues are usually local or regional issues. Partly for this reason the current mandatory EU sustainability criteria for biofuels focus on reducing GHG emissions, carbon stock losses as well as biodiversity losses and no mandatory criteria are in place to prevent air, water and soil pollution.[19]

The existing mandatory EU sustainability criteria for biofuels have so far not been challenged at the WTO, even though some countries outside the EU seriously contemplated filing a complaint. The criteria can be considered to mitigate climate change and avoid biodiversity losses. Of the four main policy measures proposed by the EC to address ILUC, some are clearly building on the current directive and therefore can be assumed to be in line with WTO rules.

The proposed measures are (see also section 2.2):

1. 5% cap in the RED for biofuels produced from cereals and other starch rich crops, sugar and oil crops;
2. Double and quadruple counting in the RED of biofuels produced from certain wastes, residues, lignocellulose and non-food cellulose material;

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[16] This is called the 'most-favoured-nation' principle, which is laid down in article 1 of the General Agreement on Tariffs and Trade (GATT) and also plays an important role in the other two main WTO agreements: the General Agreement on Trade in Services (GATS) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

[17] This is called 'national treatment', it only applies to imported goods after they have entered the importing countries' market, meaning imposing custom duties does not violate the national treatment principle.

[18] Preserving the environment is one of the 'human values and welfare goals' laid down in the Marrakesh Agreement, the WTO founding charter.

[19] Although many voluntary certification schemes recognized by the European Commission for the purpose of complying with the sustainability criteria for biofuels do contain mandatory criteria and indicators to prevent air, water and soil pollution and the RED specifies that the European Commission shall monitor and report on impacts on soil, water and air.

3. Bringing forward in time and extending the scope of the 60% minimum required GHG threshold for biofuels in the RED and FQD;
4. Introduction of feedstock type specific ILUC factors in the RED and FQD for Member State reporting purposes.

Of the measures listed above, measure 2 builds on the current double counting provision as already included in the RED by adding the option of quadruple counting and including specific positive lists. This fact combined with the notion that the measure constitutes an incentive rather than a ban or cap probably means the measure is compliant with WTO rules. The Commission does not comment on the compatibility of the measure with WTO rules because the measure is not included in its Impact Assessment.

Measure 3 directly builds on the existing GHG threshold for biofuels, merely bringing it forward in time and extending its scope from installations in operation after 1 January 2017 to installations in operation after 1 July 2014. The measure stays close to the existing RED and FQD text and is clearly aiming to reduce GHG emissions, and should therefore be in line with WTO rules. This is also the conclusion of the European Commission in its Impact Assessment.[20]

Measure 4 is a new addition to the directives but is non-mandatory for economic operators. In its current form, the mere reporting on the indirect GHG impact by Member States (for the purpose of the RED) and fuel suppliers (for the purpose of the FQD), the measure is unlikely to lead to a WTO complaint. This might be different if mandatory ILUC factors were introduced since certain biofuel feedstocks receive preferential treatment over others and it would be very difficult for oilseeds to still meet the minimum required GHG saving if the IFPRI ILUC factors would apply. However, as the European Commission states in its Impact Assessment, this preferential treatment does not necessarily lead to an exclusion of certain feedstocks. Also, the EC points out that the US federal administration as well as the state of California, have introduced ILUC factors which did not lead to WTO complaints.[21]

It is in relation to proposed measure 1 that the question can be asked, to what extent do WTO rules allow a cap on biofuels produced from conventional crops? If the cap was targeting only oilseed crops, which according to the IFPRI 2011 modelling study have a high ILUC risk, it would have been easier to argue that the cap is a measure to reduce GHG emissions. The cap however also targets cereals and other starch rich crops and sugars in addition to oilseeds. These crops have a medium ILUC risk according to IFPRI 2011. This non-differentiation reduces the impact of the measure to reduce GHG emissions, as is described in section 6.2 and brings into question whether the cap can be argued to be a measure directly aimed at reducing GHG emissions. Law firm Sidley Austin stated on a conference organised by UNICA, the Brazilian biofuels organisation, that a cap on 'food based' biofuels would be discriminatory against non-EU biofuels producing countries since most advanced biofuels produced from non-food material is produced in the EU and the US. The cap could thus

[20] SWD(2012)343, European Commission Impact Assessment accompanying the ILUC proposal, p.47
[21] Idem, p. 56

breach WTO rules according to the law firm.[22] The EC does not expect WTO complaints against the proposed cap as the measure does not change the biofuels GHG calculation method and is not based on modelling. However, the EC also points out that no differentiation is made between high and medium ILUC risk feedstocks.[23]

[22] ENDS Daily, 6 March 2013.
[23] Idem, p. 63

5 Factual correctness of the EC Impact Assessment

In this chapter we assess the factual correctness of the European Commission's Impact Assessment on ILUC[24] which was published together with the legislative proposal and contains the background and argumentation of the proposed policy measures.

5.1 Structure of the Impact Assessment

The Impact Assessment starts with giving an overview of EU biofuel production and consumption, both currently and as projected in 2020. It describes the Land Use Change impact of EU biofuels and the main drivers of ILUC. It goes on to explain the estimated size of ILUC and how this has been modelled for the Commission by the IFPRI institute. Subsequently, the EC document assesses several policy options[25] with the aim to explain why the Commission chose to propose certain policy measures and did not choose others. The policy options assessed are:

A: To do nothing. ILUC effects would be continued to be modelled but no policy action would be taken;
B: Increase the minimum required GHG threshold for biofuels. Biofuels would have to achieve a higher CO_2-saving compared to fossil fuels; this would increase the chances that biofuels have lower overall (direct and indirect) CO_2-emissions than fossil fuels;
C1: Implement country level actions in biofuel feedstock producing countries. Unwanted *Indirect* Land Use Change caused by biofuels is always also unwanted *direct* Land Use Change caused by the food, feed or timber sectors. If all forests, peatlands, wetlands, and highly biodiverse areas worldwide would be protected, no unsustainable land use change could take place and expansion of farmland would be steered towards areas more suitable for sustainable agriculture. This policy option would aim to achieve this in biofuel producing countries;
C2: Project level ILUC mitigation. If biofuels are produced from biomass which is produced additional to existing production and does not displace current agricultural production, no ILUC takes place. Farmers who cultivate biomass for biofuels on unused land or from yield increase produce additional biomass without displacing current production. This additional production is ILUC-free. The policy option would stimulate such low ILUC or ILUC-free biofuels production;
D: Introduce ILUC-factors; Biofuels need to achieve a positive CO_2-saving compared to fossil fuels. The CO_2 saving is calculated in grams of CO_2 per Megajoule of biofuel. The calculation formula includes all emissions in the cultivation, processing, production and transport of biomass into biofuels. ILUC factors are a certain number of grams of CO_2 which is added to the calculation formula

[24] SWD(2012)343
[25] Mostly the policy options included in the Commission's report on ILUC published in 2010, COM(2010)811.

in order to account for indirect effects. Such factors reduce the CO_2-saving of biofuels compared to fossil fuels and aim to give the overall direct and indirect CO_2-saving of biofuels. Whether or not such factors should be introduced and how they can be quantified in a robust way is one of the central questions in the ILUC debate.

E: Limit the use of conventional biofuels to the RED-targets. Results of ILUC modelling by IFPRI show high ILUC emissions for biodiesel produced from oilseeds medium ILUC emissions for bioethanol produced from sugar and cereal or other starch crops. The policy measure would limit the use of these biofuels in favour of biofuels produced from wastes, residues and cellulose which are assumed to have low ILUC effects.

The policy measures which the Commission chose to propose are listed in section 2.2.

The Commissions' Impact Assessment contains many statements and facts, the most important of which are listed in Table 5, including references to the relevant sections and page numbers of the EC document. We assess the correctness of these statements and facts. A brief assessment per statement or fact is included in the table. Appendix I contains a more substantiated analysis of the most relevant statements and facts of the EC's Impact Assessment.

5.2 EC statements and their factual assessment

Table 5. Assessment of factual correctness of EC Impact Assessment

Section (page)	Number	EC statement	Factually correct	Assessment
1.1 (6)	1	The contribution towards the FQD and RED targets from biofuels is expected to be significant.		The RED target is very likely to be met with a large contribution from biofuels. Biofuels supplied to meet national mandates in EU Member States contribute to meeting both the RED and FQD targets. However, it remains to be seen whether biofuels are really necessary in the same quantities or meet the FQD target as required to meet the RED target. This depends on whether reductions in flaring and venting of methane released at oil drilling rigs worldwide can be counted fully towards the FQD target, meaning that no or hardly any biofuels would be required for the FQD. A decision in comitology on this issue is expected in 2013.
2.2.1. (8)	2	Biofuels represent around 1 to 2.5 percentage points of the 20% GHG reduction target and overall 2020 renewable energy target respectively.		In 2020, biofuels will represent 4 percentage points of the 20% GHG reduction and represent 2.2 percentage points of the 2020 EU overall renewable energy target.
2.2.3. (9)	3	The globe has approximately 13 200 Mha of land, of which around 1600 Mha is used for cropping.		The EC statement is based on The Energy Report by Ecofys, based on an IIASA study with source data from FAOSTAT, which estimates 1,563 Mha are used for cropping.

Section (page)	Number	EC statement	Factually correct	Assessment
	4	IPCC special report on RE estimates 780 Mha of land is available for bioenergy production without irrigation, mostly unprotected grassland and woodland found in Africa (35%), Latin America (21%), North America (16%) and Europe (14%), having the potential to deliver over 4000 Mtoe bioenergy.		The EC IA refers to the IPCC special report on RE, the reference is correct and credible and does not differ too much from the figure estimated by Ecofys. Ecofys, in its Energy Report, calculated a total sustainable land potential for rain-fed cultivation of energy crops of 673 Mha, which is slightly below the IPCC figure but in the same order of magnitude.
	5	Total EU biofuels in 2020 causes 3mln ha of LUC.		IFPRI models a total LUC of 1.73mln ha for the assumed 15.5Mtoe increase in biofuels between 2008 and 2020.[26] Based on this result, the Commission calculated the LUC associated with the total EU biofuels consumption in 2020 of 27.2 Mtoe, assuming that the 2008 level of EU biofuels consumption has the same ILUC emissions as the increase in 2008-2020. It cannot be assumed that the baseline level of biofuel consumption has just as high ILUC emissions as the increase in biofuel consumption. For one because IFPRI did not model biofuel consumption prior to 2008 and partly also because some EU rapeseed production before 2008 took place on set aside lands.[27] The statement is also not in line with the statement 35, where the EC states that LUC emissions of existing 2008 EU biofuel consumption are lower than the emissions associated with the increase in consumption up to 2020
	6	IEA biofuels for Transport - Technology Roadmap assumes that 27% of total transport fuel demand will be covered by biofuels in 2050.		The 27% share of biofuels in 2050 road transport is based on IEA's Energy Technology Perspectives 2010 (ETP 2010) Blue Map Scenario, which is in line with the 450 ppm scenario required to limit global temperature rise to below 2°C. The same report acknowledges that "achieving this will require a significant and sustained push by policy makers". Until 2050 biofuels will still play an important role in transport and could even contribute with more than 27% to the total transport fuel demand.
2.2.3. (10)	7	Global land-use for biofuels increases from 30 Mha today to around 110 Mha in 2050, which corresponds to around 7% of current cropland.		The EC source (IEA) actually mentions a figure of 100 million hectares (Mha) in 2050 as opposed to 110Mha. This corresponds with 6.4% of current cropland, instead of 7% claimed by the EC. Global land use for EU consumed biofuels currently is between 2.2 and 5.7Mha or 0.14 and 0.36% of global cropland.[28]

[26] David Laborde (IFPRI) - Assessing the Land Use Change Consequences of European Biofuels Policies, 2011
[27] http://ec.europa.eu/agriculture/envir/report/en/n-food_en/tab1.htm
[28] Ecofys, PREBS report 2012, http://ec.europa.eu/energy/renewables/reports/reports_en.htm. Note that this is an improved analysis compared to an earlier Ecofys report.

Section (page)	Number	EC statement	Factually correct	Assessment
	8	Emissions from EU biofuels represent 0.1% of annual global emissions if based on annual estimated emissions by IFPRI-MIRAGE BioF at 50Mt CO_2.		IFPRI concludes that LUC emissions associated with the increase in EU biofuel consumption between 2008 and 2020 are 505 $MtCO_2$ [29] or 39Mt per year. The IPPC 4th Assessment concludes total global annual GHG emissions are 50,000 $MtCO_2$ of which 7500 Mt is caused by Land Use Change. This means that the 39MT of annual LUC emissions from EU biofuels represent just under 0.08% of total global GHG emissions and 0.5% of global LUC emissions.[30] Note that the 39 MT are the LUC emissions of the increase in EU biofuels between 2008 and 2020 and do not cover the level of biofuels consumed in the EU in 2008. The EC assumes the overall LUC of all EU biofuels to be 50MT which can be questioned (see under statement 5 above)
	9	Total global production of biofuels reached 70 Mtoe in 2008, which represents 1.7% of global oil consumption.		The global production of biofuels in 2008 according to IEA was 56 Mtoe, thereby representing 1.6% of global oil consumption. The EC IA does not give a reference for the 70Mtoe of global production of biofuels in 2008. It is unclear whether the IFPRI model uses the figure of 56 or 70Mtoe.
2.2.4. (10)	10	Less than 3% of global cropland is used for global biofuel production.		The EC IA does not specify the year to which the statement refers. According to FAO figures, the share of biofuels stood at 2% of global cropland in 2009, while in 2011 the share was 3%, assuming a fixed quantity of total global cropland based on IIASA estimate.
2.2 (11)	11	On a global level, 16% of vegetable oils (rapeseed, soybean, palm and sunflower oil) are used for biodiesel, 15% of maize and some 2% of wheat is used for bioethanol.		The statement refers to a paper by David Laborde, which indeed contains these figures. Laborde obtained the figures by taking global crop output figures from FAOSTAT and figures on global biofuel feedstock use from the USDA FAS reports and several other sources.
	12	Figure 2 – 2009 production and trade in biofuels. In 2009, the EU imported soy biodiesel mainly from Argentina and US, and to a significantly lesser extent palm oil from South East Asia. Bioethanol, to be blended with petrol, was imported from Brazil [in 2009].		The figure and EC statements are based on IPPC data. These data are corroborated by data from Lamers et al 2011, although significant ethanol imports also came from the Caribbean and the USA in 2009. It should be noted that trade flows of biofuels (ethanol and biodiesel) are very volatile, and highly dependent on weather conditions (leading to crop failures or success) and industry as well as trade policies (subsidies and tariffs). Trade flows in 2010 and 2011 differ significantly from the situation in 2009.
	13	Two thirds of the biofuels consumed in the EU are currently produced domestically.		The EC Impact Assessment does not provide a reference year. Statistics from 2010 show that 83% of EU consumed biodiesel and 80% of EU consumed ethanol were produced within the EU. This is higher than the two thirds claimed by the EC, although only around 60% of *feedstocks* for EU biofuels were produced within the EU.[31]

[29] David Laborde (IFPRI) - Assessing the Land Use Change Consequences of European Biofuels Policies, 2011

[30] Note that IFPRI only modelled the LUC associated with the increase in EU biofuels consumption and not the LUC associated with total EU biofuels consumption.

[31] Ecofys, PREBS report, http://ec.europa.eu/energy/renewables/reports/reports_en.htm, p. IV.

Section (page)	Number	EC statement	Factually correct	Assessment
2.4 (12)	14	No macro-economic models used to estimate indirect land-use change emissions are currently capable of modelling the effects of the EU sustainability criteria, so these criteria are consequently assumed not to have any effect. As such, the models are not able to distinguish between direct and indirect land-use change.		It is correct that models can quantify LUC rather than ILUC, because: 1. Models compare a policy scenario (e.g. 27 Mtoe conventional biofuels in the EU in 2020) with a baseline (e.g. the world in 2008) and do not specify whether resulting converted land is used for biofuel feedstock production or for other uses. 2. The only certainty is that LUC has been caused by additional EU biofuel demand, since this is the only difference between the two scenarios. While the IFPRI model does not model the effect of the EU sustainability criteria it does assume a 50% GHG saving for biofuels. This basically means that EU biofuels do not cause LUC since otherwise in most cases biofuels would not be able to meet 50% saving. The EU sustainability criteria for biofuels ensure direct sustainability and start to have a positive spill-over effect to certification of food products. For example, palm oil plantations who are certified to meet the sustainability criteria for biofuels might also produce for the food sector and also, large food companies start to source certified palm oil as a result from the discussion on biomass sustainability. While this is promising, on a global scale these spill-over effects are not yet large in absolute terms. This means the criteria are currently insufficient to prevent ILUC. The criteria ensure than no harmful *direct* conversion of high-carbon stock areas takes place but cannot ensure such conversion takes place *indirectly* in other sectors. For example, the production of certified RED-compliant palm oil for biodiesel does not lead to high direct LUC emissions thanks to the EU sustainability criteria, but could still lead to indirect emissions if existing palm oil production for food is displaced and leads to the conversion of new land.
2.4.2. (14)	15	Key assumptions on ILUC models can have a substantial effect on the outcomes and can be a cause of uncertainty.		Differences in outcomes of various ILUC quantification studies stem either from differences in the underlying datasets, in assumptions on how the baseline and what the policy scenario looks like and assumptions on how international commodity markets are interlinked and on the role and influence of changes in prices on consumption, crop yields and area expansion. Some key assumptions in IFPRI are: (1) 2020 Biodiesel/ethanol split is 72/28 (energy), (2) 27.2 Mtoe conventional biofuels in 2020 (8.6%), of this figure 15.5 Mtoe is additional compared to 2008, (3) EU represents 25% of global biofuels consumption, (4) Yield on price elasticity of 0.2 (0.15 for EU, 0.3 for global south), (5) Area-to-price elasticity slightly higher than yield elasticity, in line with literature. IFPRI itself lists a number of uncertainties in its study. It would be worthwhile to further explore these points with the aim to further increase the robustness of the study. One of the points missing in IFPRI is the role of future R&D and

Section (page)	Number	EC statement	Factually correct	Assessment
				technical progress in agriculture.
2.4.3. (14)	16	Recent research indicates that a higher fossil fuel comparator would be more accurate.		A higher fossil fuel comparator is indeed more accurate, as it also reflects increasing energy needed to deploy crude oil. Easy extractable oil is getting more scarce and as a result average oil extraction is getting more GHG-intensive. This means the current RED and FQD fossil comparator is 83.8 gCO_2eq/MJ is probably too low. Recent research by JRC shows that 90.3g would be more appropriate. The EC uses this figure in its Impact Assessment. The fossil comparator will probably be discussed in the context of FQD comitology.
2.4.3. (14/15)	17	The global marginal emissions from fossil fuels are expected to be higher than average emissions of fossil fuels used in the EU, the latter being reflected in the fossil fuel comparator used in the Impact Assessment of 90.3g/MJ.		Currently, the GHG performance of biofuels is compared to the average EU fossil fuel performance, even though the use of biofuels prevents an increase of the supply of higher-emitting (non)conventional fossil fuels. It is currently unclear whether marginal emissions are higher or lower than average emissions of fossil fuels.[32] The 90.3 gCO_2eq/MJ the Commission uses in its Impact Assessment does not reflect global marginal emissions from fossil fuels, but is based on average emissions of fossil fuels used in the EU.
2.5.1. (16)	18	The extent to which land availability is limited in various regions of the world is much debated. Compared to 1981 the harvested land has significantly declined in Europe, CIS and North America, thus suggesting that there would be low carbon stock land available.		Source of this statement is FAOSTAT. Whereas the harvested area globally increased since 1982, there was a drastic decline in Europe, North America and in the CIS. Sound assessment of these areas including ground truthing is necessary to identify whether any of these areas is indeed low carbon stock and suitable for biofuel production. FAOSTAT and ERBD estimate some 23 million hectares of land were abandoned in Ukraine, Russia and Kazakhstan in the early 1990s. Not all of this land was very fertile and could easily be brought back into production but a share of 11 to 13mln hectares is good agricultural land and could be brought back into production. Some of this land might already be turned back into farmland after 2007.[33] Also the Worldbank highlights the potential for land available for sustainable agriculture, especially in Sub-Saharan Africa and Latin-America.[34] Ecofys currently assesses the availability of unused land in the EU.
2.5.1. (16)	19	With regard to the EU, it is expected that the agricultural area will continue to reduce by around 0.5 million hectares each year.		According to DG AGRI the agricultural area in the EU is expected to reduce with 0.18 million hectare per year on average between 2010 and 2020. The EC IA is therefore overestimating the expected decline and not using proper information from DG AGRI although DG AGRI is mentioned as the source for the statement. The main reasons mentioned for the decline are increased urban areas,

[32] Energy Unlimited study

[33] FAOSTAT ResourceSTAT, figure quoted in FAO and EBRD, *Fighting food inflation through sustainable investment* (London, 2008), p.2.

[34] Worldbank, *Rising Global Interest in Farmland* (2011), xxxiv.

Section (page)	Number	EC statement	Factually correct	Assessment
				increased nature protection areas and a focus on profitable crops.
2.5.2. (16)	20	Recent studies suggest that tropical forests were the primary sources of new agricultural land in 1980-90s.		The EC IA statement is based on only one study instead of several. This study confirms that a slight majority of new agricultural land has been gained though the conversion of tropical forest (55%). While the statement is factually correct, its value for the present discussion is questionable since the study covers the period 1980-2000.
	21	Various studies highlight significant role for soy production and cattle ranging, as well as palm oil, as drivers behind the expansion of agricultural land into the Amazon and South East Asia respectively.		In Latin America as a whole cattle pasture was the main driver for agricultural expansion into tropical forests in the 1980-90s, while soy production was the main driver in the Amazon area. Palm oil was the main driver of forest conversion in Southeast Asia. In the period 1990-2010 these drivers are still found to be important drivers for deforestation. The EC IA statement therefore correctly states important drivers for deforestation, but is not well reflecting the impact of relatively recent initiatives to prevent deforestation (e.g. soy moratorium and RSPO) which reduce the impact of certain crops on deforestation.While some of the deforestation will either directly or indirectly be related to EU biofuels, the vast majority of deforestation results from (increased) demand in food, feed and timber, especially in emerging markets such as China.
2.5.2. (16)	22	If conversion of carbon rich areas such as forests and wetlands were to be limited, the risk of damaging indirect land-use change would be lower.		IFPRI 2011 assumes 35%of LUC emissions result from the conversion of peatland, 4% from primary forest and 31% from managed forests. If peatlands, forests and other carbon rich areas would be effectively protected, limiting their conversion into agricultural land, ILUC would be limited since the additional agricultural land brought into use as an indirect effect of biofuel production would be located on land with lower carbon stocks.
2.5.3. (17)	23	Proper implementation of LULUCF worldwide would significantly reduce ILUC emissions as converting high carbon stock land would have a cost.		LULUCF was created as a category in national GHG inventory to register emissions from land use, land use change and forestry. If properly implemented converting high carbon stock land would indeed have a cost and ILUC would be reduced. However, currently no international binding rules exist which impose a cost on LULUCF emissions.
2.8.1. (18)	24	Employment related to biofuels could be 400,000 jobs in 2020.		The 400,000 jobs related to biofuels in 2020 would require that the number of current jobs in the biofuel sector in the EU doubles. Looking at the decline of biofuel consumption and employment rate in the biggest intra-European biofuel market, i.e. Germany, and the economic challenges the European biofuel sector as a whole faces, the 400,000 jobs seem very ambitious. If an EU ILUC policy would lead to a closure of biofuel plants this would lead to job losses.
2.8.1.1 (19)	25	Current incentives, particularly, those set out in Article 21(2) of the RED, are not enough to spur the desired level of		The EC bases its statement on the NREAPs and not on actual developments. Figures on biofuel deployment in the period 2009-2011 show a significant increase in advanced biofuel production in the EU, mainly UCOME and animal fat based biodiesel. At the same time, investments in cellulosic ethanol

Section (page)	Number	EC statement	Factually correct	Assessment
		investment in advanced 2nd generation biofuels.		increased only slightly. Double counting therefore proved to be effective in stimulating production and supply of low-tech double counting biodiesel whereas it did not spur investments in high-tech advanced biofuels. The EC IA does not contain a list of definitions. The statement would be correct if applied solely to technologically advanced biofuels. Elsewhere in the IA the EC seems to use the term 'advanced biofuels' to describe these biofuels. For a further assessment please see statement 29.
2.8.1.2. (19)	26	In 2009/10 3.2% of EU cereal production and 5.4% of sugar beet was used for biofuels.		The reference quoted in the Impact Assessment actually states that 2.7% of the EU cereal production was used for biofuels, which was slightly lower than the mentioned 3.2%. Ecofys' own calculations for the EC estimated that in 2009/10 more than 12% of the EU sugar beet production was processed into bioethanol, which is more than double the figure in the Impact Assessment.
2.8.1.2. (20)	27	In 2010/11 38% of EU vegetable oil consumption was used for biofuels, of which 41% consisted of imports.		FEDIOL data show that biofuels represented indeed 38% of all vegetable oil consumed in the EU in 2011. However only 16.4% of the vegetable oil processed into biodiesel was imported.
2.8.1.3. (20)	28	The EC IA gives a biodiesel to ethanol split in 2020 of 72/28		The EC bases its statement on the NREAPs. Actual biofuel consumption in the EU in the period 2007-2011 shows the biodiesel/bioethanol split remained constant at 78/22%. There seems little reason why this split would increase in the years to 2020.
2.8.1.4. (21)	29	Advanced biofuels installed capacity in the EU is currently negligible and limited to a few pilot plants.		The EC statement does not seem to refer to all advanced biofuels but only to those with advanced technologies. We focus here on cellulosic ethanol. A significant number of initiatives on cellulosic ethanol are developed in the EU. These initiatives mainly concern pilot and demonstration plants. The estimated installed production capacity for advanced biofuels in the EU was 16,150toe in 2011 and 101,150toe in 2013. While this is a steep increase, in relative terms it's still only 0.3% of total EU biofuels capacity.
2.8.1.4. (21)	30	Biofuel capacity utilisation is at around 50%.		Biofuel production capacity utilisation in the EU in 2010 was on average 44%, with the biodiesel capacity being used at 42% and bioethanol capacity at 56%.
2.8.1.4. (21)	31	150 EU crushers process 13Mt of vegetable oil in 2008, with biodiesel being a major market.		The quote in the EC IA refers to FEDIOL, representing around 150 oil seed crushers. FEDIOL reported a production of 13 million tons of vegetable oil for 2008. EU biodiesel production in 2008 was at 6.84 Mtoe.[35] For 2011 FEDIOL stated a vegetable oil production of 19.92 million tons, of which 7.68 million tons have been processed into biodiesel (i.e. 38%).

[35] Ecofys - Progress in Renewable Energy and Biofuels Sustainability, forthcoming, 2013

Section (page)	Number	EC statement	Factually correct	Assessment
2.8.1.5. (22)	32	Future of ethanol blending is challenging due to the trend in the diesel/petrol split, but additional costs of flexifuel cars are €100 per vehicle or lower.		Table 2 of the EC IA shows that the biodiesel to ethanol split is expected to develop towards a larger share of ethanol at the expense of biodiesel. In addition, new technologies to convert sugar and starch into biodiesel could make split between biodiesel and bioethanol irrelevant from a biofuel feedstock perspective. Until the moment these technologies become economically viable, flexi fuel cars can play a role in facilitating the use of higher bioethanol blends. Introducing flexi-fuel vehicles takes time, as retrofitting existing vehicles is expensive and renewing the passenger car fleet takes about 10-15 years.
2.8.2. (23)	33	It is important to note that the IFPR modelling assumes that the sustainability criteria have no effect. The IFPRI baseline therefore assumes the consumption of some biofuels that might not meet the greenhouse gas savings and not meet the land use criteria in 2020.		See also statement 14 above. IFPRI does take a 50% GHG threshold for EU biofuels into account. If forest is converted into cropland for biofuels it's impossible to meet the 50% threshold. However grassland with low-carbon stock but high biodiversity could be converted under the IFPRI model, as it would still meet the 50% GHG threshold.
2.8.2 (23)	34	Other initiatives, such as the moratorium for peatland and primary forests agreed between Norway and Indonesia, in the context of REDD+, might also impact on indirect land-use change emissions. Such agreements are not reflected in the modelling.		If international agreements would be implemented and enforced in a robust way in the future they could help to limit ILUC. If this would be the case it would be good to include them in ILUC modelling which is currently not the case.
2.8.2.1 (25)	35	It is pointed out that for rapeseed, which is the most important feedstock used in 2008 (5.7 Mtoe out of a total of 10 Mtoe), the average land-use change is significantly lower in the baseline.		The total biofuel consumption in the EU in 2008 was 9.55 Mtoe, of which 6.84 Mtoe were biodiesel.[36] For the exact rapeseed share in 2008 no figure could be found. However in 2011 rapeseed biodiesel had a share of 66.8% in biodiesel production.
2.8.2.3 (26/27)	36	Table 4: non-land using waste/2nd generation biofuels are estimated to have no ILUC emissions. Land using waste/2nd generation biofuels are estimated to have ILUC emissions of 15 gram CO_{2eq}/MJ.		The sources of the ILUC estimations for advanced biofuels are unclear, IFPRI only modelled 8 conventional feedstocks. The ILUC values for waste/2nd generation biofuels are presumably based on 'COWI and Commission calculations'. Apart from the fact that ILUC emissions cannot be calculated, the estimate of zero emissions for non-land using advanced biofuels is incorrect. Animal fats are a non-land using residue. The material has existing uses in the oleochemical industry. If all animal fats would be diverted to biodiesel production, the oleochemical industry could resort

[36] Ecofys - Progress in Renewable Energy and Biofuels Sustainability, forthcoming, 2013

Section (page)	Number	EC statement	Factually correct	Assessment
			(red)	to using (uncertified) palm oil. The associated ILUC emissions could be high. Note that conventional ethanol is modelled to have lower ILUC emissions than the 15 grams the EC assumes for certain waste feedstocks. This is not reflected in the current EC proposal which limits conventional biofuel consumption and stimulates waste and residue feedstocks.
2.9 (27)	37	Biofuel sustainability criteria are based on article 114 of the Treaty: internal market.	(green)	This article concerns the 'Approximation of laws' in the EU. Paragraph 3 stipulates that the Commission will take as a base a high level of protection in its proposals concerning health, safety, *environmental protection* and consumer protection, taking account in particular of any new development based on scientific facts. The European Parliament and the Council will also seek to achieve this objective, within their respective powers.
2.9.1 (28)	38	Article 191(2) of the Treaty states that EU policy on the environment shall be based on the precautionary principle. In view of this, the Commission noted in its December 2010 report on indirect land-use change that action should be based on the precautionary approach.	(green)	The precautionary principle is indeed included in the Lisbon Treaty and the EC indeed refers to it in its 2010 Communication on ILUC. See in annex for more information on the precautionary principle and the conditions that apply.
3.1 (30)	39	The provisions on sustainability criteria, including the requirement to analyse indirect land-use change emissions, are based on the functioning of the internal market provisions of the Treaty. Any legislative proposal that addresses indirect land-use change emissions must therefore also be based on these provisions.	(green)	The European Commission's ILUC proposal is based on articles 192(1) and 114 of the Treaty on the Functioning of the European Union (TEC). Article 192 (1) contains provisions aimed to protect the environment while article 114 contains the rules for the functioning of the EU internal market. These articles form the legal basis for both the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD). The RED and FQD articles in which the sustainability criteria for biofuels are laid down as well as the article which obliges the EC to monitor ILUC are based on the internal market Treaty article. The ILUC proposal is based on the same two Treaty articles, the 5% cap being based on the internal market article and the reporting on ILUC emissions on the environment article, which gives Member States more flexibility in their national interpretation.
Statements below relate to EC IA assessment of policy options				
5.2.1 (39)	40	Table 5: average saving of 15% in 2020 if ILUC is taken into account. [In footnote:] If the sustainability criteria are assumed to have an effect the emission balance is improved to	(yellow)	According to IFPRI 2011 the average GHG saving of the 15.5Mtoe additional EU biofuel consumption in 2008-2020 is 21% with a 90.3 gCO2eq/MJ fossil fuel comparator and assuming improved technology.[37] Taking into account that the 2008 biofuels consumption level of 11.7Mtoe biofuels is likely to have lower ILUC emissions (see statement 5), meaning that average GHG saving of total EU biofuel consumption in 2020 will be higher than 21% when taking

[37] David Laborde (IFPRI) - Assessing the Land Use Change Consequences of European Biofuels Policies, 2011

Section (page)	Number	EC statement	Factually correct	Assessment
		22%.		the IFPRI ILUC values into account. It is not correct to just apply the ILUC emissions of additional biofuel consumption to the 2008 consumption level.[38]
5.3.1 (42)	41	Rapeseed is likely to be excluded when the threshold reaches 60%.		There is a significant potential to reduce GHG emission of rapeseed biodiesel in the cultivation and processing phase. A study for DG TREN states that rapeseed biodiesel could achieve 62% of GHG reduction by using biomethanol in the processing.
5.3.2 (43)	42	The availability of double-counted biodiesel is a question of supply, both in terms of availability of raw-material e.g. waste oil, but also a technical question whether enough production capacity can be cost-efficiently installed by 2020. Achieving a supply of 3.8 Mtoe of double counted biodiesel would therefore be challenging.		The term advanced biofuels can lead to confusion. It seems to be defined by the Commission as biofuels produced from waste, residues and cellulose. While the uptake of cellulosic biofuel capacity is technically challenging (see statement 29), the availability of sufficient capacity of biofuels produced from wastes and residues does not pose a technical challenge. Esterification plants could be converted to process waste/residue feedstocks such as UCO or waste animal fat. This requires a significant investment, which could however make economic sense. Ample capacity is available in the EU which could be used for advanced biofuel production, although retrofitting capacity which is integrated with crushing capacity might be challenging. Supply of double counting *feedstocks* in a sustainable way could be challenging.
5.5.4 (55)	43	There is a high risk that the transport target of the Renewable Energy Directive is not achieved (if ILUC factors would be introduced).		This assumes that ILUC factors are introduced in the RED. The option included in the leaked EC proposal of introducing the factors only in the FQD is not clearly assessed in the EC IA.
5.5.5 (55)	44	The introduction of ILUC factors would affect the viability of existing investments in the long run as Member States and industry cannot continue to follow the submitted NREAPs since no conventional biodiesel feedstocks would be available.		The introduction of ILUC factors based on the IFPRI 2011 values would indeed mean that conventional biodiesel feedstocks can no longer be used for EU biofuels (except when certified ILUC-free, see statement 46). This would have a negative effect on especially investments in smaller, land-locked, stand-alone biodiesel installations which already currently operate under difficult circumstances and would probably never been profitable investments. Installations which have gone bankrupt in previous years will never be paid back. As this loss is already taken, they do not require further protection. These installations are still counted in capacity utilisation rate figures. Existing biodiesel plants who are currently in operation have a higher than average capacity utilisation and an average amortisation period of around 10 years and would be largely be paid back if ILUC factors would enter into force around 2018-2020., although their closure after 2020 would still lead to job losses. The closure of biodiesel plants which are integrated with oilseed crushers would have a negative impact on the overall value and profitability of the companies, regardless whether the biodiesel installation has been paid back. Investments in new or enlarged installations after 2010 would be most affected, unless they manage to retrofit to produce biodiesel from waste oils.

[38] David Laborde indicates this is not correct in personal correspondence with the author.

Section (page)	Number	EC statement	Factually correct	Assessment
5.6.4. (62)	45	Limiting the use of conventional biofuels would affect the financial investment stability, although the impact is limited as the cap would maintain today's production levels of conventional biofuels.		See also statement 44. The fact that the increase to 8.6% biofuels as included in the NREAPs would no longer take place if a 5% cap would be introduced obviously has a negative impact on biodiesel producers who see themselves restrained and future growth opportunities stalled. This negative impact is limited by the fact that current levels of conventional biofuel production are upheld.
5.7 (63-65)	46	If ILUC factors were applied, demonstrating ILUC free biofuels production could justify that ILUC factors are not applied.		The production of guaranteed ILUC-free biofuels is possible and can play an important role to mitigate ILUC of EU biofuels. The Low Indirect Impact Biofuels (LIIB) methodology developed by Ecofys, WWF and the Roundtable on Sustainable Biofuels secretariat enables biofuel produces to demonstrate low ILUC risk or ILUC free biofuel production by implementing ILUC mitigation strategies on project level. A successful certification of ILUC free biofuel production would make ILUC factor obsolete in this case. If no ILUC factor is introduced, certified ILUC free biofuels could still be used to get beyond the 5% cap, provided that conventional biofuel could demonstrate that their production caused no or low ILUC. The LIIB methodology can be used in policy. While the Commission dedicated Annex XII of its Impact Assessment to ILUC free biofuels it did not include an incentive for such biofuels in its proposal. Ecofys and WWF are currently testing the LIIB methodology in the EU, leading to an improved version and plan to produce a 'LIIB indicator document' which independent auditors can use to certify ILUC-free biofuels. An incentive in policy is needed to make this a reality.
6 (67)	47	Potentially costly and administratively burdensome to comply with C2 (project level ILUC mitigation).		Ecofys, WWF and RSB developed the LIIB (Low Indirect Impact Biofuels) methodology to identify and certify ILUC-free biofuels. The already conducted LIIB pilot revealed that the implementation costs are relatively low and provide no economic barriers for the biofuel producers. As LIIB is designed as a plugin to existing sustainability schemes the additional certification costs and administrative efforts are also limited. Ecofys is currently conducting LIIB pilots within the EU to further test the implementation of LIIB and double check the previous outcomes gained outside the EU.
7 (69)	48	The current EC ILUC proposal distinguishes between feedstocks according to their estimated indirect land use change impacts which would be reported, thereby providing more transparency.		Introduction of cap (policy option E) does not distinguish between feedstocks. Combination of cap with reporting ILUC factors is not assessed in section 5.6 of the IA. The reporting of ILUC factors does distinguish between feedstocks, although technically between feedstock categories.

5.3 Conclusions on factual correctness

The Commission's Impact Assessment on ILUC contains a lot of information and provides, in 129 pages, a comprehensive overview of the size of the EU biofuels market and its land use impacts. The two main questions to be answered here are whether the Impact Assessment is factually correct and whether it covers all aspects that should be covered.

1. Does the Impact Assessment (EC IA) form a factually correct justification of the ILUC legislative proposal?
Although it is found that most statements are correct, or at least partially correct, a total of 11 out of 48 assessed statements were found to be factually incorrect. This is a lot and much more than could be expected from such an important document in such an important discussion on the future of EU biofuels policy.

Overestimating global biofuels use while underestimating biofuels contribution to climate mitigation
The Commission substantially overestimates 2008 global biofuel consumption, which is stated as 70 Million tonnes of oil equivalent (Mtoe), but was in fact only at 56 Mtoe. In addition the actual EU biofuel consumption was 9.55 Mtoe, whereas IFRPI used 11.7 Mtoe in its model. On the other hand the EC seems, in statement 2, to underestimates the impact of biofuels on meeting the EU 2020 climate change reduction target the 2020 EU renewable energy target.

Underestimating the role of the EU biofuels sector
The Commission states, in statement 13, that biofuels consumed in the EU are for two thirds produced in the EU. The latest available statistics over 2010 show that 83% of biodiesel and 80% of bioethanol were produced within the EU and only a small part of biofuels were imported. This shows that EU biofuels producers contribute greatly to EU biofuels consumption and have a lot to lose in the ILUC discussion.

Not always using best available information
Some statements in the EC IA are not based on the best available information within the EC, although this information was already available at the time when the EC IA was drafted. The figure on expected reduction of agricultural area in the EU mentioned in statement 19 conflicts with a report from DG AGRI which mentions a lower figure. The claim that rapeseed biodiesel is likely to be excluded when the minimum required GHG saving would be raised to 60% conflicts with a study performed for DG TREN in 2009 which concludes that rapeseed biodiesel could reach 62% saving (statement 41).

Conflicting statements on ILUC emissions of 2008 level of EU biofuels consumption
A point which needs clarification are the ILUC effects of 2008 EU biofuels consumption. In statement 5, the 2008 consumption level of 10Mtoe is expected to have the same associated ILUC emissions as

the increase in EU biofuels consumption in 2008-2020, whereas in statement 35 the opposite is claimed. It is likely that biofuels in the 2008 baseline have a lower ILUC than additional biofuels consumed between 2008 and 2020 because they are partly produced on set aside lands.

2. Does the document cover all relevant aspects related to the policy discussion on ILUC?
The EC IA covers many relevant aspects. However one important aspect is missing, which is the proposed quadruple counting of certain biofuel feedstocks. When the Impact Assessment was prepared, the Commission did not yet anticipate to include a cap or quadruple counting in its proposal. A chapter on the proposed cap was later inserted into the Impact Assessment but analysis of quadruple counting and the choice of feedstocks for the double and quadruple counting positive lists are lacking. The Impact Assessment does not provide a justification for the choice of feedstocks which are selected for double or quadruple counting and only focuses on ILUC caused by conventional biofuels while not providing an analysis on ILUC caused by certain types of advanced biofuels. The Commission chooses to support advanced biofuels. This may well be a wise decision but the Impact Assessment does not give sufficient evidence why certain advanced biofuels are counted twice and others counted quadruple. The Commission does estimate in statement that land using biofuels produced from waste have higher ILUC emissions than ethanol. This could well be the case but this has never been properly modelled.

While the lack of justification on double and quadruple counting is the main shortfall of the Impact Assessment, some other points have not received the attention they deserve. The EC Impact Assessment could have highlighted the positive spill-over effects of the EU sustainability criteria for biofuels to the food sector, where the share of certified biomass is rising. Also, it would have been relevant to discuss the parallels between the ILUC debate and the current EU discussion on requiring 7% of EU farmland to be taken out of production. This proposal could also lead to unwanted direct or indirect Land Use Change. Also, the extent to which EU overall agricultural production benefits from biofuel crop production could have been discussed.

6 Assessing the 5% cap on conventional biofuels

This chapter describes the proposal to introduce a 5% cap on conventional biofuels counting towards the RED transport target. It is assessed whether the proposed measure helps to achieve the aims of the EC ILUC proposal of achieving GHG savings, protecting current investments and incentivising advanced biofuels. Also, the impact on administrative burden is assessed. This analysis will be repeated for the other proposed measures in subsequent chapters.

6.1 Description of the proposed measure

The Commission proposes to set a cap on the percentage of conventional first-generation biofuels that can be counted towards the RED renewable energy in transport target. The cap is designed to be set at the level of the current (2011) use of biofuel. Note that the cap is within the RED only, not the FQD, and also applies only to the specific renewable energy in transport target, not to the overall renewable energy consumption target.

EC proposal text
To Article 3, paragraph 4 of the RED the following point (d) is added: "(d) for the calculation of biofuels in the numerator, the share of energy from biofuels produced from **cereal and other starch rich crops, sugars and oil crops** shall be no more than 5%, the estimated share at the end of 2011, of the final consumption of energy in transport in 2020."

Cereals and other starch rich crops and sugars are used to produce ethanol whereas oil crops are used to produce biodiesel. The cap is presented as a cap on 'biofuels from food crops'.[39] This is however not exactly true. Although most food crops fall within the categories of starch rich crops, sugars and oil crops, some non-food crops fall within the same categories. 'Oil crops' for example, include both the food crops palm oil, rapeseed oil and sunflower oil, but also non-food crops such as jatropha oil. The proposed measure is thus not a cap on biofuels from food crops but a cap on conventional biofuels. The measure is also not a cap on land-using biofuels as the production of non-food cellulosic crops and ligno-cellulosic material could use land and does not fall under the cap.

The proposed cap is intended to be set at the level of the 2011 EU biofuel consumption level, much of which is assumed to be produced from conventional biofuel. The 5% cap indeed roughly corresponds with the 2011 level. Total supply of biofuels in the EU in 2010 was 13 Mtoe or 4.3%, of which 0.1 percentage points was advanced biofuels, meaning total conventional biofuel supply stood at 4.2%.[40] In 2011 this total figure will have risen to around 5% due to rising national biofuel mandates. The

[39] EC(2012)595, in the Summary of the proposed actions on p. 3, in recital 9 on p. 8.
[40] Ecofys, Renewable Energy Progress and Biofuels Sustainability (2012), p. 201.

cap does not lead to a lowering of total EU conventional biofuel consumption but prevents anticipated future growth.

This measure has to be considered in close relation with the multiple counting of 'non-capped' advanced biofuels, which have to deliver most of the 5% renewables in transport beyond the cap necessary to reach the RED-target. The proposed measure to stimulate advanced biofuels is discussed in chapter 7.

It should be noted that the proposed cap is that it does not as such ban the use of conventional biofuels beyond 5%. The measure only means conventional biofuels beyond 5% cannot be counted towards the RED target or receive financial support. More than 5% conventional biofuels could still be supplied to meet the FQD target, as is discussed in the next section. Also, higher volumes of conventional biofuels could still be supplied if biofuels without financial support were cheaper than fossil fuels. The latter however is unlikely to occur in the years up to 2020 since all biofuels currently rely on policy support and incentives to make them competitive with fossil alternatives.

6.2 Impact on direct and indirect GHG emissions

Question
Does the proposed measure increase the direct and indirect GHG performance of biofuels deployed in the EU up to 2020?
Answer
Advanced biofuels have lower *direct* GHG savings compared to conventional biofuels but can in certain cases still lead to considerable *indirect* emissions. The potential indirect impacts of certain wastes and residues are recognised but have not been quantified for the EU. While in many cases the overall GHG performance of advanced biofuels will be (much) better than conventional biofuels, this will not always be straightforward. In general, this means the proposed cap on conventional biofuels should improve, on average, the GHG-performance per litre of biofuels . The cap does not distinguish between high ILUC risk biodiesel feedstocks and medium ILUC risk ethanol feedstocks (according to IFPRI 2011 modelling). This non-differentiation does not undo the achieved decrease in emissions. However, if the cap would differentiate between conventional ethanol and biodiesel, the GHG reduction resulting from the proposed measure could be further increased.

The proposed measure will lead to a reduction in GHG emissions per litre of biofuels if:

1. Capped conventional biofuels have higher direct and indirect GHG savings than non-capped advanced biofuels, and;
2. This benefit is not undone by a rise in GHG emissions *within* the capped biofuels.

Comparing direct and indirect GHG savings of capped and non-capped biofuels

Advanced biofuels have a very high *direct* GHG savings of often 80 to 90% compared to fossil fuels, following annex V of the RED. Conventional biofuels in general have higher direct GHG emissions compared to advanced biofuels. Therefore, capping conventional biofuels while increasing the contribution of advanced biofuels in the overall EU biofuels mix should improve overall biofuels GHG performance.

Looking at *indirect* GHG emissions, conventional biofues are thought to have higher emissions than double and quadruple counting biofuels. This is especially true for oilseed crops which have much higher modelled associated ILUC emissions of 52-56 gCO_{2eq}/MJ, according to IFPRI 2011, than sugar and starch rich crops, which have 7-14 gCO_{2eq}/MJ modelled ILUC emissions. No studies have been published which quantify ILUC effects of advanced biofuels in the EU, although indirect effects of wastes and residues are discussed since 2009.[41] The Commission in its Impact Assessment estimates the indirect emissions of these biofuels to be between zero for non-land using residues and 15 grams CO_2 equivalent per mega joule of biofuels for land using residues. These estimations are not based on modelling work. The Commission based the estimation of 15 grams for land using residues on the IFPRI value for sugar cane, as the EC assumes they share some key characteristics such as normally no feed co-product and high yields.[42] The estimation of zero grams for advanced biofuels produced from non-land using residues seems incorrect. Animal fats for example are a non-land using residue of which the best available quality category is currently used by the oleo chemical industry. If this animal fat would be used to produce biodiesel, the oleochemical industry would have to use vegetable oil as an alternative to compensate for the loss in available waste animal fats. This could be palm oil, which would lead to considerable ILUC emissions.[43] Indirect emissions of advanced biofuels have not been modelled and thus are unclear. In some cases indirect emissions can be considerable; in other cases they will be very limited. Because advanced biofuels have a very good direct GHG emission performance compared to fossil fuels and compared to conventional biofuels, in general the overall GHG balance of most advanced biofuels will often be (much) better than conventional biofuels.

Figure 3 below provides an overview of the overall GHG balance of biofuels, taking into account both direct and indirect emissions. From the figure it can be concluded that advanced biofuels have higher combined direct and indirect savings compared to conventional biofuels, even though the difference between medium ILUC risk ethanol and land using (agricultural) residues is small. As discussed above, this is not the case for all advanced biofuels in all cases. But in general it can be concluded that the proposed cap on conventional biofuels leads to an improvement of the average GHG performance per litre of biofuels.

[41] Following the publication of a study commissioned by the UK RFA and DECC. Ecometrica, Eunomia and Imperial College, *Methodology and evidence base on the indirect greenhouse gas effects of using waste, residues and by-products for biofuels and bioenergy* (2009).
[42] Ecofys communication with the European Commission
[43] The European Commission acknowledged this risk by excluding Category 3 animal fats from the positive list for double counting.

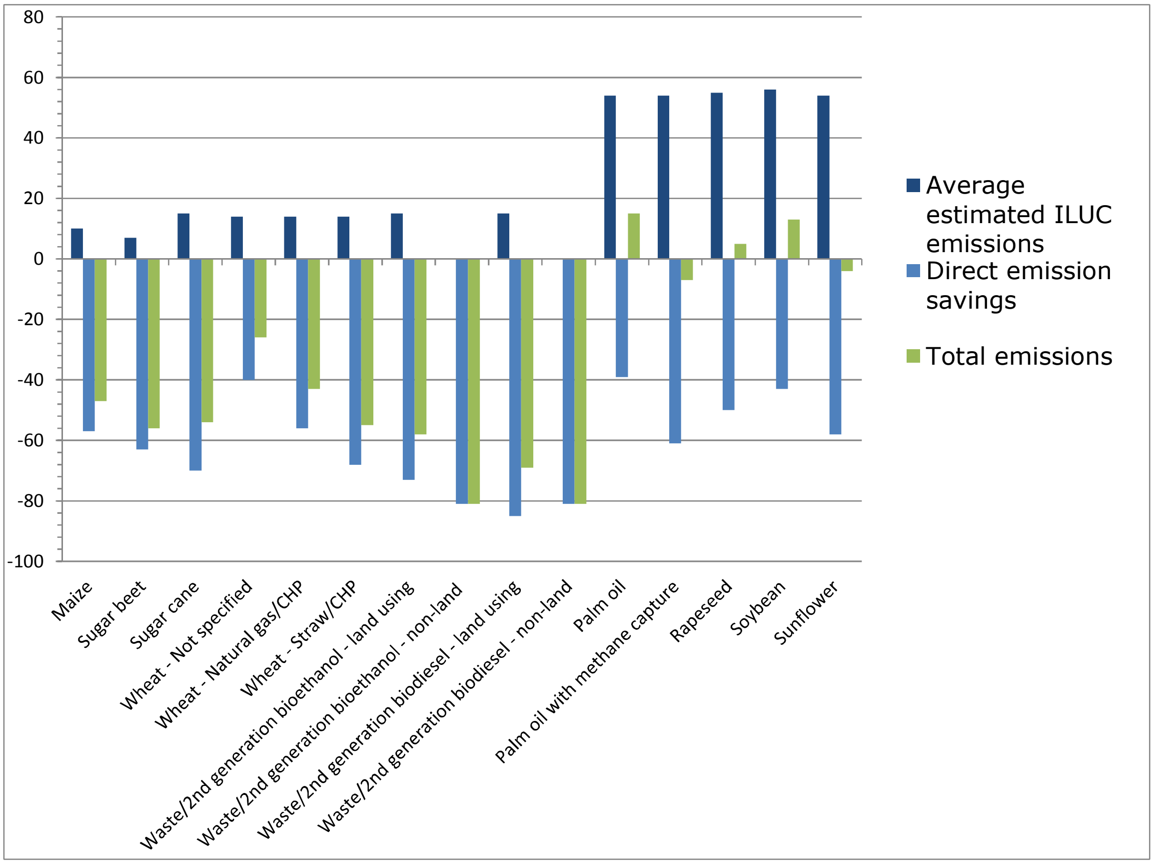

Figure 3. Typical annual direct savings compared to estimated ILUC emissions per crop (gCO_2/MJ) taken from EC Impact Assessment

Expected development in biodiesel versus ethanol split under the cap

However, the fact that the cap does not differentiate between high ILUC risk oilseed crops and medium ILUC risk sugar and starch crops could limit the effectiveness of the proposed measure in reducing GHG emissions. If under the cap the share of high ILUC risk biodiesel were to increase at the expense of medium ILUC risk ethanol, the introduction of a non-differentiated cap could lead to a *rise* in indirect GHG emissions. It's unclear whether this will happen in reality. .Looking at past developments, such a shift does not seem likely. Between 2007 and 2011, the biodiesel to ethanol split was fairly constant at 78/22% and. according to the National Renewable Energy Action Plans which Member States submitted to the EC, the split would be 72/28% in 2020. This would mean that the share of biodiesel in the total mix would actually slightly reduce under the current RED and FQD without the ILUC proposal. It's unclear what impact the proposed cap will have on the development of the biodiesel to ethanol split but there are no indications that it would lead to a shift ethanol to biodiesel. Of course, if the cap were to differentiate between conventional ethanol and biodiesel, it would be ensured such a shift would not take place. .

In order to avoid a rise in GHG emissions due to the cap, a maximum share of 78% conventional biodiesel feedstocks (oilseed crops) could be required within the cap. This figure corresponds with the share of biodiesel related to ethanol in the EU between 2007 and 2011.[44] Such a measure would avoid higher indirect GHG emissions caused by an increasing share of conventional biodiesel in the overall EU biofuel supply. This fine-tuning of the proposed cap might also reduce the risk of non-compliance with WTO rules as the measure, combined with an increased role for advanced biofuels, would more clearly ensure a reduction in GHG emissions per litre of biofuels.

Improved GHG improvement per litre of biofuels but less litres consumed in 2020

The proposed measure leads to a shift from conventional to advanced biofuels and thus improves on average the GHG balance of every litre of biofuel supplied to the EU market. On average, every litre of EU biofuel thus will have a better GHG performance compared to the current situation. However, the European Commission also proposes to lower the *total quantity of litres of biofuels* required to meet the 2020 RED target, due to the proposed double and quadruple counting of certain biofuels (see next chapter). This means that it is unclear whether the EC proposal will lead to a larger role for biofuels in overall EU climate mitigation. As discussed in the next chapter, an alternative incentive for advanced biofuels and an increased role for low ILUC conventional biofuels would ensure that the proposal not only leads to an improved GHG-performance per litre of biofuels but also the total contribution of biofuels in mitigating climate change is increased.

Capped biofuels partly ILUC free

The case has been made that a large part of capped biofuels are in fact ILUC free because ILUC emissions took place in the past, before biofuel production started. This would be the case for the level of EU biofuel consumption in 2008. This argument was voiced by Öko-Institut. At the core of this argument are two assumptions[45]:

1) All biofuels produced *in the EU* until late 2008 do not cause ILUC since they were produced on set-aside land, a category of land that is no longer obligated for farmers under the CAP since the CAP health check at the end of 2008;
2) Biofuel imports from *outside the EU* were just 10% by the end of 2007, with varying risks of LUC, so 90% of EU biofuel consumption was produced on ILUC-free set-aside land.

This means that some of the conventional biofuels produced within the EU could indeed be ILUC-free. It would be interesting to assess to what extent EU biofuel production before 2008 took place on set-aside land as this portion of EU biofuels would indeed be ILUC-free in the sense that ILUC emissions already took place in the past, before the start of biofuel production. This would even be the case if EU biofuel feedstock production on set-aside lands would no longer be cultivated on the same fields because if biofuel feedstocks and other agricultural production would 'swap' fields in the EU, this would not lead to ILUC if yields per hectare are assumed to be the same. It is *additional* biofuel production requiring *more agricultural land* that leads to ILUC. Since it is not possible that a larger quantity than the capped quantity of biofuels would be ILUC free, this is not an argument to raise the cap, it would merely show that some of the capped biofuels are ILUC-free. The quantity of ILUC-free

[44] See Appendix 1 under Statement 28.
[45] Öko-Institut, *Sustainable biofuels? Some thoughts and data on the ILUC issue in the EU 27. Informal paper* (Darmstadt, August 2011).

biofuels is definitely lower than Öko-Institut assumes. Their first assumption could indeed be the case and would need to be further assessed. The second assumption is misleading: although indeed most EU consumed biofuels were produced in the EU, actually 42% of biodiesel feedstocks and 24% of bioethanol feedstocks consumed in the EU in 2008 were imported from outside the EU.[46]

6.3 Impact on meeting the RED and FQD targets

Question
Does the proposed measure allow the RED and FQD 2020 targets to be met?
Answer
The RED transport target can be met if a 5% cap is introduced since the necessary 'non capped' advanced biofuels can be shipped to the EU from across the globe. It will be more difficult however to produce the necessary volumes of these biofuels within the EU and without ILUC effects. The cap is not included in the FQD target and thus does not have a negative impact on meeting that target. The fact that the cap does not apply to the FQD means that up to 7.2% conventional biofuels could be supplied to the EU market in 2020. The actual use of conventional biofuels to meet the FQD will depend on several factors, but notably on the role of non-biofuel options, such as flaring.

6.3.1 Meeting the RED target

With the cap in place, it could be possible to meet the RED transport target by having 5% conventional biofuels, plus either 2.5% by energy content of double counting biofuel, or 1.25% by energy content of quadruple counting biofuel or a combination in between. Therefore, even if the full renewable transport target is achieved in all Member States, the maximum biofuel by energy content would only ever be 6.25% to 7.5% biofuel. This has a knock-on effect for the overall RED renewable energy target (20% across the EU as a whole in 2020), because the double and quadruple counting does not apply towards the overall renewable energy target. The contribution from transport renewables will not in fact be 10% but will be less. The ILUC proposal will lower the contribution from biofuels to the overall RED target from 2.5% (if there was 10% by energy content biofuels) to around 1.6-1.9% (if only 6.25-7.5% biofuel by energy content is achieved).

Whether the required quantities of double and quadruple counting advanced biofuels are indeed available in the EU is an important question. Chapter 7 addresses this question in detail. Of course there will always be sufficient double and quadruple counting biofuel feedstocks available on a global scale which could be shipped to the EU, with possible negative implications for their traceability and sustainability. Allowing conventional biofuel production with a low ILUC risk to fulfil (part of the) RED-

[46] Ecofys, Assessing grandfathering options under an EU ILUC policy, p. 17-21, 40.

target beyond the 5% cap, as described in section 6.8, would help to avoid these negative implications.

In 2011 fuel suppliers in the Netherlands supplied 4.31% of biofuels overall, which includes double counting biofuels (see section 3.1). Double counting biofuels accounted for 40% of the supply in the Netherlands in 2011, or 20% by energy content (because of the double counting). Conventional biofuels, as per the ILUC proposal definition, therefore totalled 2.6% (60% * 4.31) of fuel supply. Therefore, to meet the 2020 target with the proposed cap in place, fuel suppliers in the Netherlands could supply up to an additional 2.4% conventional biofuels, which is just under double the 2011 supply. This is pictured in Figure 4 below, where the inner ring shows that 2.41% additional conventional biofuels can be supplied to the Dutch market with the cap in place.

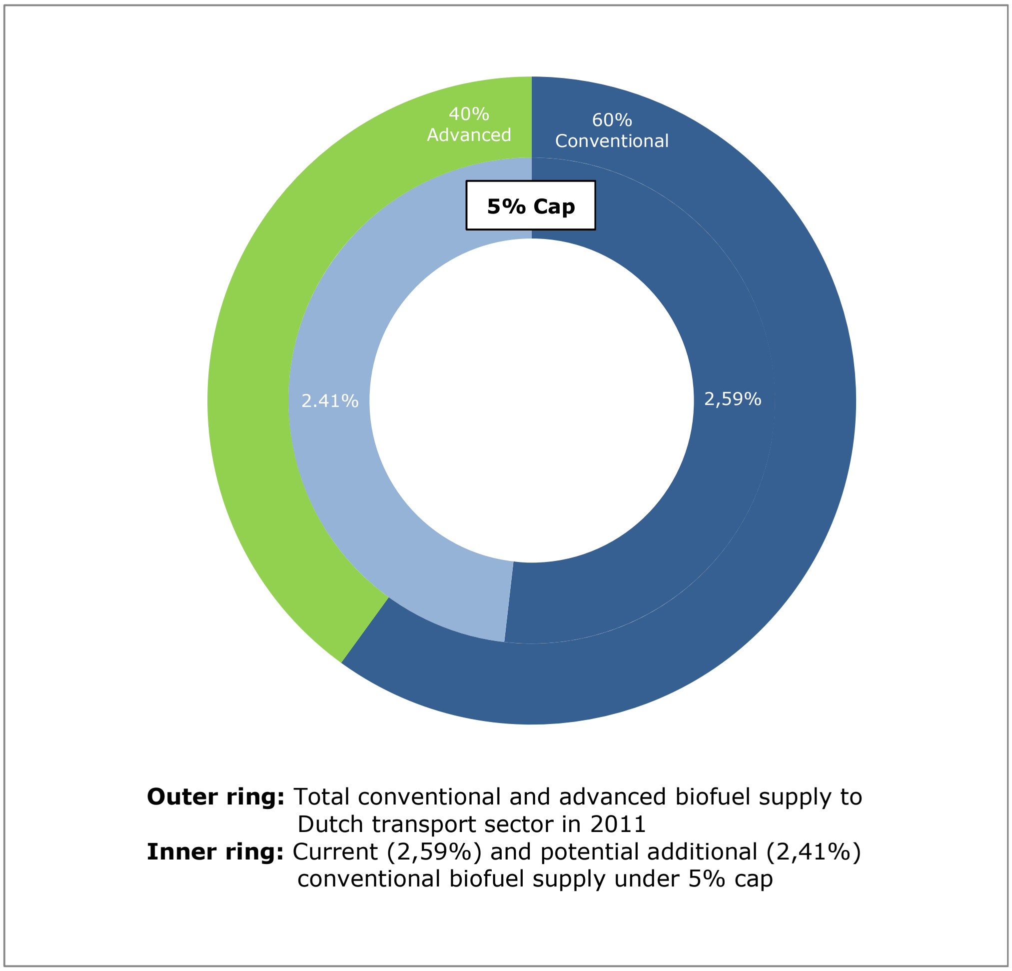

Figure 4. Conventional biofuels supplied in the Netherlands in 2011 and remaining space under the 5% cap

6.3.2 Meeting the FQD target

As stated above, the cap is only introduced in the RED and not in the FQD. This means that the introduction of the CAP has a neutral impact on meeting the FQD target. It also means that under the FQD more than 5% conventional biofuels are allowed and this means that more than 5% conventional biofuels could be supplied to the EU market. Whether this will indeed be the case depends on the following three factors:

1) The quantity of double and quadruple counting biofuels supplied to the EU market to meet the RED target. The less quadruple counting biofuels are supplied under the RED, the more double counting biofuels are required to meet the target, and therefore the lower the likelihood that additional conventional biofuels would be used to meet the 6% FQD GHG reduction;
2) The average GHG savings of biofuels supplied. The higher the GHG savings, the lower the volume of biofuels needed under the FQD;
3) The role of non-biofuel options to meet the FQD target. If more well-to-wheel emission savings are achieved by non-biofuel options, less biofuels are needed to meet the FQD target.

A likely scenario to meet the RED target in 2020 in a biofuels-only situation could be 5% conventional biofuels with 60% GHG saving, 1.5% double counting biofuels with 85% GHG saving (counting as 3%) and 0.5% quadruple counting biofuels with 85% GHG saving (counting as 2%). This scenario to meet the RED would reduce well-to-wheel GHG emissions by 4.7%, meaning an additional 1.3% GHG saving is needed to meet the FQD 2020 target. If the FQD were fully met by biofuels, this 1.3% could be met by supplying an additional 2.2% conventional biofuels (on top of the 5% cap) with 60% GHG saving. This would mean that the total quantity of conventional biofuels supplied would be 7.2%, well beyond the 5% cap.

1) Quantity of double and quadruple counting biofuels supplied to meet the RED

If less quadruple counting biofuel is supplied to meet the RED, the total quantity of conventional biofuels would reduce as well. If in the example scenario the share of quadruple counting biofuels were to drop from 0.5% to zero, the share of double counting biofuels would have to rise from 1.5% to 2.5% in order to reach the 10% target. This means that the total well-to-wheel GHG saving of the scenario would rise from 4.7% to 5.1% due to the larger volume by energy content of biofuels with 85% GHG emission saving. In order to meet the FQD target in a situation where only biofuels would be used to meet the FQD, an additional 0.9% GHG saving would be needed. This corresponds with 1.5% conventional biofuels at 60% saving, leading to a total supply of conventional biofuels of 6.5% instead of the 7.2% needed in the example scenario. Of course the additional 0.9% well-to-wheel savings could also be filled in with double counting biofuels with 85% saving. If this would be the case, only 1.1% additional biofuels would be required and total conventional biofuel supply would stay at 5%. This however is not likely since no double counting exists under the FQD and conventional biofuels are generally cheaper than advanced biofuels if counted as single.

2) Average GHG savings of biofuels supplied

If the average biofuel GHG saving were to increase, the total quantity of conventional biofuels would reduce. If in the scenario in mentioned above, conventional biofuels GHG savings would rise from 60% to 65% and double and quadruple counting biofuel savings would rise from 85% to 90%, the well-to-wheel overall GHG saving of the scenario would rise from 4.7% to 5.3%. In order to meet the FQD target in a situation where only biofuels would be used to meet the FQD, an additional 0.7% GHG emission saving would be needed. This corresponds with 1% conventional biofuels with 70% saving, leading to a total supply of conventional biofuels of 6% instead of the 7.2% needed in the example scenario. As said above, of course the additional 0.7% well-to-wheel GHG savings could be achieved by an additional supply of advanced biofuels rather than conventional biofuels. However, as the FQD does not have double and quadruple counting, it is likely that any additional biofuels required will be conventional.

3) Role of non-biofuel options to meet the FQD target

In addition to the role of double and quadruple counting biofuels and the average biofuels GHG savings, the overall quantity of conventional biofuels is also influenced by the extent to which non-biofuel options are used to meet the FQD target. Possible non-biofuel options are:

- Reducing flaring and venting of natural gas at oil wells. Natural gas is a by-product in oil production and is often burned or released when considered to have too little economic value;
- Supplying electricity in road transport;
- Capturing EU refinery emissions and storing them underground (CCS)
- Reducing refinery emissions of fossil fuels supplied to the EU. Refinery emissions constitute around 8% of total well-to-wheel emissions;
- Reducing transport emissions associated with fossil fuel production and distribution, although transport only makes up a very small share of emissions.

Tailpipe emissions constitute around 85% of total well-to-wheel emissions. Most of the options listed above reduce the 15% upstream emissions. The use of biofuels is a way to reduce tailpipe emissions and therefore can play a large role in meeting the FQD 2020 target.

The extent to which non-biofuel options are used depend on two factors:

1. The role non-biofuel GHG reduction measures are allowed to play from a regulatory point of view, and;
2. The difference in cost between biofuel and non-biofuel GHG reduction measures.

Regulatory role for non-biofuel measures

It still remains to be seen how much biofuels will be needed to meet the FQD target as some important aspects of the directive still need to be agreed on by the EU. In October 2011, the European Commission published a draft decision on various elements of the FQD. The main elements included in this document are:

- Default values for fossil fuel GHG emissions which fuel suppliers can use for reporting. Different values apply for different fuels depending on their carbon intensity of production. Fuel produced from natural bitumen (tar sands) for example, has a value of 107 gCO_2/MJ (petrol) or 108.5 gCO_2/MJ (diesel), while conventional crude based petrol has a value of 87.5 gCO_2/MJ and conventional crude based diesel 89.1 gCO_2/MJ;

- The option for fuel suppliers to report actual values for fossil fuels with a higher default value than conventional oil based fuels, which provides an incentive to reduce emissions;
- A methodology for the calculation of the 2010 GHG baseline, against which the 6% GHG reduction target in 2020 must be achieved. Unconventional fuels (tar sands, oil shale etc.) are not included in this baseline;
- The possibility for fuel suppliers to count reductions in flaring and venting worldwide towards the EU FQD target, regardless of whether the fuel from the wells where the reduction was realised is supplied to the EU or to other parts of the world.

The last point mentioned above deserves further attention. Flaring and venting of natural gas at oil wells takes place on a large scale. Each year a total of 110 billion m^3 natural gas is estimated to be flared and vented.[47] If only part of these emissions could be stopped by fuel suppliers, the FQD target could be fulfilled without the use of biofuels. The FQD target requires oil companies to reduce well to wheel emissions of fossil fuels supplied to the EU. The problem is that if indeed all GHG reductions need to be directly related to fuels supplied to the EU, oil companies might not invest in flaring and venting reductions. Oil drilling often takes place in joint ventures between a western oil major and a national oil company and often the oil will be supplied to several places, only in part to the EU. This means that if a western oil company which uses part of the oil at a specific well to produce fuels for the EU would reduce flaring and venting, only part of the resulting GHG emission reduction would be linked to oil supplied to the EU market. This means that only part of the investment to reduce flaring and venting can be used by the company to help to meet its FQD target. This leaves of course the question why oil companies need an incentive to reduce flaring and venting. As drilling often takes place in remote places, the natural gas would have to be transported over long distances, leading to a poor business case for investments in reductions.

As said, the European Commission proposed in 2011 to allow worldwide flaring and venting emissions to count towards the FQD target. This would probably lead to investments in flaring and venting reduction but would also undermine the basic well-to-wheel emission reduction principle of the FQD. The draft Commission decision needs to be endorsed by the Committee on Fuel Quality. The Committee discussed the proposed decision in early 2012 but could not reach agreement and the topic was scheduled to be voted on in the EU Environment Council in June. As in the Committee, no sufficient majority could be found among the EU environment ministers in favour of the proposal. One of the points of discussion was the introduction of a separate GHG default value for tar sands, which was vehemently opposed by the Canadian government. The European Commission will prepare a new draft decision which is expected to be published in early 2013.

Cost difference between biofuels and non-biofuel measures

[47] Franz Gerner et al, `Gas flaring and venting‘, World Bank estimate, 2004, p.1. see: http://rru.worldbank.org/documents/publicpolicyjournal/279gerner.pdf

It is up to fuel suppliers to decide how they will meet the FQD target. They are likely to use the quantity of biofuels needed to meet the RED target to also meet part of the FQD target. As described above, because of the proposed introduction of the 5% cap and double and quadruple counting it is unlikely that the entire FQD target can be met with biofuels needed to meet the RED target. This either means that more biofuels are supplied or that suppliers opt for non-biofuel measures. This choice depends on the cost difference between the two. Analysing this cost difference goes beyond the scope of this report, but could be interesting for policy makers.

Thus there are many uncertainties in judging whether the RED or FQD will be leading driver for biofuels towards 2020. Today it is clear that the RED is the leading driver, as the FQD does not include interim targets before 2020 and many Member States are not (at the moment) prioritising implementation of the FQD. The RED will be the leading policy driver for investment in biofuels for the short term, so if the cap is introduced in the RED it seems more likely that there will be an increased drive to report higher GHG emissions from the biofuels used to meet the FQD, rather than using additional conventional biofuels above the 5% cap that cannot be counted towards the RED target.

It is likely that a small share of the RED will be met with electricity, which would also count towards the FQD target. This would lower the share of double and quadruple counting biofuels more than the share of conventional biofuels as electricity is allowed to be used beyond the proposed 5% cap.

6.4 Protection of current investments and impact on actors in the chain

Question
Does the proposed measure effectively protect current investments in the EU biofuels sector and how does it impact various actors in the chain?
Answer
The proposed 5% cap could lead to some income losses for a small portion of European farmers, hasa limited negative impact on biofuel feedstock processors and a negative impact for biofuel producers because the cap prevents the anticipatedgrowth in conventional biofuel production in the EU. Current investments are protected because the proposal does not lead to a lower demand for conventional biofuels in the EU. However, as the current EU biofuel production sector is not very profitable (a situation unrelated to the ILUC discussion), the cap will further depress earnings and margins and could lead to plant closures. The proposal does provides a positive incentive for producers of advanced biofuels

The European Commission aims with its ILUC proposal to address ILUC while protecting current investments in biofuels capacity. Combining these two policy goals is ambitious. After 2004, hundreds of millions of euros were invested in biofuel production facilities in the EU, mainly consisting of biodiesel installations. Investors put their money into biofuels, not with the aim of earning their investment back but, beyond that, to make a good return on investment while supplying the EU with 'green' fuels. Most of these investments were made between 2005 and 2008, a period sometimes called the 'gold rush' into biofuels because the prospect of the upcoming EU Renewable Energy Directive seemed to ensure a bright future for biofuels in the EU. The gold rush led to overcapacity which depressed capacity utilisation rates and earnings. Some investments, especially small, stand-alone, land-locked, old-technology or expensive custom-made installations, were probably never good investments and could only have survived in a market with chronic under capacity. Owners of many of these installations have filed for bankruptcy. Others, especially larger, modern installations, integrated with oilseed crushers at port locations are still running at high utilisation rates. Even these installations did not live up to expectations due to high feedstock prices and, at times, cheap biofuel imports from outside the EU. With hindsight, investing in biofuels capacity was often not a good investment. With the current EU biofuels market in dire straits, protecting current investments while introducing measures to address ILUC will be very challenging. This report does not aim to assess the current situation of the EU biofuels sector under the current EU biofuels policy, but assesses the impact of the EU ILUC proposal. We do not to take the hopes and expectations of investors as starting point but limit ourselves to the amortisation period of investments. This is the period during which investments are paid back to the bank or other financer. The amortisation period differs from the depreciation period, which is the (often legally maximised) period during which the asset is written off.

The effect of the ILUC proposal on current investments in the EU biofuels sector will be assessed, looking first at feedstock cultivation and subsequently at feedstock processing and biofuel production. The cap clearly has a positive impact for processors and producers of advanced biofuels. This impact is discussed further in chapter 7.

6.4.1 Impact of the proposed measure on EU farmers

Conventional biofuel feedstocks are generally crops which can also be used for food production, while their by-products are used for feed production. EU farmers mostly did not invest capital in producing for biofuels but saw an economic benefit in producing biofuel crops such as rapeseed instead of purely food crops such as beans or peas in crop rotation agriculture. An advantage of producing rapeseed is that it enables switching between food and fuel markets. The total global gross agricultural land which was used to produce the biofuels consumed in the EU in 2008 is estimated to be 7 Mha, of which 3.6 Mha was located in the EU and 3.3 Mha in third countries.[48] These 7 Mha represent roughly 4.4% of the total EU utilised agricultural area[49], which was over 159 Mha in 2010.

The extent to which the proposed cap influences the demand for biofuel crops and the level of flexibility to switch to other markets determine the impact of the proposed 5% cap on their business.

[48] Ecofys, *Biofuels Baseline Report*, 2011
[49] Utilised agricultural area (UAA) describes the area used for farming and includes arable land, permanent grassland, permanent crops. Source: Eurostat FSS.

As stated in section 6.1 above, the overall demand for biofuel crops will not decrease as a result of the cap.

Biofuel crops produced in the EU are almost always food crops. Also, EU farmers mainly produce short rotation crops, which makes it much easier to shift between crops compared to, for example, palm oil plantations. Farmers can switch from rapeseed to sunflower or other crops from one year to the next. The Common Agricultural Policy (CAP) has no influence on this flexibility. The CAP does restrict the conversion of pastureland to cropland[50], but pastureland is not used to produce biofuels. Although EU farmers are flexible to switch between food and fuel markets, a possible reduction of demand in certain feedstocks due to an EU ILUC policy will not lead to an increased demand for food products and will thus lead to an overall reduction in feedstock demand, relative to a scenario with uncapped conventional biofuel production. This means farmers might partly switch from rapeseed to other 'break' crops which are currently less interesting from an economic perspective. This can lead to income losses. As biofuel production only constitutes a small share in total EU crop production, such an effect will be limited.

Individual farmers producing biofuel feedstocks generally have not invested in processing or production capacity. However, some cooperatives which are active in biofuel production are owned by farmers including large ethanol producers such as Tereos and Cristal Union[51]. The majority of EU biofuel capacity is not owned by farmers and the majority of EU farmers have not invested in biofuel production capacity.[52]

There are three reasons to conclude that the impact of the proposed 5% cap on EU farmers is low. Firstly, the fact that the proposed 5% cap does not lead to a decrease in conventional biofuel feedstock demand but rather prevents the anticipated increase towards 8.6% conventional biofuels according to the EU Member State's National Renewable Energy Action Plans, secondly the fact that farmers are flexible to switch between feedstocks in their crop rotation scheme from rapeseed to beans and peas for example. Thirdly the fact that no substantial investments by farmers in feedstock processing or biofuel production installations have taken place.t As stated above, the cap could however lead to some income losses for the small part of EU farmers who produce biofuel feedstocks.

6.4.2 Background information on conventional biofuel feedstock processing

Before assessing the impact of the 5% cap, first some brief background on biodiesel and ethanol feedstock processing is provided.

Biodiesel feedstock processing

[50] Personal communication with COPA-COGECA.
[51] Personal communication with COPA-COGECA, Ecofys expertise. Both companies mentioned are cooperatives owned by farmers and active in bioethanol production amongst other activities.
[52] Ecofys expertise

Biodiesel feedstocks are transported to crushing facilities. A differentiation can be made between seeds with high oil content such as rape and sunflower, and soybeans, with a relatively low oil content. Rape and sunflower are preheated before being mechanically pressed in expellers, whereas soy beans are thermally treated and then mechanically crushed.[53]

Total EU oilseed crushing stood at 41,877,000 tonnes in 2011, 53% of which consisted of rapeseed crushing, 29% of soybeans and 15% of sunflower seeds and 3% other oilseeds. Of total EU crushing, 4,013,000 tonnes or 9.6% took place in the Netherlands.[54] The output of crushing facilities mainly goes to the food market and only a relatively small quantity is crushed for biofuels. According to FEDIOL, the EU vegetable oil and protein meal association, 38% of the vegetable oil was used for biofuel production in 2011. Crushing of crude palm oil from fresh fruit bunches[55] takes place in Asia. Most crude palm oil is further processed in Asia although some is exported to the EU where it is further processed.

Ethanol feedstock processing

Various ways of processing are used for different ethanol feedstocks. Sugarbeet is processed[56] in sugar processing installations that can produce sugar for both food use and ethanol production. Sugarcane ethanol is produced directly in sugar cane mills that produce both sugar and ethanol. Wheat and corn ethanol is produced directly in ethanol plants without a separate processing step.

6.4.3 Impact on conventional feedstock processors and biofuel producers

As discussed above, the market for EU biofuel production has not been very healthy during the past few years, mainly due to large overcapacity. This led to consolidation in the markets with many smaller players filing for bankruptcy. In such a market, any additional requirement or restriction for biofuel producers who supply to the EU market leading to a lower than anticipated demand for conventional biofuels will negatively affect the biofuels business and has a negative impact on current investments in the EU biofuels sector. We do not aim to assess the overall state of the industry under the current policy framework impact, but the specific impact of the ILUC proposal on current investments.

Current investments in EU feedstock processing and biofuel production will be impacted if one or more of the three (interlinked) situations take place:

1. The proposed measure leads to a lower capacity utilisation of production installations;
2. The estimated average amortisation period for EU conventional biofuel production installations [57] has not yet been achieved;

[53] See http://www.fediol.eu/web/oilseeds%20crushing/1011306087/list1187970116/f1.html
[54] FEDIOL statistics, available at: http://www.fediol.be/data/1318929878Stat%20seeds%20evolution.pdf
[55] FFB, the bunch of fruit harvested from the oil palm tree, weighing 10-50 kg containing many smaller individual fruits.
[56] Beets are sliced thinly and sugar is extracted by diffusing with hot water, after which further processing takes place.
[57] Ecofys, Assessing grandfathering options under an EU ILUC policy, p. 14, 15, 28.

3. Lower earnings from processing or biofuel production have a negative draw on the overall value of a company.

1) Impact on capacity utilisation.
The 5% cap could have a negative impact on the utilisation rate of both conventional biofuel feedstock processing installations as well as biofuel production installations. This impact depends on:

1. The extent to which the 5% cap will lead to a reduction in EU conventional biofuel demand, and;
2. The degrees of flexibility processors and producers have to switch to non-conventional biofuel or non-biofuel markets.

Effect of the cap on conventional biofuels on biofuel capacity utilisation
As described above at the beginning of section 6.4, the EU biofuels market has been (partly) consolidated in recent years. Several production facilities went bankrupt. These installations are currently unused, could still be used in the future and are counted in capacity utilisation figures. Average EU conventional biofuel production capacity utilisation rates have been low in recent years. Conventional biodiesel capacity utilisation varied between 40 and 46% in the years 2005-2010, while utilisation rates for ethanol averaged between 56 and 64% between 2005 and 2009.[58] These low rates can partly be explained by the fact that some installations have gone bankrupt and completely stopped operating but are still counted. Installations which currently are in operation have higher than average utilisation rates. The proposed cap does prevent future growth, which does have a negative impact and will prevent a more intensive use of current production capacity.

Flexibility to switch to non-conventional biofuel or non-biofuel markets
Biofuel feedstock processors are flexible to switch between food and fuel markets, this is especially true for processors with good transport links, i.e. in port locations. Biofuel production installations are dedicated installations and cannot switch to other uses. Sometimes, oilseed crushers have an on-site, integrated biodiesel installation which means that while the crusher is flexible to switch to produce vegetable oil for the food market, this move would come at the expense of the biodiesel plant.

Conventional biofuel producers can sometimes switch to non-conventional biofuels. This is especially true for conventional biodiesel (FAME) producers who can switch to producing waste oil based biodiesel. In the Netherlands, the Electrawind GreenFuel biodiesel installation was built as Roosendaal Energy to produce rapeseed biodiesel and recently switched to produce UCOME (biodiesel from used cooking oil). Switching from FAME to UCOME could require a substantial investment depending on the quality of UCO which is used. High quality UCO with little impurities and a low content of free fatty acids could be used without problems in FAME installations. Often however, the quality of available UCO will require an investment at the biodiesel facility. Such a retrofit could include pre-treatment (filtering) of the UCO and building UCO storage tanks. It requires the installation of an esterification unit at the beginning of the process, and a distillation unit at the end, to make sure the biodiesel still meets the European EN 14214 standard for biodiesel. These additional units reduce the conversion efficiency of the installation. According to a biodiesel technology provider, such an investment

[58] Ecofys, *Grandfathering ILUC* (2011), based on EBB and ePure statistics.

typically cost 3 to 5 million euro for 50% of a 100,000 tonne installation[59], meaning somewhere between 33% and 50% of the initial biodiesel plant investment costs. Shifting from FAME to UCOME is more suitable for stand-alone biodiesel plants and less suitable for plants which are integrated with oilseed crushers. An investment in retrofitting is especially interesting for investors who buy a biodiesel installation who went bankrupt from its previous owner for a modest sum of money, as was the case with the old Roosendaal Energy installation in the Netherlands.

While feedstock processors are and biodiesel producers have some flexibility to shift to non-conventional biofuel or non-biofuel markets, the proposed cap does impact EU biofuel capacity utilisation. Not to the extent that current rates are expected to decrease, but the expected future growth of the market up to 2020 will not take place, preventing a future increase in capacity utilisation.

2) Estimated average pay-back time for EU biofuel production installations not yet achieved. The largest share of production costs for the final biofuel producer consist of feedstock costs. Technology and O&M (operation and maintenance) costs are usually relatively low. The higher capacity utilisation of installations is, the shorter the investment pay-back period. In early 2011, Ecofys estimated the amortisation period for conventional biodiesel installations to be 5 to 10 years.[60] This assumed average pay-back time was based on the current EU biofuels policy not taking into account the ILUC proposal. Ecofys has performed additional research and interviews with biofuel sector stakeholders. Based on this, we conclude that, while in 2003-2005 sometimes the payback period was only 3 to 4 years, an estimation of 10 year amortisation period seems reasonable for an average EU biodiesel installation under the current EU policy framework. Conventional ethanol installations generally are more expensive than biodiesel installations. Ecofys does not have specific information available on the amortisation period for conventional ethanol capacity but a 10 year amortisation period does not seem unrealistic.
Of course this amortisation period only refers to installations which are currently in operation and not to installations which have gone bankrupt in recent years. Also, some installations temporarily stop producing due to unfavourable market circumstances (earnings too low to cover feedstock and operational costs). In these cases the amortisation period would be prolonged. The ILUC proposal could also lead to a situation in which the amortisation period is longer than 10 years.

Cellulosic biofuel and HVO (Hydrotreated Vegetable Oil) installations have a longer payback period as capital costs are much higher. Assuming a pay-back period of 10 years for conventional biofuel production installations means that, if it is assumed that an EU ILUC policy takes effect from mid-2016 onwards,[61] installations in operation by 2006 which are still in operation, can be assumed to have been able to pay back investment costs. Investments in biodiesel installations that became operational after 2008 will be affected by a drop in capacity utilisation. EU biodiesel capacity was 10,289 tonnes at the end of 2007, while 2011 capacity was 22,117 tonnes.[62] From this it can be

[59] Interview with BDI
[60] See further: Ecofys, Assessing grandfathering options under an EU ILUC policy, p. 14, 15, 28.
[61] Political triologue agreement between EU institutions in 2015, followed by 12 month transposition period.
[62] European Biodiesel Board statistics, available at http://www.ebb-eu.org/stats.php

deduced that around 12 Mtonnes or around 53% of biodiesel capacity would not yet have achieved full investment pay-back at the time the EU ILUC policy enters into force in EU Member States. Current EU ethanol production capacity stands at around 8 Mtonnes.[63]
As the proposed 5% cap does not reduce but rather freeze current conventional biofuel production, average pay-back periods for current conventional biofuel installations are not expected to be seriously impacted. As described under point 1, biodiesel producers could switch from conventional feedstocks to wastes and residues. This could increase their capacity utilisation rate and would certainly increase the average capacity utilisation rate of other producers since the 5% conventional biofuel production can be 'shared' between less producers, thus reducing their amortisation periods.

3) *Lower earnings from processing or biofuel production have a negative draw on the overall value of a company.*

Even in cases where the installation investments have been fully paid back, a drop in demand leading to lower capacity utilisation could still have a negative impact. Obviously it would affect earnings and margins, and it could also affect the total value of a company, which consists of more than just fixed investments. For biodiesel production installations, this effect can be avoided by switching to waste and residue feedstocks. Feedstock processing installations such as oilseed crushers do not have this option and their earnings and margins might be impacted.

As a general conclusion, the proposed 5% cap does have a very small negative impact on farmers, a limited negative impact on biofuel feedstock processors and a negative impact on conventional biofuel producers because the cap prevents the anticipated growth in conventional biofuel production in the EU. Current investments of installations currently in operation are protected because the proposal does not lead to a lower demand in conventional biofuels in the EU. However, the measure does add to the issues of a depressed market which largely results from overcapacity. The proposal also provides a positive incentive for producers of advanced biofuels.

Specific situation in the Netherlands

The proposed introduction of a cap places a restriction to biofuel producers but does not lead to a lower demand for conventional biofuels. As described in the previous section, the Netherlands could still nearly double the supply of conventional biofuels up to 2020 and in the EU as a whole the supply of conventional biofuels will not decrease, and might even increase, depending on how the FQD target will be met. As described in section 3.2, current capacity utilisation of ethanol production in the Netherlands stands at 66% while biodiesel capacity utilisation is 60%. While Dutch biofuel production installations produce for other EU markets as well, the scope to double conventional biofuel supply offers a chance to raise their utilisation rates if (part of) the additional conventional biofuel is produced in the Netherlands. Such a potential rise in capacity utilisation would help to shorten the payback time of current investments which is based on the average capacity utilisation rates in recent years as described in section 6.4.3 below.

[63] http://www.epure.org/statistics/info/Productiondata1

6.5 Impact on administrative burden

Question
How does the proposed measure impact the administrative burden for companies?
Answer
Fuel suppliers have to report to authorities on the ratio of conventional versus advanced biofuels they supply, which could mean a slight additional reporting. Other parties in the chain experience no additional administrative burden.

Administrative burden can take many forms. The assessment in this report is limited to reporting requirements for economic operators to Member State authorities and certification requirements to parties in the biofuel supply chain.

The cap has a very limited negative effect on administrative burden for fuel suppliers, who have to report to Member State authorities on the ratio of conventional versus advanced biofuels they supply (this assumes that Member States take a pragmatic approach to implementation of the cap). This leads to only limited administrative burden since under the FQD, fuel suppliers are already obliged to report on the types of biofuels they supply, and under the RED the portion of double counting advanced biofuels is already reported. The proposal will not lead to additional certification requirements for feedstock producers, processors or biofuel producers and therefore does not lead to additional administrative burden for these actors in the supply chain.

6.6 Incentive for cellulosic biofuels

Question
Does the proposed measure provide sufficient incentives to stimulate the production and consumption of cellulosic biofuels in the EU?
Answer
A cap alone might provide some increased incentive for cellulosic biofuels. However the availability of cheaper double and quadruple counting biofuels means that the cap plus the double and quadruple counting biofuels leads to little incentive for more expensive advanced biofuels options, such as from cellulosic feedstocks.

As discussed in the above sections, it is feasible to meet the RED transport target through increased utilisation of the current conventional biofuel production capacity, plus an increase in double and quadruple counting biofuels other than cellulosic biofuels (e.g. UCO). It is also feasible to report substantially higher GHG savings than the RED default values for conventional biofuels without changing current processes but by using actual GHG data, which would help to meet the FQD target.

A cap alone provides little incentive for advanced (cellulosic) biofuels. The availability of cheaper double and quadruple counting biofuels such as biodiesel from Used Cooking Oils and rendered animal fats, means that the cap plus the double and quadruple counting biofuels leads to little incentive for more expensive advanced biofuels options, such as from cellulosic feedstocks. The question whether double and quadruple counting offers sufficient incentive to lead to a substantial increase in cellulosic biofuel capacity is discussed in section 7.6.

6.7 Impact on biofuel prices

Question
How will the proposed cap impact the price of biofuels?
Answer
This impact of the proposed 5% cap on conventional prices is estimated to be limited since feedstock prices are a very important part of biofuel prices and the biofuel market is too small to drive feedstock prices. The reliance on advanced biofuels to meet the RED transport target beyond the cap might lead to higher average biofuel costs since advanced biofuels could be more expensive. However, the double and quadruple counting leads to a de facto lowering of the RED target and therefore lowering the overall costs of the EU biofuels policy.

Biofuel prices are determined to a large extent by feedstock prices. The cost of conventional biodiesel production is determined for 90% by feedstock prices, whereas for ethanol production costs this share is 70-80%.[64] As the biofuel market is too small to drive feedstock prices, the proposed cap, which caps demand growth for agricultural crops for biofuels, will not impact conventional biofuel prices. More so because the cap is not included in the FQD and overall biofuel supply in the EU might be higher than 5%. The proposed cap could however lead to higher overall prices of biofuels because the dependence on advanced biofuels is greatly increased. Some advanced biofuels produced from waste and residue materials can be produced relatively cheaply, but the introduction of double counting has already led to a sharp increase in prices of double counting used cooking oils and waste animal oils in recent years, to such an extent that these biofuels often are no longer cheaper than conventional biofuels. Still, biodiesel produced from wastes and residues are cheap compared to cellulosic ethanol, which requires expensive production technology. Although the impact of the proposed cap on biofuel prices is hard to predict, the resulting reliance on advanced biofuels could lead to increased biofuel prices, either because more expensive cellulosic biofuels will be supplied, or because wastes and residues will be imported from outside the EU in large quantities and prices of those feedstocks will rise.

[64] Ecofys, *Grandfathering ILUC* (2012), 14-15.

While advanced biofuels might in some cases be more expensive compared to conventional biofuels per litre, the fact that they are counted twice or four times towards the RED transport target reduces the overall quantity of biofuels required, possibly leading to a lower overall cost of the EU biofuel policy.

6.8 Alternative scenarios

Alternative policy scenarios related to the cap could be envisaged:

1) **Sub-cap for conventional biodiesel:** as discussed in section 6.2, the fact that the cap does not differentiate between high ILUC risk oilseed crops and medium ILUC risk sugar and starch crops could limit the effectiveness of the proposed measure in reducing GHG emissions if a shift from conventional ethanol to conventional biodiesel were to take place under the cap. The fact that the expected biodiesel to ethanol ratio in 2020 will stay more or less at the same level as currently makes this scenario unlikely. In order to exclude the risk of rising indirect emissions under the cap, the quantity of biodiesel within the cap could be maximised to 72%. This would resemble the sub-targets for ethanol and biodiesel within the Dutch biofuels mandate, which currently no longer apply. This alternative scenario would reduce the options for fuel suppliers to determine the mix of biofuels they would like to supply to the market.
2) **Higher or lower cap:** The cap could be set at, for example, 4% or 6%. Decreasing the cap would increase the production of advanced biofuels, and thereby increase the risk of unwanted practices regarding the supply of wastes and residues. It would be possible to supply sufficient relatively cheap double and quadruple counting biofuels if sourced globally, with possible sustainability risks attached. Decreasing the cap would lead to an increased risk that current investments are not properly protected since it could lead to a reduction in conventional biofuels supply in the EU and corresponding lower capacity utilisation rates for biofuel installations. Note that the cap is not included in the FQD, which might mean that the level of conventional biofuels supplied will be higher than the cap. Increasing the cap would have reverse effects compared to a decrease.
3) **Inclusion of cap in the FQD:** As described in section 6.3.2., tailpipe emissions are 85% of total well-to-wheel emissions and the use of biofuels are a logical way to reduce these emissions. Especially if counting worldwide flaring and venting emission reductions towards the FQD target is not allowed, a considerable quantity of biofuels will be needed.

   A cap on conventional biofuels also in the FQD, e.g. a limit of 3% GHG savings from conventional biofuels, could lead to increased use of advanced biofuels, which could lead to unwanted practices as described in the next chapter. A cap on conventional biofuels in the FQD would therefore ideally be combined with allowing (conventional) low ILUC biofuels (see section 6.8) to fulfil the FQD beyond the cap.

A cap in the FQD would however reduce a key benefit of having a GHG-based target in addition to the volume-based RED target: the fact that it incentivises biofuels with a good GHG performance. With a cap in the FQD, fuel suppliers have no incentive to supply biofuels with a higher GHG-saving than the minimum required saving. It would decrease the ability to meet the FQD target by reporting actual (higher) GHG savings from existing conventional biofuels supply chains.

The cap would not reduce the potential use of non-biofuel measures to meet (part of) the FQD target as the cap sets a maximum, not a minimum.

If the cap were to be included in the FQD the cap could be administered on the basis of fuel supplier's annual biofuels reporting which already would have to specify the feedstock in order to be able to administer the cap in the context of RED-compliance. This means administering a cap in the FQD would probably not lead to a large additional administrative burden.

4) **Allow the use of conventional low ILUC biofuels beyond the cap.** The Commission proposal only allows the use of advanced biofuels (often double and quadruple counting) to fulfil the RED target beyond the 5% cap. The current proposal distinguishes clearly between 'bad' conventional biofuels and 'good' advanced biofuels. In reality, it is possible to produce ILUC-free conventional biofuels and, as described in section 8.8, advanced biofuels are not necessarily low ILUC. Advanced biofuels, even if produced from non-land using residues, could lead to ILUC if other uses are displaced (see section 6.2).

   Conventional biofuels can be produced without leading to ILUC. This is the case if *additional* biofuel feedstocks are produced without displacing other agricultural uses. Examples are:
   1) Biofuel feedstock production on currently unused non-agricultural land;
   2) Biofuel feedstock production from yield increase above the normally expected yield increase;
   3) Integrating biofuel feedstock production with existing agricultural production (integrating additional sugar cane production with existing cattle herding);
   4) Biofuel feedstock production on existing agricultural land which is fallow as part of normal crop rotation.

   The most credible way to identify ILUC free conventional biofuel production is at the level of individual biofuel feedstock producers. A national or regional approach would risk to not take into account the global nature in which ILUC occurs.[65]

[65] It is for example not possible to declare all EU biofuel production ILUC free because the EU has effective legislation in place to prevent unsustainable practices. This does not take into account that EU food producers who use rapeseed for food products will have to import palm oil if EU rapeseed is used for biofuel production. This import of palm oil could lead to conversion of forests to agricultural land in Asia, thus causing ILUC.

The only instrument currently available to identify and certify ILUC-free conventional biofuel production is the Low Indirect Impact Biofuels (LIIB) methodology, developed by WWF International, the Roundtable on Sustainable Biofuels (RSB) and Ecofys.[66] The LIIB methodology aims to enable cost-effective and objective identification and certification of Low ILUC biofuels. The methodology is designed to be used together with recognised voluntary certification schemes such as RSB and NTA 8080 which ensures its practical, cost effective use. The LIIB methodology is currently being tested for use in the EU, which will increase the robustness of the methodology. The fourth category of ILUC free conventional biofuel production mentioned above is currently not yet included in the methodology, although work on this is planned.

ILUC-free conventional biofuels will only be produced on a large scale with some kind of incentive; this is because it is easier and sometimes cheaper to just produce conventional biofuel feedstocks on existing agricultural land. Allowing conventional, ILUC free biofuel production beyond the 5% cap could be an effective incentive. This approach would facilitate the fulfilment of the RED and FQD targets with biofuels while at the same time reducing ILUC effects and protecting current investments in the conventional biofuel sector.

[66] http://www.ecofys.com/en/publication/ensuring-biofuels-with-a-low-risk-of-indirect-impacts/

7 Assessing the increased use of wastes and residues

7.1 Description of the proposal

The EC proposes a list of feedstocks that will be eligible to be either double or quadruple counted towards the RED renewable energy in transport target. This replaces the current double counting of biofuels from wastes and residues in the RED. Note that the double and quadruple counting applies within the RED only, not the FQD, and also only counts towards the specific renewable energy in transport target, not to the overall renewable energy consumption target.

Notably, the EC proposal includes positive lists of feedstocks that would be double and quadruple counted. This is a departure from the current approach in the RED, whereby it is the responsibility of the individual Member States to set out which feedstocks can be double counted. This should ease implementation and increase harmonisation across the Member States. The EC mentions that the list will be adapted according to scientific and technical progress, however, the process for updating the list is not defined.

The choice of feedstocks is thought to be based on an assessment performed by REFUREC, the Renewable Fuels Regulators Club of national biofuel policy administrators. It is however unclear on what basis feedstocks are included in the quadruple counted positive list rather than in the double counting list. It seems the feedstocks which have sparked most controversy in the double counting discussion in recent years, UCO and animal fats, are included in the double counting list while most of the other materials count four times towards the target, including straw, the feedstock which is thought to be most commonly used for cellulosic ethanol.

EC proposal text
To Article 3, paragraph 4 of the RED the following point (e) is added: "The contribution made by: (i) biofuels produced from feedstocks listed in Part A of Annex IX shall be considered to be four times their energy content; (ii) biofuels produced from feedstocks listed in Part B of Annex IX shall be considered to be twice their energy content; (iii) renewable liquid and gaseous fuels of non-biological origin shall be considered to be four times their energy content. Member States shall ensure that no raw materials are intentionally modified to be covered by categories (i) to (iii). The list of feedstock set out in Annex IX may be adapted to scientific and technical progress, in order to ensure a correct implementation of the accounting rules set out in this Directive. The Commission shall be empowered to

EC proposal text
adopt delegated acts in accordance with Article 25 (b) concerning the list of feedstock set out in Annex IX'"   **Annex IX:**   "Part A. Feedstocks whose contribution towards the target referred to in Article 3(4) shall be considered to be **four times** their energy content.   (a) Algae.   (b) Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under Article 11(2)(a) of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.   (c) Biomass fraction of industrial waste.   (d) Straw.   (e) Animal manure and sewage sludge.   (f) Palm oil mill effluent and empty palm fruit bunches.   (g) Tall oil pitch.   (h) Crude glycerine.   (i) Bagasse.   (j) Grape marcs and wine lees.   (k) Nut shells.   (l) Husks.   (m) Cobs   (n) Bark, branches, leaves, saw dust and cutter shavings.   Part B. Feedstocks whose contribution towards the target referred to in Article 3(4) shall be considered to be **twice** their energy content.   (a) Used cooking oil.   (b) Animal fats classified as category I and II in accordance with EC/1774/2002 laying down health rules concerning animal by-products not intended for human consumption.   (c) Non-food cellulosic material.   (d) Ligno-cellulosic material except saw logs and veneer logs.

7.2 Impact on direct and indirect GHG emissions

Question
Does the proposed measure increase the direct and indirect GHG performance of biofuels deployed in the EU up to 2020?
Answer
Advanced biofuels have lower *direct* GHG savings compared to conventional biofuels but can in certain cases still lead to considerable *indirect* emissions. The potential indirect impacts of certain wastes and residues are recognised but have not been quantified for the EU. While in many cases the overall GHG performance of advanced biofuels will be (much) better than conventional biofuels, this will not always be straightforward. Because double and quadruple counting gives an incentive for the supply of these better performing biofuels, average biofuels GHG savings could improve, but this should be studied in more detail. Since the multiple counting reduces the overall quantity of biofuels supplied under the RED, it could reduce the positive impact of the use of biofuels overall when compared to a single counting sub-target for these biofuels. This possible overall reduction also depends on the quantity and types of biofuels supplied under the FQD.

The proposal provides an incentive for the supply of advanced biofuels, which have higher direct GHG emissions compared to conventional biofuels, as discussed in section 6.2. The same section alsodiscussed the fact that , it is currently unclear to what extent advance biofuels lead to indirect emissions. Some residues such as straw probably have ILUC emissions because they are land-using residues. Some residues may be non-land-using such as used cooking oils or animal fats. But using these residues for biofuel production might lead to displacement of current uses, for example in the oleochemical industry. If current users start using palm oil as an alternative to compensate for the loss in available waste animal fats, this will lead to ILUC emissions. No studies have been published which quantify ILUC effects of advanced biofuels in the EU, although indirect effects of wastes and residues are discussed since 2009.[67] As discussed in section 6.2, the Commission in its Impact Assessment estimates the indirect emissions of these biofuels to be between zero and 15 gCO_2eq/MJ, the scientific sources of these estimates being unclear. However, since the direct GHG savings of advanced biofuels are generally very high, the overall direct and indirect GHG savings of these biofuels will often be be lower compared to fossil fuels and compared to conventional biofuels. Providing incentives for advanced biofuels in the form of double and quadruple counting therefore will in many cases have a positive effect on the average GHG savings of biofuels, although the indirect emissions of advanced biofuels needs to be studied further before credible conclusions can be drawn.

The notion that advanced biofuels will often have a better overall GHG saving compared to conventional biofuels does not mean that the proposed measure has a positive effect on *overall* GHG reduction of EU biofuel consumption in absolute terms. Because of the double and quadruple

[67] Following the publication of a study commissioned by the UK RFA and DECC. Ecometrica, Eunomia and Imperial College, *Methodology and evidence base on the indirect greenhouse gas effects of using waste, residues and by-products for biofuels and bioenergy* (2009).

counting, a smaller quantity of biofuels will be supplied to the EU market to meet the RED target and thus the overall role of biofuels in mitigating climate change is lower compared to a situation in which these biofuels would be supplied single-counting, for instance in the form of a separate sub-target. As discussed in the previous chapter, the overall quantity of biofuels supplied depends very much on the way fuel suppliers decide to meet the FQD target.

7.3 Impact on meeting the RED and FQD targets

Question
Does the proposed measure allow the RED and FQD 2020 targets to be met?
Answer
The proposed double and quadruple counting in the RED means effectively that the RED target is lowered, since a smaller quantity of renewables in transport is required to meet the target. From this perspective, the proposed measure helps to meet the RED target. The measure is not included in the FQD but increases the quantity of conventional biofuels needed to meet the FQD target in a biofuels-only scenario. The introduction of a 5% cap on conventional biofuels combined with double and quadruple counting of advanced biofuels leads to a situation where up to 7 Mtoe of advanced biofuels is required to meet the RED transport target. Currently, a total of 1-1.5 Mtonnes of these feedstocks are used for biofuel production and some 6.1 Mtonnes might potentially be available in the EU in 2020. It can be concluded that the currently used waste and residue feedstocks are insufficiently available to produce the required quantity of advanced biofuels in 2020 from EU feedstocks. This 'EU feedstock gap' could be filled by the use of other EU waste and residue materials such as grape marc and wine lees, but this is questionable. Another option would be a substantial increase of (expensive) cellulosic ethanol production from straw. A more likely third option is the import of waste and residue feedstocks (or biofuels) from outside the EU.

The proposed measure is only included in the RED and de facto reduces the RED target. The measure has no direct impact on meeting the FQD target. However, as also discussed in section 6.3.2, the proposed measure does have an impact on the way the FQD target could be met. As mentioned in that section, the double and quadruple counting makes the FQD target, in a biofuels-only scenario, the driver for biofuels in terms of quantities supplied. Biofuels supplied to meet the RED will logically also be used to meet the FQD and in addition more (conventional) biofuels will be required. This means that the total required quantity of double and quadruple counting biofuels needed to meet the RED will also be used to meet the FQD.

The additional quantity of conventional biofuels used as a result of the double and quadruple counting is reduced when less quadruple counting biofuels are supplied under the RED. In this case more double counting biofuels are required to meet the target. This means a higher volume of biofuels actually supplied to the market and a higher overall well-to-wheel emission saving from biofuels, leading to less conventional biofuels necessary beyond the 5% cap to meet the 6% FQD GHG reduction.

When assessing the impact of the proposed measure on meeting the RED-target it's relevant to see whether:

1) Sufficient quantities of advanced biofuel feedstock could become available for the EU
2) Sufficient advanced biofuel capacity is available to meet the EU demand

Advanced biofuels feedstocks

Even though double and quadruple counting reduces the quantity of biofuels needed under the RED, the combined introduction of the 5% cap on conventional biofuels means that fulfilling the RED target will still require a large quantity of advanced biofuels. Currently, the expectation is that 29 Mtoe of biofuels is required to meet the RED. With the Commission proposal, 14.5 Mtoe will be provided by capped conventional biofuels and the rest from double or quadruple counting advanced biofuels. When only double counting and no quadruple counting biofuels would be used to fill in the 'other 5%', the required quantity would be just above 7 Mtoe. If quadruple counting biofuels will play a role by 2020, less than 7 Mtoe of advanced biofuels would be required. This is an enormous quantity which equals 54% of the total EU biofuel supply in 2010, especially given that in 2011 only 9.3% of EU biodiesel was produced from UCO and 6.6% from animal fats, currently the largest sources of advanced biofuels in the EU.[68] A logical question to ask is whether it is possible to supply sufficient advanced biofuels to the EU market in a sustainable way.

Waste and residue feedstocks are currently already shipped in large quantities to the EU from the US and China. In the Netherlands for example, 24% of animal fats used to produce biodiesel in 2011 was imported from the US.[69] However, it is questionable if more overseas shipping of wastes and residues is a desirable outcome of the EU ILUC policy as this adds to transport emissions and poses a risk to fraud or a sustainability risk if the sustainable origin is not traced back all the way through the chain of custody to the point where the waste and residue materials are created. For used cooking oils for example, it is questionable if the sustainability of UCO from China or elsewhere can be sufficiently guaranteed if sustainability is traced back only to the point of collection of the UCO, rather than the restaurants where the UCO is created. Therefore, any additional incentive for the use of advanced biofuels should be accompanied by stringent chain of custody auditing requirements and enforcement. This is further discussed in section 7.8. Also, it is relevant to assess how much advanced feedstock listed on the double and quadruple counting positive lists of the Commission proposal is available within the EU. Table 6 provides rough estimates of this and a more detailed assessment of the double and quadruple counting materials is provided in Appendix II. Materials which are only generated outside the EU are not relevant for the current assessment and therefore marked grey.

[68] FEDIOL and EBB figures
[69] Dutch Emissions Authority, Naleving jaarverplichting 2011, p. 23.

Table 6. Estimates of EU-availability of double and quadruple counting materials and likely use for biofuel production

Material	Annual Quantity EU27 in tonnes	Biofuels likely to be produced in 2020
Quadruple counting materials		
a. Algae	Unclear	No
b. Biomass fraction of mixed municipal waste	Municipal waste is available in large quantities; biomass fraction varies, depending on whether collected separately.	Yes
c. Biomass fraction of industrial waste	No data available	No/unclear
d. Straw	95,300,000t of cereal and rapeseed straw (Eurostat statistics, quantity takes into account leaving 60% of cereal straw and 50% of rapeseed straw on the land for soil regeneration purposes).	Yes
e. Animal manure and sewage sludge	46,000,000t (Biomass Futures Project)	Yes *(although competition with biogas)*
f. Palm oil mill effluent and empty palm fruit bunches	Not generated within the EU	Unclear
g. Tall oil pitch	75,000-240,000t, following from total EU Crude Tall Oil production of 500,000-600,000t (Ecofys quick-scan in 201) and 15-40% tall oil pitch resulting from CTO refining (Holbrom, Erä, *the composition of crude tall oil*, 1978).	No
h. Crude glycerine	867,000t, 10% of 2011 EU biodiesel production according to EBB statistics. The actual figure will be slightly higher due to some crude glycerine production from fatty acids and fatty alcohols. Unclear which part currently used for biofuels.	Yes
i. Bagasse	Not generated within the EU	Unclear
j. Grape marcs and wine lees	4,100,000t (grape marc) and 780,000t (wine lees), both estimates (Ecofys quick scan, 2011)	Yes
k. Nut shells	780,000t (EUBIONET study, 2011)	No
l. Husks	No detailed date available. Disregarding rice husks, husks are normally part of straw and usually not collected separately	No
m. Cobs	18,000,000t, based on EU maize production (Europstat) and a maize to cob ratio of 0.273 (Koopman and Koppejan, *Agricultural and forestry residues – generation, utilization and availability*, 1998)	Yes
n. Bark, branches, leaves, saw dust and cutter shavings	6,000,000 dry tonnes, 40,000,000t in 2020 in an aggressive mobilisation scenario (European Climate Foundation, *Biomass for heat and power – Opportunity and Economics*, 2010)	Yes *(although straw will be preferred for cellulosic biofuels, based on Ecofys expertise and interview with Dong Energy)*

Material	Annual Quantity EU27 in tonnes	Biofuels likely to be produced in 2020
Double counting materials		
a. Used cooking oil	558,000t, retrievable potential of 2.000.000t (Ecofys quick scan assessment, 2011, BieDieNet, *El Libro – the Handbook for Local Initiatives of Biodiesel from Recycled Oil*, 2009)	Yes
b. Animal fats classified as category I and II	410,000t for biodiesel in 2010, potential of 3,200,000t (Ecofys quick scan, 2011)	Yes
c. Non-food cellulosic material	Unclear	Unclear
d. Ligno-cellulosic material except saw logs and veneer logs	Unclear	Unclear

Although the figures in the table are only estimates, it can be concluded that most materials on the positive lists are available in relatively large quantities, with the exception of tall oil pitch. However, the feedstocks with the largest availability are either not expected to be used for biofuel production up to 2020 or can only be used though expensive (cellulosic) production technologies, as for example straw and cobs. Their use is therefore likely to be limited although quadruple counting might still mean a modest contribution of straw or even cob is probable. The materials which can relatively easily be used for biofuel production are generated in fairly small quantities.

The materials most commonly and easily used for biofuel production are UCO, animal fats of categories I and II, followed at some distance by crude glycerine. Added up, an estimated total of up to 1-1.5 Mtonnes of these three feedstocks are currently used and some 6.1 Mtonnes might potentially be available in the EU in 2020, although the retrievable potential of UCO is unlikely to be completely collected. It can be concluded that UCO, animal fats and crude glycerine are currently and in 2020 insufficiently available to produce the up to 7Mtoe of advanced biofuels required in 2020 as described above, even taking into account the quadruple counting of crude glycerine. A large-scale use of grape marc and wine lees could fill the 'EU feedstock gap', but these materials have well-established current uses and it is unclear in which quantities they would be used for biofuel production and at what cost. Unless the proposed measure unexpectedly leads to a surge in cellulosic ethanol production, it is therefore unlikely that sufficient advanced biofuels can be produced from EU feedstocks to meet the RED target. This means a certain degree of feedstock imports will be necessary.

Advanced biofuels capacity

Sufficient advanced biodiesel capacity will be available in the EU. As described in section 6.4.3, conventional biodiesel capacity can be used to produce UCOME (biodiesel from used cooking oil). It's questionable whether sufficient advanced ethanol capacity will become available. Producing ethanol from lignocellulose requires expensive technology and it is questionable whether the proposed measure, which does not contain a specific incentive for advanced ethanol, would create a sufficient incentive for more investments in cellulosic ethanol capacity in the EU. Currently, only 64,700ktonne or 0.3% of total EU biofuel production capacity consist of advanced ethanol capacity. See Appendix 1, statement 29 for a detailed overview of EU advanced ethanol capacity.

Advanced biofuels supplied in the Netherlands

Looking at the situation in the Netherlands, already in 2011 40% of all biofuels supplied were advanced biofuels, not far off the required 50% under the ILUC proposal. If quadruple counting is taken into account, the current share of advance biofuels is even higher. Of the total quantity of biofuels supplied in 2011, 4.6% was produced from crude glycerine (see Table 1), a feedstock which currently counts twice in the Netherlands, but will count four times under the proposed measure meaning it would count as 9.2% according to the EC proposal. Thus, according to the new counting rules, the Netherlands supplied 44.6% advanced biofuels in 2011, very close to the required percentage. Historically, the Netherlands has had a high share of double counting biofuels. Because of the good UCO and animal fats feedstock availability a large double counting biofuel production takes place in the Netherlands. Also, the Netherlands was the first EU Member State to implement the RED double counting provision in 2009. Note that higher quantities of double and future quadruple counting biofuels produced in the Netherlands could be supplied to other EU Member States once they have implemented the existing double counting provision and once the EC proposal becomes law.

Cellulosic biofuels versus biofuels from wastes and residues

The Commission's proposed measure does not differentiate between expensive, advanced technology cellulosic biofuels and biofuels produced from wastes and residues, although the quadruple counting of straw, the most promising cellulosic ethanol feedstock and the double counting of UCO and animal fats, the most used double counting materials, could provide a certain advantage for cellulosic biofuels compared to wastes and residues. The issue with this limited differentiation is that biofuels from wastes and residues are much cheaper than cellulosic biofuels and are likely to take up all available space of up to 7 Mtoe of advanced biofuels beyond the 5% cap to meet the RED target. The existing double counting of straw in various Member States has not led to a substantial uptake of cellulosic ethanol production, although some initiatives exist. Therefore the proposed measure might not lead to a substantial increase in cellulosic biofuel production.

Member States do have the flexibility to introduce a subtarget for cellulosic biofuels unilaterally. This has been indicated by the European Commission following questions from the Danish authorities.

7.4 Protection of current investments and impact on actors in the chain

Question
Does the proposed measure effectively protect current investments in the EU biofuels sector and how does it impact various actors in the chain?

Answer
Farmers might benefit from increasing prices of agricultural residues. Biofuel processors will not benefit but the measure will also not have an additional negative impact and producers of advanced biofuels are set to benefit substantially, although it remains to be seen if the measure will be sufficient to lead to increased cellulosic biofuel production.

In this section the impact of the proposed double and quadruple counting is discussed. The impact of the 5% cap which interlinks with this measure is assessed in section 6.4.

The proposed double and quadruple counting provides an incentive for advanced biofuels thus leading to an increased biofuel production. Current investments in advanced biofuel production are sufficiently protected and production capacity is likely to increase up to 2020.

In terms of the impact on specific actors in the supply chain:

- Farmers might benefit from the additional demand for agricultural residues if used in greater quantities for biofuel production. If so, this is likely to lead to higher residue prices, as was the case for UCO and animal fat prices in recent years.
- Biofuel processors will not benefit from the measure as it will not lead to more oilseed crushing or sugar milling. The measure does not impact current processing investments *additional* to the negative impact of the 5% cap. This is because the double and quadruple counting is a mere option to meet the RED target *above* the 5% cap and processors depend on processing feedstocks which fall *under* the cap.
- Biofuel producers which currently produce double counting biofuels will benefit from the measure; they see their market expanding as a result of the introduction of an EU positive list as opposed to current fragmented double counting rules at Member State level. Some conventional biodiesel production capacity might also be used to produce waste or residue based biodiesel.
- It is unclear to what extent producers of cellulosic ethanol will benefit. As they have to compete with producers of biofuels from waste and residues it seems unlikely that the proposed measure will lead to a large increase in cellulosic biofuel production capacity.

7.5 Impact on administrative burden

Question
How does the proposed measure impact the administrative burden for companies?
Answer
Fuel suppliers have to report to Member State authorities on the supply of quadruple counting biofuels, which mean a new reporting item additional to the existing reporting on double counting biofuels. Other parties in the chain experience no additional administrative burden as there is no

increased certification requirement compared to conventional biofuels.

7.6 Incentive for cellulosic biofuels

Question
Does the proposed measure provide sufficient incentives to stimulate the production and consumption of advanced (cellulosic) biofuels in the EU?
Answer
The measure aims to support advanced biofuels, both cellulosic and from wastes and residues. Whereas the measure provides sufficient incentive for using waste and residues such as UCO and animal fats it remains to be seen whether the measure will lead to substantial additional cellulosic ethanol production.

Certain agricultural and forestry residues such as straw, nut shells, husks, cobs and bark and branches can be quadruple counted towards the target. Other non-food cellulosic material and ligno-cellulosic material (except saw logs and veneer logs) can be double counted towards the target. This provides some incentive for cellulosic biofuels, especially those that can be quadruple counted, although the analysis in the previous sections shows that the proposal overall provides only a weak driver for advanced biofuel, as the target can be achieved with cheap imported UCO and animal fats from outside the EU.

7.7 Impact on biofuel prices

Question
What will the economic cost of the proposal be, and how will it impact the price of biofuels?
Answer
This impact is estimated to be limited since sufficient relatively cheap double and quadruple counting biofuels are available.

Assuming that the 2020 targets can be met by reporting actual GHG values from existing biofuel supply chains and sufficient relatively cheap double and quadruple counting biofuels are available, and therefore that little or no advanced (cellulosic) biofuels are required, the proposed measure is unlikely to have a significant effect on biofuels prices.

Some of the double and quadruple counting biofuel feedstocks (e.g. UCO and tallow) are relatively cheap and could have a downward effect on biofuel prices. However they are already eligible for double counting in most Member States today, so there is not likely to be a significant change. Other double and quadruple counting biofuel feedstocks are in general more expensive (e.g. ligno-cellulosic and algae). This may have an upward pressure on biofuels prices, compared to a scenario with no cap on conventional biofuels, however as we have seen there is unlikely to be a strong incentive to produce biofuels from the most novel feedstocks.

7.8 Avoiding double claiming of wastes and residues

Question
How to avoid double claiming of wastes and residues (e.g. claiming the same fuel twice in two different countries) and other unintentional practices with wastes and residues. Is it still appropriate to have less stringent chain of custody requirements for wastes and residues;[70]
Answer
The chain of custody needs to start from the origin of the feedstock and more cooperation and information sharing between Member States is desirable to mitigate risks.

Current double counting has seen a large increase in double counting feedstocks and along with that have come concerns about fraud. There are reports and suspicions, for example, of unused cooking oil being sold as used, or users being incentivised to use the cooking oil less before discarding it, as it now has a value. Additionally there are reports of the same double counting feedstocks being reported in more than one Member State. Quadruple counting will provide an even larger incentive, although there are fewer cheap biofuel production options in the list of quadruple counting feedstocks.

To ensure a robust implementation, the chain of custody needs to start at the origin of the feedstock to guarantee that the feedstock is what it is claimed to be. In other words the chain of custody checks need to start where the feedstock is produced. For example:

- For used cooking il (UCO), the chain of custody needs to include verified evidence from the actual restaurant or food processor;
- For agricultural residues (straw, husks, cobs etc) chain of custody checks must start at the farm. This is already required since the land related sustainability criteria are applicable to these residues;
- For palm oil mill effluent chain of custody checks need to start at the mill;
- For Bagasse chain of custody checks need to start at the sugar cane mill.

Although such an approach would ensure the sustainability of the feedstock used, the practical implementation should not be forgotten. Where waste or residue material is produced at a large point

[70] Following RED Article 17(1), waste and residue materials (other than residues from agriculture, aquaculture, fisheries or forestry) only have to comply with the GHG requirement. Also, these materials are considered to have zero GHG emissions up to the point of collection (RED Annex V, part C, point 18). This means the chain of custody (CoC) for waste and residue materials in effect starts after the point of collection, so at the first processing step, even though the RED implies that the CoC starts at the point of collection. This leaves room for unintended practices. A CoC which does not start at the point of creation of the material leaves room for unintentional practices.

source (e.g. palm oil mill or sugar cane mill) checking the origin of the material is relatively easy. In cases where feedstocks are generated at many locations prior to their collection, such as restaurants producing UCO, the approach might not be very practical. This could be partly solved by applying a certain annual sample size, meaning that every year a small percentage of the chain is actually checked. This is how the German audit requirements for double counting material work and it remains to be seen how much UCO will be supplied to the German market in the future. For UCO, the first point in the supply chain to be audited could be the first collector of the material.

It would be helpful if a way could be found to check the chain of custody of supplied biofuels across Member State borders. Auditors should do this, but they may need to be alerted to the risks by Member States. Member States should have systems to inform auditors/verifiers of new risks as they emerge.

7.9 Alternative scenarios

Alternative policy scenarios related to double/quadruple counting could be envisaged:

1. **Allow the use of conventional low ILUC biofuels beyond the cap.** The Commission proposal only allows the use of (double and quadruple counting) advanced biofuels to fulfil the RED target beyond the 5% cap. As described in section 8.8 however, advanced biofuels are not necessarily low ILUC. Advanced biofuels, even if produced from non-land using residues, could lead to ILUC if other uses are displaced (see section 6.2). Also, over-incentivising advanced biofuels from wastes and residues could lead to unwanted and unsustainable practices. At the same time, as described in section 6.8, conventional biofuels can be produced in an ILUC-free way.

   Conventional biofuels are ILUC-free when produced from *additional* biofuel feedstocks which do not displace existing agricultural production. Examples are provided in section 6.8, which also describes the only methodology currently available for ILUC-free conventional biofuels, the Low Indirect Impact Biofuels (LIIB) methodology.

2. **Introduce double/quadruple counting in the FQD**. Currently, the double and quadruple counting is only included and proposed in the RED. Earlier in this chapter it is discussed that this could lead to a situation in which more conventional biofuels are required to meet the FQD in a biofuels-only scenario. Inclusion of the policy measure also in the FQD would avoid this situation.

3. **Introduce sub-target for lignocellulosic biofuels beyond the cap:** Setting a sub-target for advanced biofuels would drive the development of advanced biofuels. Depending on the

cost of different feedstocks, this may decrease both conventional biofuels below the 5% cap and decrease biofuels from other wastes and residues.

8 Assessing the raising of the GHG threshold

8.1 Description of the proposed measure

The current RED and FQD directives contain a minimum required GHG saving of biofuels compared to fossil fuels of 35%, rising to 50% from 1 January 2017 and 60% from 1 January 2018. The increase to 60% only counts for installations in operation after 1 January 2017. The European Commission proposes to change the scope of the 60% GHG-threshold to include biofuels from installations in operation after 1 July 2014 and to bring forward the entering into force of the measure to the moment the amended directive enters into force. This could mean the 60% threshold enters into force in 2016 instead of 2018, depending on the date of adoption of the amending directive and taking into account the 12 month transposition period.[71] The proposed measure thus only marginally modifies the scope of the current 60% GHG-threshold and brings it only slightly forward in time.

EC proposal text
RED Article 17 is amended as follows: (a) paragraph 2 is replaced by the following: '2. The greenhouse gas emission saving from the use of biofuels and bioliquids taken into account for the purposes referred to in paragraph 1 shall be at least 60 % for biofuels and bioliquids produced in installations starting operation after 1st July 2014. An installation is "in operation" if the physical production of biofuels or bioliquids has taken place. (similar text proposed for FQD, excluding bioliquids)

The definition of 'installation' is not entirely clear. It could include biofuel production installations only but could also include biofuel feedstock processing installation. In 2010, the European Commission defined 'installation' to mean both processing and production installations[72], so it is likely that both types of installation are covered under the proposed measure. This would mean that if for example rapeseed is crushed in a crushing installation which started operations after 1 July 2014 and the resulting oil is used to produce biodiesel in an existing biofuel plant, the 60% threshold would apply to the biofuel.

[71] This is the period during which Member States have to transpose the EU directive into national legislation. The EC proposes a transposition time of 12 months, the length of the period will ultimately be decided by the European Parliament and Council.

[72] 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), section 3.1.

8.2 Impact on direct and indirect GHG emissions

Question
Does the proposed measure increase the direct and indirect GHG performance of biofuels deployed in the EU up to 2020?
Answer
The measure might lead to a small increase in direct GHG emission saving, especially from imported biodiesel. The measure might lead to a very small decrease in indirect GHG emissions.

The measure could lead to a reduction of *direct* GHG emissions of biofuels if two conditions are met:

1. Biofuels produced from installations in operation between 1 July 2014 and 1 July 2017 are supplied to the EU market, and;
2. These biofuels would not have achieved a 60% GHG emission reduction without the proposed measure.

At the moment, considerable overcapacity in biofuel production installations exists in the EU, as capacity utilisation is only around 64% for ethanol in 2009[73] and 44% for biodiesel in 2010.[74] Also, in recent years only very few new biofuel installations have started operations in the EU. This makes it unlikely that many new installations will be starting to process or produce biofuels used to supply biofuels to the EU market, meaning that the 60% GHG threshold will only have a very limited effect on reducing average EU biofuels direct GHG emissions. Of course it is possible that biofuels imported from outside the EU are produced in new installations. In this case the measure might lead to a lowering of direct GHG emissions of biofuels supplied to the EU market.

Even if biofuels are produced in new installations and supplied to the EU, certain feedstocks already achieve GHG savings higher than 60% and the proposed policy measure would thus not lead to additional GHG emission reductions. Sugar cane ethanol for example has a default GHG emission saving of 71% according to the RED and FQD. If produced in an installation which starts operations in 2015 and supplied to the EU market in 2017, the sugar cane ethanol would have to comply with the 60% threshold, while under the current RED only a 50% emission reduction would have to be achieved. This would however not lead to additional GHG savings since sugar cane already achieves 71% GHG saving. The proposed measure only reduces GHG emissions if producers of biofuels which can meet the 50% but not the 60% are obliged to invest in measures to reduce lifecycle GHG-reductions and prove 60% saving by undertaking actual GHG calculations. This is the case for biodiesel produced from rapeseed oil, sunflower, soybean oil and palm oil (without methane capture) and ethanol produced from wheat (except if straw is used as process fuel) and corn. These biofuels are listed in table 7 in the next section.

[73] ePURE statistics, quoted in Ecofys, Assessing Grandfathering options, p. 4-5.
[74] European Biodiesel Board statistics, available at: http://www.ebb-eu.org/stats.php#

In general, not much GHG saving is to be expected from the policy measure mainly because no large quantities of biofuels supplied to the EU market are expected be produced in installations which started operating between 1 July 2014 and 1 July 2017. To a lesser extent, the GHG saving is limited because certain biofuels currently already meet the 60% threshold, although many biofuels do not.

The measure could lead to a reduction of *indirect* GHG emissions of biofuels if, due to the measure, less high ILUC biofuels would be supplied on the EU market. This would be the case if for example the measure would lead to less palm oil biodiesel produced in installations which start operations between 1 January 2014 and 1 January 2017 which could meet a 50% but no longer a 60% threshold. The reduction of indirect GHG emissions as a result of the proposed measure is expected to be very limited due to the fact that no large quantity of biofuels is expected to comply with the two conditions mentioned above.

The contribution of the proposed measure to a reduction of direct and indirect GHG emissions might be further reduced by the expected update of the default and typical GHG emission values by the European Commission as well as a possible rise of the fossil fuel comparator from the current 83.8 gCO_{2eq}/MJ to 90.3 gCO_{2eq}/MJ.[75] The EC Joint Research Centre submitted new values to the EC in early 2013 and it is expected that the EC will shortly take a decision on whether to replace the current values with the new ones. It is expected that the new values will in most cases be lower than the current values. This, together with a higher fossil comparator, makes it easier for biofuels to meet the minimum required GHG savings.

8.3 Impact on meeting the RED and FQD targets

Question
Does the proposed measure allow the RED and FQD 2020 targets to be met?
Answer
The proposed measure makes it slightly more difficult to meet the RED target and slightly reduces the quantity of biofuels needed to meet the FQD target. However, this effect will be very small since no large investments in new conventional biofuel capacity are expected given the current market conditions.

Biofuels which do not meet the minimum required GHG saving compared to fossil fuels ('GHG threshold') cannot be used to meet the RED and FQD target. In theory, the proposed policy measure thus makes it more difficult to meet the targets, especially the RED target as it is a volumetric target. This effect is expected to be small since not many biofuels produced from installations in operation between 1 July 2014 and 1 July 2017 are expected to be supplied to the EU market. Most biofuels will be supplied from existing installations, as described in the previous section.

[75] EC Impact Assessment SWD(2012)343, p. 14, 15 and 92.

The proposed measure could lead to a reduction in biofuels needed to meet the FQD target. If biofuels used to meet the FQD target have a higher direct GHG emission saving (this is the case if the two conditions mentioned in the section above are met), less biofuels are required to reach the 6% FQD target. This effect will however be limited as the overall effect of the proposed measure is estimated to be small.

Biofuels listed in the table below might not be able to meet 60% GHG saving and would be affected by the proposed measures:

Table 7. Overview of biofuels which might not be able to meet the 60% GHG saving threshold (Note the values listed are the typical GHG saving values from Annex V of the RED, not the default values that economic operators report in the absence of actual values.)

Feedstock	RED/FQD typical GHG saving	Comment
Wheat ethanol (all processes but straw as process fuel)	32-53%	Passes threshold if straw is used as process fuel in CHP plant (69% saving)
Corn ethanol	56%	Passes threshold with minor efficiency gains in production chain
Rapeseed biodiesel	45%	Could still pass threshold after considerable efficiency gains in production chain
Sunflower biodiesel	58%	Passes 60% threshold after minimal improvements
Soybean biodiesel	40%	Could still pass threshold after considerable efficiency gains in production chain
Palm oil biodiesel (process not specified)	36%	Palm oil can easily pass threshold if methane capture is used at the oil mill
HVO from rapeseed	51%	Currently not produced in the EU
HVO from palm oil (process not specified)	40%	Palm oil can easily pass threshold if methane capture is used at the oil mill

Biofuels not mentioned in the table, including sugar beet and sugar cane ethanol and biofuels from wastes and residues, currently already meet the 60% threshold. From the biofuels mentioned in the table above, most would be able to meet the threshold with small to moderate GHG savings improvements in the production chain. In the case of wheat ethanol, a switch to straw as process fuel in the CHP plant is required and palm oil biodiesel should be produced with methane capture at the oil mill in order to meet the 60% threshold. Even rapeseed biodiesel could still make the threshold, as currently examples of more than 50% GHG savings from biodiesel are known.

If the EC decides to introduce new, generally lower GHG default and typical values as explained in the previous section, more feedstocks, including those listed in table 7, would be able to meet the 60% threshold. However, rapeseed and soy could fall 'victim' to the 60% threshold would be soy biodiesel produced in new installations, although also this feedstock could still meet the threshold if considerable efficiency gains in the production chain are achieved. It would be easier for soybean biodiesel to meet the 50% threshold which would apply to production from existing installations.

8.4 Protection of current investments and impact on actors in the chain

Question
Does the proposed measure effectively protect current investments and jobs in the EU biofuels sector?
Answer
The proposed measure to bring forward and extend the scope of the 60% GHG threshold only applies to new investments. This means that current investments and employment are not affected.

8.5 Impact on administrative burden

Question
Does the proposed measure impact the administrative burden for economic operators
Answer
The proposed measure does not lead to a significant additional administrative burden since it only brings forward the existing GHG requirement, on which fuel suppliers have to report already. For some feedstocks economic operators will have to report actual GHG values sooner to meet the threshold instead of using default values. The measure also does not significantly impact other actors in the chain as it does not lead to additional certification or auditing requirements, beyond an increased demand for actual GHG data.

8.6 Incentive for cellulosic biofuels

Question
Does the proposed measure provide sufficient incentives to stimulate the production and consumption of advanced (cellulosic) biofuels in the EU?
Answer
No. The proposed measure is only a slight change from the existing GHG requirement which will not lead to more cellulosic biofuel production in the EU.

8.7 Impact on biofuel prices

Question
What will the economic cost of the proposal be, how will it impact the price of biofuels?
Answer
This impact is estimated to be limited since the proposed measure is only a slight change from the existing GHG requirement.

8.8 Alternative scenarios

1. **Increase the GHG threshold to 65% for installations in operation from 1 July 2014**
   This alternative scenario would slightly improve the GHG performance of biofuels from new installations as more biofuels need to report actual values to still meet the threshold. As with the proposed measure, it can be questioned how many new installations for conventional biofuels will become operational in the EU given the large overcapacity and the limited opportunities for growth in conventional biofuel supply due to the proposed 5% cap.

2. **Increase the GHG threshold to 65% for all installations**
   Given the likely increase of the fossil baseline from the current 83.8 gCO_2/MJ to 90.3 gCO_2/MJ, as discussed above, combined with the upcoming review of the default GHG values included in the RED and FQD, only an increase of the GHG threshold to 60% and the application of this to biofuels from *all* installations would have a significant impact on the overall EU biofuels GHG performance. It would require most biodiesel and ethanol producers to apply the best available production techniques to still meet the threshold.

3. **Keep the GHG threshold at 35% in combination with mandatory ILUC factors and an incentive for low ILUC biofuels**
   This alternative scenario would allow the Netherlands to see its preferred policy option being realised with a real incentive for certified low ILUC biofuels.

9 Assessing the introduction of ILUC factors

9.1 Description of the proposal

The Commission proposes to include ILUC factors in both the FQD and RED for reporting purposes only. In the FQD, fuel suppliers are required to report the indirect GHG emissions of biofuels supplied to the Member State's authorities whereas under the RED, Member State authorities report on the indirect emissions of biofuels supplied as part of their reporting to the Commission. The ILUC values to be reported are based on the results of the IFPRI 2011 modelling study (see section 2.3.1). Biofuels produced from non-land-using feedstocks such as wastes have a factor of zero.

EC proposal text
FQD Article 7(d) is amended as follows: (a) paragraphs 3 to 6 are replaced by the following: '3. The typical greenhouse gas emissions from cultivation of agricultural raw materials in the reports referred to in Article 7d(2) in the case of Member States, and in reports equivalent to those in the case of territories outside the Union, may be submitted to the Commission.' '4. The Commission may decide, by means of an implementing act adopted in accordance with advisory procedure referred to in Article 11(3), that the reports referred to in paragraph 3 contain accurate data for the purposes of measuring the greenhouse gas emissions associated with the cultivation of biofuel feedstocks typically produced in those areas for the purposes of Article 7b(2). ' '5. By 31 December 2012 at the latest and every two years thereafter, the Commission shall draw up a report on the estimated typical and default values in Parts B and E of Annex IV, paying special attention to greenhouse gas emissions from transport and processing. The Commission shall be empowered to adopt delegated acts pursuant to Article 10a concerning the correction of the estimated typical and default values in Parts B and E of Annex IV.' '6. The Commission shall be empowered to adopt delegated acts pursuant to Article 10a concerning the adaptation to technical and scientific progress of Annex V, including by the revision of the proposed crop group indirect land-use change values; the introduction of new values at further levels of disaggregation; the inclusion of additional values should new biofuel feedstocks come to market as appropriate, review the categories of which biofuels are assigned zero indirect land-use change emissions; and the development of factors for feedstocks from non-food cellulosic and ligno-cellulosic materials.' **RED** Article 19 is amended as follows: (c) paragraph 6 is replaced by the following: 'The Commission shall be empowered to adopt delegated acts pursuant to Article 25(b) concerning the adaptation to technical and scientific progress of Annex VIII, including the revision of the proposed crop group indirect land-use change values; the introduction of new values at further levels of disaggregation (i.e. at a feedstock level); the inclusion of additional values should new biofuel feedstocks come to market as appropriate; and the development of factors for feedstocks from non-food cellulosic and ligno-cellulosic materials.' In RED Article 22, paragraph 2 is replaced by the following:

'2. In estimating net greenhouse gas emission saving from the use of biofuels, the Member State may, for the purpose of the reports referred to in paragraph 1, use the typical values given in part A and part B of Annex V, and shall add the estimates for indirect land-use change emissions set out in Annex VIII.'

Note that the ILUC factors to be reported on slightly differ from the IFPRI 2011 results since only three values (for cereals and other starch rich crops, sugars and oil crops) are included in Annex V, part A of the EC proposal instead of the eight different values for the eight conventional biofuel feedstocks modelled by IFPRI. IFPRI values for oil crops vary between 52 and 55 gCO_2/MJ whereas Annex V contains a figure of 55 gCO_2/MJ for all oil crops. IFPRI figures for cereals and starch rich crops are 14 and 10 gCO_2/MJ, Annex V contains a median value of 12 gCO_2/MJ and IFPRI sugar values are 7 and 13 gCO_2/MJ, whereas in the ILUC proposal all sugar based biofuels need to be reported as 13 gCO_2/MJ. The proposed Annex V is outlined below.

EC proposal text

'Annex V, Part A. Estimated indirect land-use change emissions from biofuels

Feedstock group Estimated indirect land-use change emissions (gCO_2eq/MJ)

Cereals and other starch rich crops 12

Sugars 13

Oil crops 55

The reason for the Commission to propose the inclusion of mandatory reporting on ILUC values in the RED and FQD is to prepare biofuels market on a possible introduction of mandatory ILUC factors, as follows from recital 20 of the EC proposal states, included in the text box below.

EC proposal text

Recital 20

The Commission should review the effectiveness of the measures introduced by this Directive, based on the best and latest available scientific evidence, in limiting indirect land-use change greenhouse gas emissions and addressing ways to further minimise that impact, which could include the introduction of estimated indirect land-use change emission factors in the sustainability scheme as of 1st January 2021.

The effects of mere reporting of ILUC factors does not have a large effect on the aspects assessed in the sections below, merely since it does not limit or restrict the use of certain biofuels or introduce an additional sustainability requirement. However, given the Commission's longer term aim of introducing mandatory ILUC factors, if ILUC quantification is found to be sufficiently robust, mere reporting looms over the EU biofuel sector like the sword of Damocles.

9.2 Impact on direct and indirect GHG emissions

Question
Does the proposed measure increase the direct and indirect GHG performance of biofuels deployed in the EU up to 2020?
Answer
No, as the ILUC factors are for Member State reporting purposes only it does not improve the overall GHG performance of biofuels supplied in the EU. However it would not decrease the GHG performance either.

9.3 Impact on meeting the RED and FQD targets

Question
Does the proposed measure allow the RED and FQD 2020 targets to be met?
Answer
Yes, as the ILUC factors are for Member State reporting purposes only, the measure has no impact on the fulfilment of the RED and FQD 2020 targets.

9.4 Protection of current investments and impact on actors in the chain

Question
Does the proposed measure effectively protect current investments in the EU biofuels sector and how does it impact actors in the chain?
Answer
The proposed measure does not have an impact on current investments as it does not introduce an additional requirement on biofuels produced from existing installations. Current investments are thus sufficiently protected. The measure does however have a negative impact on new investments in conventional biodiesel production capacity in the EU given the suggested post-2020 aim to introduce mandatory ILUC factors. With the outlook of a possible future introduction of mandatory ILUC factors, no investments in new conventional biodiesel installations are expected. Investments in new conventional ethanol installations might still take place given the low ILUC values for ethanol included in the proposed new FQD Annex V and new RED Annex VIII. However, these investments are likely to be small due to large current overcapacity combined with the proposed introduction of the 5% cap for conventional biofuels.

9.5 Impact on administrative burden

Question
Does the proposed measure impact the administrative burden for economic operators?
Answer
The proposed measure adds a small additional admin burden on operators who have to report ILUC values under the FQD. It does not impact certification requirements or put any other burden on other parties in the supply chain. The proposed measure does add a small additional administrative burden on Member States who have to report ILUC values to the EC under the RED and FQD.

9.6 Incentive for cellulosic biofuels

Question
Does the proposed measure provide sufficient incentives to stimulate the production and consumption of advanced (cellulosic) biofuels in the EU?
Answer
The proposed measure does not provide an incentive for cellulosic biofuels as ILUC factors are for Member State reporting purposes only.

9.7 Impact on biofuel prices

Question
What will the economic cost of the proposal be, how will it impact the price of biofuels?
Answer
The proposed measure does not impact biofuel prices or have an economic cost as ILUC factors are for Member State reporting purposes only.

9.8 Alternative scenario

ILUC factors made binding with a factor of zero for low ILUC biofuels

Mandatory ILUC factors

Currently ILUC factors only have to be reported and are not binding, as was originally proposed by the EC in a leaked version of the ILUC proposal. The Netherlands has advocated the introduction of mandatory ILUC factors in the GHG calculation methodology of biofuels in the RED and FQD since 2010, provided that the factors have a sound scientific basis. In order to get to ILUC factors, the EC commissioned IFPRI to model 8 conventional biofuels feedstocks. According to the IFPRI model outcomes, biodiesel crops have high ILUC values, whereas ethanol feedstocks have medium ILUC values.

Although IFRPI is the best available ILUC model today, uncertainties remain (see also section 2.3.1) Actual emissions caused by the ILUC effect can never be measured and attributed to an individual biofuel producer, due to the complexity of the involved parameters, the assumptions and the global scope. Therefore even the best model will always have some uncertainties. An absolute "correct" ILUC factor will never be achieved. The introduction of ILUC factors is a political decision, based on best available but not fully robust scientific evidence.

Mandatory ILUC factors would have a profound impact on GHG emissions resulting from biofuel demand in the EU. If for instance the proposed ILUC factor for oilseeds of 55 gCO_2eq/MJ became mandatory, oilseed-derived biofuel would not meet the GHG reduction target in the RED, so oilseed-derived biofuel production would come to an end. With mandatory ILUC factors the conventionally used biodiesel feedstocks (soybean, rape and palm oil) have no or significantly reduced GHG savings compared to fossil fuels and would therefore not even meet the current GHG savings threshold of 35%.

Mandatory ILUC factors in addition to the proposed 5% cap for conventional biofuels, would lead to a situation in which the cap could only be fulfilled by bioethanol, as most bioethanol feedstocks would still meet the increased GHG threshold of 50% in 2017 in combination with ILUC factors. However bioethanol can only completely fill the 5% cap if E10 is rolled out throughout the EU. From 2018 onwards the GHG savings threshold will be 60% for new installations, which can only be met by sugar cane and sugar beet as well as waste and residues (see also figure 3 in chapter 6.2).

Only current investments in bioethanol and advanced biofuels from waste and residues will be protected in a situation where mandatory ILUC factors are introduced. Investments in conventional biodiesel will struggle to provide a return on investment. The introduction of mandatory ILUC factors leads to a slight increase in administrative burden as fuel suppliers would have to report them to Member State authorities.

ILUC factor of zero for advanced and conventional low ILUC biofuels
Biofuels without ILUC should not receive an ILUC factor. This is the rationale behind the ILUC factor of zero for advanced non-land using biofuels in the reporting requirement included in the Commission proposal. But advanced biofuels are not necessarily low ILUC. Advanced biofuels, even if produced from non-land using residues, could lead to indirect emissions if other uses are displaced, as described in section 6.2. Advanced biofuels from wastes and residues should therefore only receive an ILUC factor of zero if a substantial 'excess potential' of the material exists, i.e. if the waste or residue can be used without displacing other uses. The ILUC risk of advanced biofuels for the EU has

never been modelled; it would be desirable therefore if the Commission would also model ILUC factors for cellulosic and lignocellulosic biofuels.

Conventional biofuels can also be produced without causing ILUC and if so, should receive an ILUC factor of zero. This is the case if *additional* biofuel feedstocks are produced without displacing other agricultural uses. Examples are biofuel feedstock production on unused land, feedstock production from yield increase above the business as usual yield increase development, and feedstock production by integrating biofuel feedstock production with existing agricultural production. ILUC-free conventional biofuels will only be produced on a large scale with some kind of incentive; this is because it is easier and sometimes cheaper to just produce conventional biofuel feedstocks on existing agricultural land. An ILUC factor of zero if mandatory ILUC factors are introduced could be an effective incentive. This approach would facilitate the fulfilment of the RED and FQD targets with biofuels while at the same time reducing ILUC effects and protecting current investments in the conventional biofuel sector.

The only concrete methodology currently available for project level ILUC mitigation is the Low Indirect Impact Biofuels (LIIB) methodology, developed by Ecofys together with the Roundtable on Sustainable Biofuels (RSB) and WWF International[76]. See section 6.8 for a description of the methodology.

[76]For more information please see: http://www.ecofys.com/en/publication/ensuring-biofuels-with-a-low-risk-of-indirect-impacts/

Appendix I – Further analysis of actual correctness

In this appendix the facts and statements contained in the EC Impact Assessment (EC IA) and listed in table 1 in the main report are analysed in more detail. For each fact and statement its section and page numbers in the EC Impact Assessment are provided between brackets. Note that not all facts and statements which are listed in table 1 are also included in this annex, only those for which additional analysis is provided. The numbering hereby follows the numbering as listed in table 1.

2. Share of biofuels in RED target (2.2.1, p8)

EC Claim

Biofuels represent around 1 and 2.5 percentage points of the 20% greenhouse gas reduction and renewable energy targets respectively.

Ecofys Conclusion

In 2020, biofuels will represent 4 percentage points of the 20% GHG reduction and represent 2.2 percentage points of the 2020 EU overall renewable energy target.

The EU has a GHG reduction target of at least 20% compared to 1990 levels and an RED target of 20% renewable energy in the total energy mix. Biofuels consumed to meet the RED and FQD targets count towards both broader targets. GHG emissions in the EU-27 in 1990 were 5583.1MtCO_{2eq}.[77] A 20% reduction equals a reduction by 1116.62Mt. In 1990 we can assume the share of biofuels in total transport fuels in the EU was zero so all GHG reductions by the use of biofuels in 2020 would count towards the 20% GHG reduction target. Ecofys calculations show that in 2010 EU biofuels saved 22.6Mt, which is 2% of the total required GHG reduction. By 2020 the expected biofuels GHG reduction is expected to double, mainly due to increasing volumes of biofuels being supplied. This would mean that biofuels represent around 4% of the GHG reduction target. It has to be noted that the Ecofys calculations are based on direct emissions not including indirect emissions.

In 2011 13.98Mtoe biofuels were consumed in the EU27.[78] According to the National Renewable Actions Plans (NREAP) the biofuels consumption will more than double, resulting in 29.7 Mtoe of biofuels in 2020. The total consumption of renewable energy in the NREAPs in 2020 sums up to 244.6 Mtoe, so biofuels are supposed to contribute with 12% to the total volume. Total gross final energy consumption in 2020 in the EU27 is estimated with 1307 Mtoe (resp.1317 Mtoe including aviation). Biofuels will have a share of 2.2% in the total gross energy consumption in 2020 in the EU27.

[77] European Environment Agency, GHG trends and projections in the EU-27. Available at: http://www.eea.europa.eu/publications/ghg-trends-and-projections-2012
[78] Biofuels Barometer 2012

Despite the estimated increasing of volumes of biofuels in the NREAP, bioliquids for electric, cooling and heating play a small role contributing only with 0.4% to the total renewable energy in 2020 for other purposes than transport.[79]

3. Land availability (2.2.3, p9)

EC Claim

The globe has approximately 13 200 Mha of land, of which around 1600 Mha is used for cropping.

Ecofys Conclusion

The EC statement is based on The Energy Report by Ecofys, based on an IIASA study with source data from FAOSTAT, which estimates 1,563 Mha are used for cropping.

The EC IA refers to the Ecofys-WWF Energy Report (2011). The Ecofys-WWF assessment was based on an IIASA study based on FAOSTAT data[80] complemented with own analysis, using a step-wise approach. Note that the 13,200 Mha exclude Antartica, and that the IIASA figure for agricultural cropland is 1,563 Mha. Also note for comparison that according to the IIASA source data, the total amount of land currently used to support livestock is about 3,920 Mha.

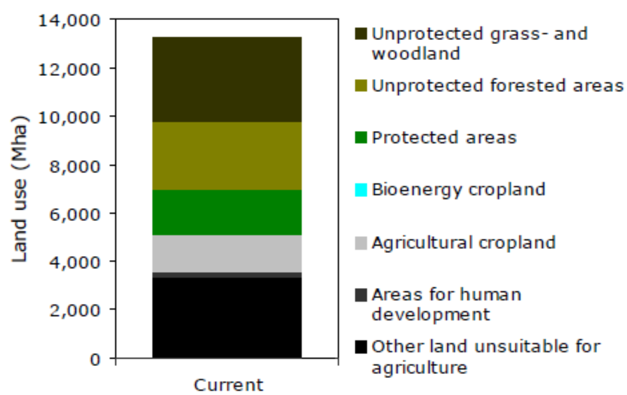

Figure 1: Current global land use data (Adapted from Ecofys-WWF 2011).

The IIASA study defines 'Cultivated land' as land producing annual crops (mostly cereals and vegetables) and permanent crops (including vineyards, orchards and plantations of e.g., oil palm, coconut, cacao, coffee and tea). Source data were extracted from FAOSTAT, which reports that for 2000-02, 1408 million hectares of land under annual crops and 136 million hectares under permanent crops.

[79] Energy Research Centre for the Netherlands, European Environment Agency - Renewable Energy Projections as Published in the National Renewable Energy Action Plans, 2011
[80] Fischer et al 2009 - Biofuels and Food Security, IIASA, Austria

6. Biofuel demand (2.2.3, p9)

EC Claim

27% of total transport fuel demand will be covered by biofuels in 2050.

Ecofys Conclusion

The 27% share of biofuels in 2050 road transport is based on IEA's Energy Technology Perspectives 2010 (ETP 2010) Blue Map Scenario, which is in line with the 450 ppm scenario required to limit global temperature rise to below 2°C. The same report acknowledges that "achieving this will require a significant and sustained push by policy makers". Until 2050 biofuels will still play an important role in transport and could even contribute with more than 27% to the total transport fuel demand.

The EC cites 'IEA 2011 - biofuels for Transport - Technology Roadmap' as source.

This source says: "*By 2050, biofuels could provide 27% of total transport fuel and contribute in particular to the replacement of diesel, kerosene and jet fuel*."

According to the IEA, "Meeting the biofuel demand in this roadmap would require around 65 EJ of biofuel feedstock, occupying around 100 Mha in 2050. This poses a considerable challenge given competition for land and feedstocks from rapidly growing demand for food and fibre, and for additional 80 EJ of biomass for generating heat and power. However, with a sound policy framework in place, it should be possible to provide the required 145 EJ of total biomass for biofuels, heat and electricity from residues and wastes, along with sustainably grown energy crops."

The IEA roadmap is based on the IEA's Energy Technology Perspectives 2010 (ETP 2010) *BLUE Map Scenario*, which sets out cost effective strategies for reducing greenhouse-gas emissions by half by 2050 (with respect to 2009), which is in line with the 450 ppm scenario required to limit global temperature rise to below 2°C. The Blue Map Scenario indicates that a significant increase in use of low-carbon biofuels will be required by 2050, but does not include a detailed analysis on how to reach these targets, which is further developed in the 2011 IEA Biofuels for transport roadmap. Based on the BLUE Map Scenario, by 2050 biofuel demand will reach 32 EJ, or 760 million tonne of oil equivalent (Mtoe). As advanced biofuels are commercialised, they will eventually provide the major share of biofuel. Reductions in transport emissions contribute considerably to achieving overall BLUE Map targets, accounting for 23% (10 $GtCO_2eq$) of total energy-related emissions reduction by 2050.

Vehicle efficiency improvements account for one-third of emissions reduction in the transport sector; the use of biofuels is the second-largest contributor, together with electrification of the fleet, accounting for 20% (2.1 $GtCO_2eq$) of emissions saving.

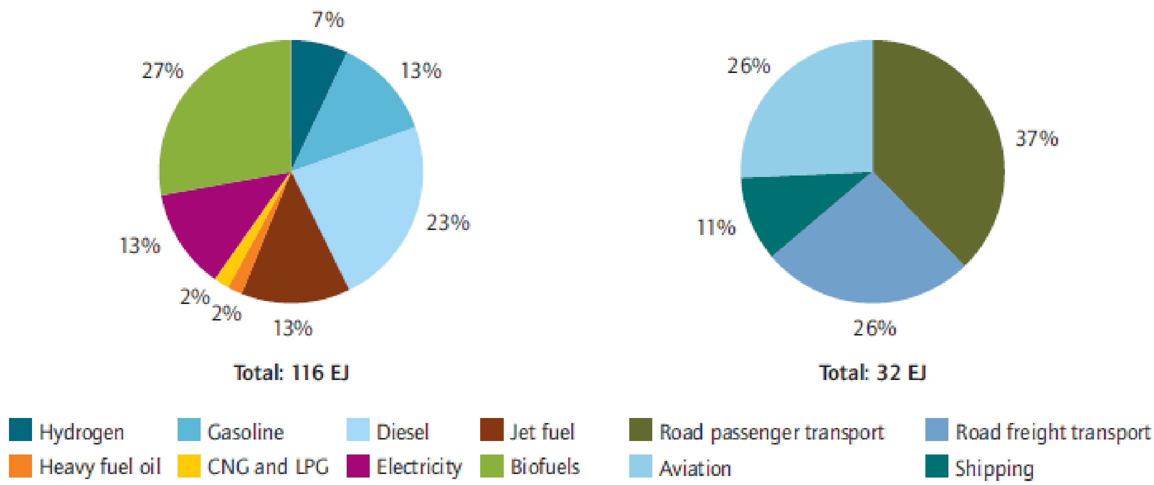

Figure 2: Global energy use in the transport sector (left) and use of biofuels in different transport modes (right) in 2050 (BLUE Map Scenario)[81].

7. Land use for biofuels (2.2.3, p10)

EC Claim

Global land-use for biofuels increases from 30 Mha today to around 110 Mha in 2050, which corresponds to around 7% of current cropland.

Ecofys Conclusion

The EC source (IEA) actually mentions a figure of 100 million hectares (Mha) in 2050 as opposed to 110Mha. This corresponds with 6.4% of current cropland, instead of 7% as claimed by the EC. Global land use for EU consumed biofuels currently is between 2.2 and 5.7Mha or 0.14 and 0.36% of global cropland.[82]

The IEA Biofuels roadmap mentions: "Meeting the biofuel demand in this roadmap would require around 65 Exajoules (EJ) of biofuel feedstock, occupying around 100 million hectares (Mha) in 2050". This is about 6.4% of current cropland, which is estimated by IIASA to be 1563 Mha.

Figure 3 shows how land availability for biofuels production is obtained in the Ecofys-WWF Energy Report (TER).

[81] IEA Biofuels roadmap 2011. Note: CNG= compressed natural gas; LPG= liquefied petroleum gas.

[82] Ecofys, PREBS report 2012, http://ec.europa.eu/energy/renewables/reports/reports_en.htm. Note that this is an improved analysis compared to an earlier Ecofys report.

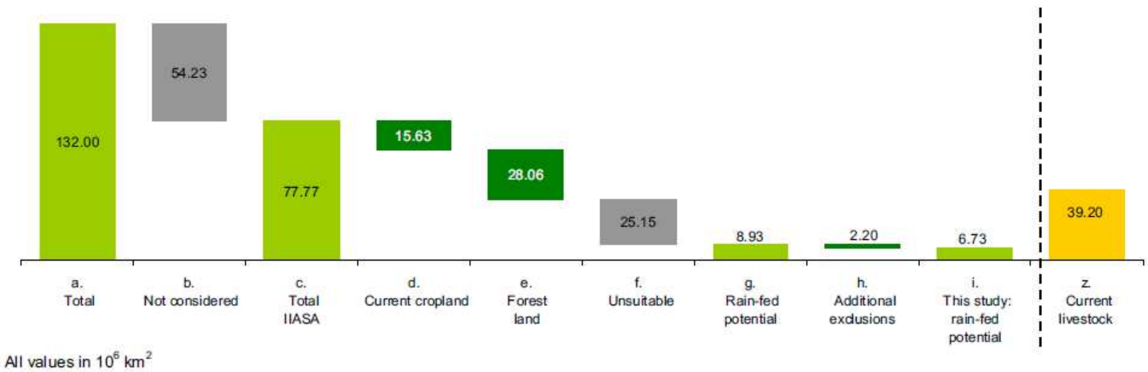

Figure 3: TER results of land potential assessment for rain-fed cultivation of energy crops
a. Total global land mass (excluding Antarctica); b. Excluded: protected land, barren land, urban areas, water bodies; c. Total land considered in the IIASA study; d. Excluded: current agricultural cropland; e. Excluded: unprotected forested land; f. Excluded: not suitable for rain-fed agriculture; g. Potential for rain-fed agriculture; h. Excluded: additional land for biodiversity protection, human development, food demand; i. Potential for energy crops found in this study; z. Current land used to support livestock (for reference only; overlaps with other categories).

Suitable rain-fed land for energy cropping in TER is estimated at 673 Mha, taking into account all sustainability criteria. This is slightly less than the 780 Mha rain-fed land claimed by the IPCC report.

The imputed increase of land used for biofuels in the EC Impact Assessment from currently 3% (see also statement 10) to 7% of current cropland in 2050, could also be lower by producing biofuels from yield increase and by using land which is not currently cropland but unused land. Ecofys has developed the Responsible Cultivation Area (RCA) methodology as a tool to identify unused land, thereby safeguarding the environment, respecting land right and assessing the suitability of the land for cultivation. Most importantly the establishment of an energy crop plantation on land without provisioning services for 3 years should not lead to a reduction in carbon stocks. The RCA methodology starts with a literature and GIS analysis and then zooming stepwise into the previous identified region.[83] Although an assessment of the worldwide potential has not been conducted yet, pilot projects provided evidence of a significant potential. For example, in Indonesia more than 8.5 mio. ha are covered with Imperata grassland, and problematic invasive weed preventing previously deforested areas from developing naturally into secondary forests. This area could potentially be used for producing biofuels, provided that the soil is suitable and there are no conflicts on land rights. By establishing a biofuel plantation on Imperata grassland the carbon stock of the land would even be increased.[84] The RCA methodology is embedded in the Low Indirect Impact Biofuels (LIIB) methodology developed by Ecofys together with the Roundtable on Sustainable Biofuels (RSB) and WWF. LIIB is a tool to demonstrate low ILUC biofuels, by implementing ILUC mitigation strategies on producer level, which could be verified by auditors. Currently Ecofys is assessing the potential for low ILUC risk biofuel production in the EU, including a potential analysis of unused land in the EU 27. Especially in Eastern Europe a significant potential of unused land is expected, which could help to get below 7% of the current cropland for biofuels.

[83] Ecofys – Responsible Cultivation Areas, 2010
[84] Ecofys – RCA feasibility studies, 2009

9. Global biofuels production in 2008 (2.2.3, p10)

EC Claim

Total global production of biofuels reached 70 Mtoe in 2008, which represents 1.7% of global oil consumption.

Ecofys Conclusion

The global production of biofuels in 2008 was 56 Mtoe, thereby representing 1.6% of global oil consumption.

IEA Key World Energy Statistics 2010 reports a global oil consumption of 3,502 Mtoe for 2008. Ecofys, in its study on renewable energy progress for the EC, calculated a global biofuel production of 56 Mtoe for 2008, based on various sources including Eurostat and US EIA.[85] This is significantly lower than the 70 Mtoe stated in the EC IA, for which no reference is provided. In 2008 global biofuels production therefore represented 1.6% of global oil consumption.

10. Global cropland used for biofuels (2.2.4, p10)

EC Claim

Less than 3% of global cropland is used for global biofuel production.

Ecofys conclusion

The Impact Assessment does not specify the reference year to which the statement refers. According to FAO figures, the share of biofuels stood at 2% of global cropland in 2009, while in 2011 the share was 3%, assuming a fixed quantity of total global cropland based on IIASA estimate.

The International Institute for Applied Systems Analysis (IIASA) estimates a worldwide used agricultural area of 1.5 billion ha in 2009[86].

According to the German Agricultural Ministry (BMELV) in 2011 45 Mio ha globally had been used for the cultivation of biofuel feedstocks, thereby having a share of 3%. In 2009 biofuels were cultivated on 2% of total agricultural land, i.e. 30 Mio ha.[87] BMELV hereby refers to an FAO study conducted by Metzger and Hütterman 2009.

[85] Ecofys - Progress in Renewable Energy and Biofuels Sustainability, forthcoming, 2013
[86] Fischer et al (IIASA) – Biofuels and Food Security 2009
[87]http://www.bmelv.de/SharedDocs/Standardartikel/Landwirtschaft/Bioenergie-NachwachsendeRohstoffe/Bioenergie/GrafikenBioenergie.html

12. Production and Trade in biofuels (2.2.4, p11)

EC Claim

Production and trade in biofuels in 2009 are represented on figure 2 in the EC IA.

Ecofys Conclusion

Trade flows represented in figure 2 are in line with other sources.

The EC Impact Assessment claims "In 2009, the EU imported soy biodiesel mainly from Argentina and US, and to a significantly lesser extent palm oil from South East Asia." This is corroborated by data from Lamers et al 2011[88].

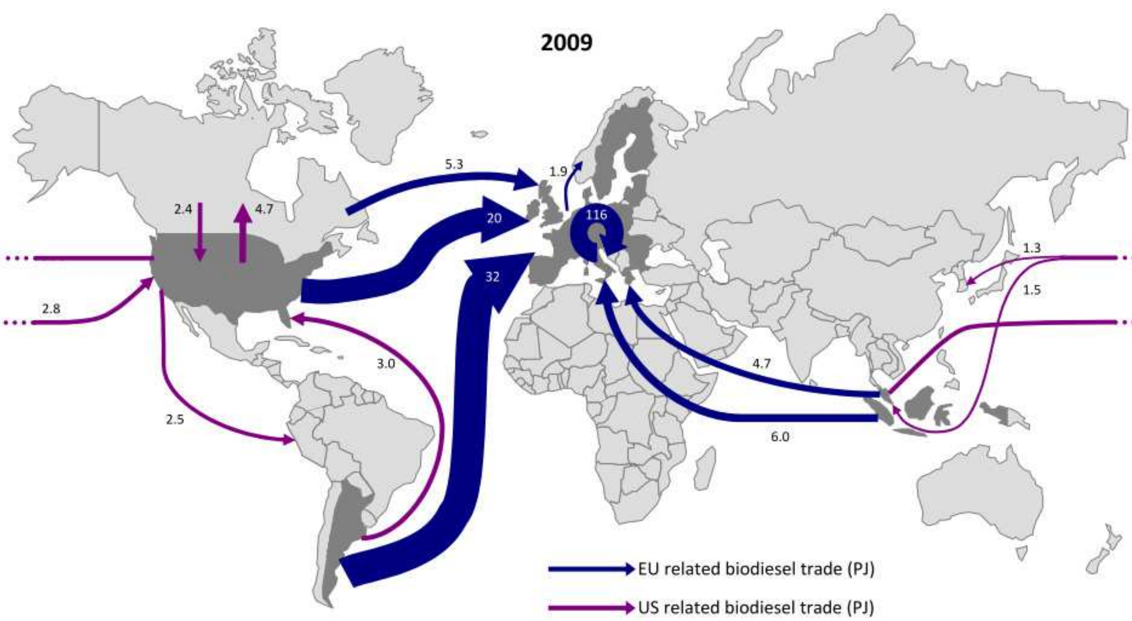

Figure 4: Global biodiesel trade streams of minimum 1 PJ in 2009

The EC Impact assessment claims: "Bioethanol, to be blended with petrol, was imported from Brazil [in 2009]." This is also mostly corroborated by data from Lamers et al 2011, although significant ethanol imports also came from the Caribbean and the USA in 2009.

It should also be noted that trade flows of biofuels (ethanol and biodiesel) are very volatile, and highly dependent on weather conditions (leading to crop failures or success) and industry as well as trade policies (subsidies and tariffs).

[88] Lamers, Hamelinck, Junginger, Faaij - International bioenergy trade – a review of past developments in the liquid biofuels market, 2011.

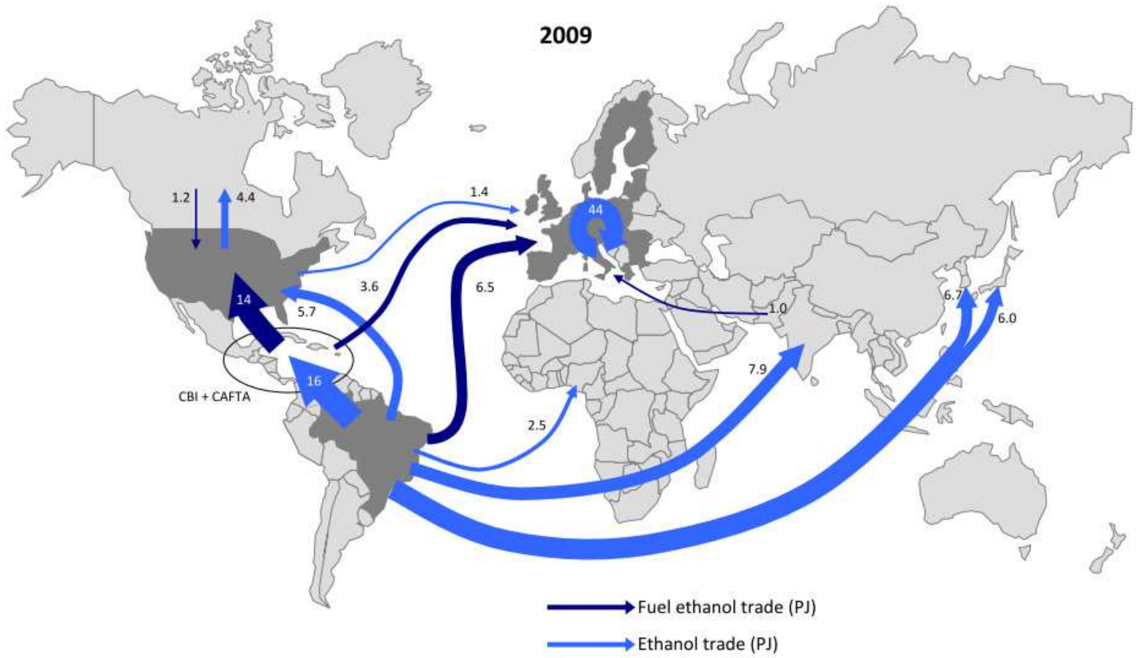

Figure 5: Global (fuel) ethanol trade streams of minimum 1 PJ in 2009.

18. Land availability (2.5.1, p16)

EC Claim

The extent to which land availability is limited in various regions of the world is much debated. Compared to 1981 the harvested land has significantly declined in Europe, CIS and North America, thus suggesting that there would be low carbon stock land available.

Ecofys Conclusion

Whereas the harvested area globally increased since 1982, there was a drastic decline in Europe, North America and in the CIS. Sound assessment of these areas including ground truthing is necessary to identify whether any of these areas is indeed low carbon stock and suitable for biofuel production. FAOSTAT and ERBD estimate some 23 million hectares of land were abandoned in Ukraine, Russia and Kazakhstan in the early 1990s. Not all of this land was very fertile and could easily be brought back into production but a share of 11 to 13mln hectares is good agricultural land and could be brought back into production. Some of this land might already be turned back into farmland after 2007.[89] Also the Worldbank highlights the potential for land available for sustainable agriculture, especially in Sub-Saharan Africa and Latin-America.[90] Ecofys currently assesses the availability of unused land in the EU.

[89] FAOSTAT ResourceSTAT, figure quoted in FAO and EBRD, *Fighting food inflation through sustainable investment* (London, 2008), p.2.

[90] Worldbank, *Rising Global Interest in Farmland* (2011), xxxiv.

Table 3 below shows the decline of harvested land in Europe and North America. In 2011 in Europe almost 100,000ha less were used to produce cereals, coarse grain and oil crops than compared to 2011. The decline in North America is less drastic, but still significant with almost 32,600 ha. Globally the harvested area for the selected feedstocks increased by more than 50,000ha.

Table 3: Harvested area in Europe, North America and World (Own calculation based on FAOSTAT)

	Harvested area of cereals, coarse grain and oil crops in ha		
	2011	**1981**	**Difference**
Europe	212,255,386	311,531,281	-99,275,895
North America	156,910,452	189,506,320	-32,595,868
World	1,283,576,637	1,233,432,164	50,144,473

The harvested area in this table has been limited to cereals, coarse grain and oil crops, as these are also potential feedstocks for biofuel production. The possible re-use of this formerly harvested area has to be assessed for each area separately on the ground, as the land might have developed into secondary forest or shrubland in the meantime. Any approach for a biofuel production on this unused land should follow a careful pre-assessment of the land, like the Responsible Cultivation Area (RCA) methodology, with regard to the carbon stock on the land.

19. Reduction of agricultural area in the EU (2.5.1, p16)

EC Claim

With regard to the EU, it is expected that the agricultural area will continue to reduce by around 0.5 million hectares each year.

Ecofys Conclusion

According to a DG AGRI study the agricultural area in the EU is expected to reduce with 0.18 million hectare per year on average between 2010 and 2020. The EC IA is therefore overestimating the expected decline and not using information from DG AGRI although DG AGRI is mentioned as the source for the statement. The main reasons mentioned for the decline are increased urban areas, increased nature protection areas and a focus on profitable crops.

As mentioned in the assessment of statement 18 above, a sharp decline of agricultural land in the EU occurred since 1981. However the EC's claim that the agricultural area will continue to reduce by around 0.5 Mha cannot be verified. The statements only refer to DG AGRI without mentioning a concrete source. Table 17 in Annex VII of the EC IA is not in line with a DG Agri study because the figures on the total utilised agricultural area differ significantly. The EC IA mentions 188.3 Mha in 2010 resp. 182.8 Mha in 2020, whereas the DG AGRI in its 2012 study 'Prospects for Agricultural

Markets and Income in the EU 2012-2022' mentions 179.2 Mha for 2010 respectively 177.4 Mha for 2020. This means that the expected reduction in EU farmland would be 0.18Mha per year on average between 2010 and 2020.The study states that the reduction of available farmland is mainly caused by increased land use for building purposes and increased protection natural habitats. In addition the concentration on most profitable crops is also seen as a reason for decreasing agricultural land in the EU. [91]

20. New agricultural land from tropical forests (2.5.2, p16)

EC Claim

Recent studies suggest that tropical forests were the primary sources of new agricultural land in 1980-90s.

Ecofys Conclusion

The EC IA statement is based on only one study instead of several. This study confirms that a slight majority of new agricultural land has been gained though the conversion of tropical forest (55%), with soy production being the main driver in the Amazon and palm oil in Southeast Asia. While the statement is factually correct, its value for the present discussion is questionable since the study covers the period 1980-2000.

The EC's claim above refers to only one study, namely "Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s" from H. K. Gibbs (Stanford University) et al. Based on the pan-tropical database of classified Landsat scences by FAO the authors assess the pathways of agricultural expansion across the tropics. The authors state that 55% of new agricultural land resulted from deforestation of tropical forests.

21. Expansion of agricultural land into the Amazon & South East Asia (2.5.2, p. 16)

EC Claim

Various studies highlight a significant role for soy production and cattle ranging, as well as palm oil, as drivers behind the expansion of agricultural land into the Amazon and South East Asia respectively.

Ecofys Conclusion

In Latin America as a whole, cattle pasture was the main driver for agricultural expansion into tropical forests in the 1980-90s, while soy production was the main driver in the Amazon area. Palm oil was the main driver of forest conversion in Southeast Asia. In the period 1990-2010 these drivers are still found to be important drivers for deforestation. The EC IA statement therefore correctly states important drivers for deforestation, but is not well reflecting the impact of relatively recent initiatives to prevent deforestation (e.g. soy moratorium and RSPO) which reduce the impact of certain crops on deforestation. While some of the deforestation will either directly or indirectly be related to EU biofuels, the vast majority of deforestation results from (increased) demand in food, feed and timber, especially in emerging markets such as China.

[91] DG AGRI – Prospects for Agricultural Markets and Income in the EU 2012-2022, 2012

The reference for this statement is the same as for statement 20 above, i.e. Gibbs et al..
In South East Asia more than 80% of the agricultural expansion was driven by palm oil plantations. Referring to other studies the authors also state that palm oil was recently responsible for the destruction of peatland in Southeast Asia. In Latin America cattle pasture had the greatest expansion followed by sugarcane and soybeans. However there are strong geographic variations in the land use change, as in the Amazon more predominately forested areas and shrubland have been converted into agricultural land. In their conclusion the authors stress the need for environmental protection mechanisms like the Reducing Emissions from Deforestation and forest Degradation (REDD) initiative by UNFCC. REDD is also mentioned in annex VII of the EC IA as a centrepiece of the Commission's effort to reduce deforestation.

The EC IA does not explicitly mention other initiatives like the soy moratorium enforced in Brazil in 2006 and extended until January 2014, which aims to prevent deforestation in the Amazon due to soy production. However in Annex VII in the EC IA it is stressed that "since 2005 deforestation rates in the Amazon have been going down significantly" thereby referring to official data from the Brazilian National Institute for Space Research. This claim is confirmed by the soy moratorium monitoring report 2012 stating that soy production was responsible for only 0.41% of all deforestation in the Amazon biome since the implementation of the soy moratorium.[92]

A study from Kissinger et. al. on deforestation drivers based on national reports confirms that cattle ranching, soybean and palm oil production have been the main drivers for deforestation in the Amazon and South East Asia from 1990 until 2010. The study also revealed that 70% of total degradation in Latin America and (sub)tropical Asia resulted from timber and logging activities. As a positive example of limiting deforestation the soy moratorium is mentioned.[93]

With regard to the impact of palm oil the Roundtable on Sustainable Palm Oil (RSPO) is expected to have a positive effect on limiting deforestation of tropical forests in South East Asia.[94] Today only 14% of global palm oil is RSPO certified, if RSPO were to cover a larger share of palm production its positive effect on preventing deforestation would further increase.[95]

The EC IA statement correctly states important drivers for deforestation, but is not well reflecting the impact of initiatives to prevent deforestation. Whereas the soy moratorium already had a positive impact, the impact of the RSPO on reducing deforestation has further potential if a larger share of global palm oil would get certified.
While some of the deforestation will either directly or indirectly be related to EU biofuels, the vast majority of deforestation results from (increased) demand in food, feed and timber, especially in emerging markets such as China.

[92] GTS Soy Task Force – Soy Moratorium, Mapping and monitoring soybean in the Amazon biome – 5th year, 2012
[93] Kissinger et al – Drivers of deforestation and forest degradation, a synthesis report for REDD+ policy makers, 2012
[94]Paoli et al - CSR, Oil Palm and the RSPO: Translating boardroom philosophy into conservation action on the ground, 2010
[95] www.rspo.org

23. Proper implementation of LULUCF worldwide would reduce ILUC (2.5.3, p17)

EC Claim

Proper implementation of LULUCF worldwide would significantly reduce ILUC emissions as converting high carbon stock land would have a cost.

Ecofys Conclusion

LULUCF could be a means to reduce ILUC as unwanted direct land-use change could be monitored and eventually sanctioned. Currently there are no international binding rules imposing costs for high emissions in LULUCF.

Land use, land-use change and forestry (LULUCF) have been included in the Kyoto protocol as a significant category for GHG emissions or removal. At the 17th Conference of the Parties to the UNFCC (COP 17) in Durban 2011 international accounting rules for LULUCF activities have been agreed upon. Important for the biofuels sector is that the aim is to monitor and control direct land-use changes emissions within an inventory of carbon stock changes, emissions by sources and removals by sinks. Even in the EU, LULUCF is not yet included in GHG accounting, due to difficulties in collecting robust carbon data and the lack of common rules for accounting. Whereas the latest EC proposal on LULUCF includes rules for accounting, no targets exist for emission reduction in the LULUCF sector. Targets will only be set, when the accounting rules have been implemented and found to be sound in practice.[96]

[97] A proper implementation of LULUCF would make negative impacts due to deforestation transparent in the GHG inventory on national level. By internalising environmental cost of emissions related to LULUCF at the national level, any increase of emissions in this sector will risk target achievement, provided that a target has been set.

Bilateral agreements on climate finance linked to reduced or maintained GHG emissions in LULUCF could however impose financial costs on unwanted land-use change if payments are linked to national GHG target achievements in LULUCF. As currently neither accounting rules nor targets for LULUCF have been implemented on European or global level, it is not possible to assess the potential costs for countries when causing LULUCF emissions.

[96] http://ec.europa.eu/clima/policies/forests/lulucf/index_en.htm

[97] IPCC Special Report – Land use, land-use change and forestry (2000)

24. Employment (2.8.1, p18)

EC Claim

Employment related to biofuels could be 400,000 jobs in 2020.

Ecofys Conclusion

The 400,000 jobs related to biofuels in 2020 would require that the number of current jobs in the biofuel sector in the EU doubles. Looking at the decline of biofuel consumption and employment rate in the biggest intra-European biofuel market, i.e. Germany, and the economic challenges the European biofuel sector as a whole faces, the 400,000 jobs seem very ambitious. If an EU ILUC policy would lead to a closure of biofuel plants this would lead to job losses.

The high number of 400,000 jobs related to biofuels is not limited to the biofuel sector as such, but includes employment in related fields like agriculture and forestry. Therefore the figure talks about gross employment covering all persons involved in construction of the plant, the operation and maintenance of the plant as well as the persons directly or indirectly involved in the feedstock supply, transport and logistics. Ecofys in its forthcoming report for the EC estimates a gross employment of 200,000 jobs related to biofuels in the EU in 2011[98], so the number of jobs related to biofuels would have to double by 2020.

The EC quoted Employ RES study analysed the economic impact of several policy scenarios for the deployment or renewable energy sources (RES). For 2020 the study estimates up to 2.8 million employees in the sector of renewable energy in Europe. As a baseline 210,000 jobs in the biofuels sector, equalling 15% of RES related employment, were mentioned, thereby including jobs in agriculture and forestry. [99] Depending on whether EU biofuel consumption will increase or decrease, the total number of jobs related to biofuels could decrease or increase, although 400,000 will be challenging.

An IEA RETD study[100], quoting the Employ RES study, estimated that within a business as usual RES policy scenario in EU MS combined with moderate export expectations 115,000 - 201,000 new jobs related to biofuels could be created in 2020. More ambitious RE policies combined with moderate export expectations could lead to a slightly higher increase in average employment of 396,000-417,000 new jobs by 2020.

The IEA-RETD mentions optimistic figures for biofuel related employment in Germany with 380,000 jobs as of 2010 which will increase over the coming years. This is in contrast to a recent study for the German Federal Ministry of Environment (BMU), which estimates a total gross of 23,200 employees related to the biofuel sector in Germany in 2011. However the authors expect a decline in the number

[98] EC report - Renewable Energy Progress and Biofuels Sustainability (forthcoming)
[99] Fraunhofer, Ecofys et al. – Employ RES, The impact of renewable energy policy on economic growth and employment in the EU, 2009
[100] IEA-RETD 2012, Policy-Brief-on-Renewables-and-Employment

of jobs in the future, based on historical trends and the decrease of biofuel consumption in Germany.[101]

26. Share of EU cereal production and sugar beet used for biofuels (2.8.1.2, p19)

EC Claim

In 2009/10 3.2% of EU cereal production and 5.4% of sugar beet was used for biofuels.

Ecofys Conclusion

The reference quoted in the Impact Assessment actually states that 2.7% of the EU cereal production was used for biofuels, which is slightly lower than the mentioned 3.2%. Ecofys own calculations for the EC estimated that in 2009/10 more than 12% of the EU sugar beet production was processed into bioethanol, which is more than double the figure in the Impact Assessment.

The EC Impact Assessment states an EU cereal production of 292 Mt in the marketing year 2009/10 with a share of 3.2% for bioethanol. A report on agricultural markets from DG AGRI is the source for these data, which mentions however that from the 292 Mt around 8Mt were processed into bioethanol, i.e. only 2.7%.

For sugar beet the EC impact assessment reports a production of 110Mt in the EU27 with a share of 5.4% for biofuels. An estimated 31.7% of bioethanol produced in EU MS is produced from sugar beet. This estimate is based on plant information provided by Alternative Energy E-track and biofuels trade date.[102] Using a conversion efficiency of 0.0777 ton ethanol/ton sugar beet, this means that 11.65 Mton of beets were needed to produce that ethanol, which is about 12.76% of all EU beet production and considerably more than the share quoted by the EC.

27. Share of biofuels in global vegetable oil market (2.8.1.2, p20)

EC Claim

In 2010/11 38% of EU vegetable oil consumption was for biofuels, of which 41% consisted of imports.

Ecofys Conclusion

FEDIOL data show that biofuels indeed represented 38% of all vegetable oil consumed in the EU in 2011. However only 16.4% of the vegetable oil processed into biodiesel was imported.

[101] DLR, DIW et al. – Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2011, 2012
[102] Ecofys - Renewable Energy Progress and Biofuels Sustainability, forthcoming, 2013

According to FEDIOL 23.8 million tons of vegetable oil were consumed in the EU in 2011, which included 2 million tons of olive oil. This is almost in line with the 23.4 million tons mentioned in the EC IA.

The output of EU crushing facilities mainly goes to the food market (54% in 2011103) and only a relatively small quantity is crushed for biofuels. FEDIOL confirms that 9.1 million tons, i.e. 38%, of the total vegetable oil consumption has been processed into biodiesel.

For the purpose of biofuel production 1.5 million tons of vegetable oil have been imported in the EU, which corresponds to 16.4% of biodiesel production in 2011.

28. Biofuel feedstock origin (2.8.1.2, p20)

EC Claim

The EC IA give a biodiesel to ethanol split of 72/28 in 2020.

Ecofys Conclusion

The EC bases its statement on the NREAPs. Actual biofuel consumption in the EU in the period 2007-2011 shows the biodiesel/bioethanol split remained constant at 78/22%. There seems little reason why this split would increase in the years to 2020.

The EC IA states that in 2008 the total biofuel consumption comprised 83% of biodiesel and 17% of bioethanol. Based on the IFPRI model the EC IA further assumes that this will change to 72% biodiesel and 28% bioethanol in 2020.

Ecofys calculations based on various data revealed that the biodiesel bioethanol split remained constant from 2008 to 2011 with around 78% for biodiesel and 22% for bioethanol.

Table 4: Historical biodiesel/bioethanol split[104]

	2007	2008	2009	2010[105]	2011[106]
Share of Biodiesel Consumption	78.20%	78.96%	79.82%	78.02%	78.31%
Share of Bioethanol Consumption	21.80%	21.04%	20.18%	21.98%	21.69%

[103] http://www.fediol.eu/data/1350640360Summary%20FEDIOL%20Split%20end-use%20of%20all%20EU27%20vegetable%20oils%20in%202010%20vs%202011.pdf
[104] Ecofys, based on Eurostat statistics.
[105] See EC report - Renewable Energy Progress and Biofuels Sustainability (forthcoming) for 2007-2010
[106] Biofuels Barometer 2012

Any increase of bioethanol consumption would require supportive policy measures.

29. Advanced biofuels installed capacity in the EU (2.8.1.4, p21)

EC Claim

Advanced biofuels installed capacity in the EU is currently negligible and limited to a few pilot plants.

Ecofys Conclusion

The EC statement does not seem to refer to all advanced biofuels but only to those with advanced technologies. We focus here on cellulosic ethanol. A significant number of initiatives on cellulosic ethanol are developed in the EU. These initiatives mainly concern pilot and demonstration plants. The estimated installed production capacity for advanced biofuels in the EU was 16,150toe in 2011 and 101,150toe in 2013. While this is a steep increase, in relative terms it's still only 0.3% of total EU biofuels capacity.

In the overview of advanced biofuel capacity below we only take into account advanced capacity for ethanol. This because advanced biodiesel can be produced in abundantly available conventional biodiesel installations, with retrofitting investments required depending on the quality of the feedstock. Advanced ethanol capacity requires expensive, innovative new production capacity.
Chemtex in Italy has started production in its 60,000t cellulosic ethanol plant in the last quarter of 2012. Since April 2013, Abengoa produces ethanol from municipal solid waste in a demonstration plant in Babilafuente, Spain.. Chemtex in Italy has started production in its 60,000t cellulosic ethanol plant in the last quarter of 2012. Since April 2013, Abengoa produces ethanol from municipal solid waste in a demonstration plant in Babilafuente, Spain. Other players like Chempolis, Inbicon and Süd-Chemie (now Clariant) have a very limited production capacity. Table 4 below provides an overview of the installed advanced biofuel production capacity in the EU.

Table 5: Installed advanced biofuel production capacity in the EU 27 (tons per year) [107]

Company	2011	2012	2013	Country	Advanced Biofuels
Chempolis	6,900	6,900	6,900	Finland	Ethanol
Chemtex	0	60,000	60,000	Italy	Ethanol
Inbicon	8,250	8,250	8,250	Denmark	Ethanol
Abengoa	0	0	25,000	Spain	Ethanol
Sud-Chemie	1,000	1,000	1,000	Germany	Ethanol
TOTAL	16,150	76,150	101,150		

From 2011 to 2013 the installed advanced bioethanol production increased from 16,000 tonne to 101,150 tonne or 64,700 Mtoe. While a steep increase in relative terms, still only 0.3% of total EU biofuel capacity, of 24.5Mtoe.[108]

[107] Own calculations based on Biofuels Digest – Advanced Biofuels Project Database, 2011 and company websites
[108] EC Impact Assessment based on data from EBB and Pure.

30. Biofuel production capacity utilisation (2.8.1.4, p21)

EC Claim

Biofuel production capacity utilisation is at around 50%.

Ecofys Conclusion

Biofuel production capacity utilisation in the EU in 2010 was on average 44%, with the biodiesel capacity being used at 42% and bioethanol capacity at 56%.

Table 6 shows the total production of biodiesel and bioethanol in the EU compared to the installed production capacity.

Table 6. Production of biofuels in the EU compared to the production capacity (both in Mtoe)[109]

	Capacity	Actual Production	Capacity Utilisation
Biodiesel			
2005	3.76	1.63	43%
2006	5.40	2.46	46%
2007	9.16	3.85	42%
2008	14.24	5.67	40%
2009	18.61	7.44	40%
2010	19.49	8.14	42%
Bioethanol			
2005	0.92	0.55	60%
2006	1.43	0.84	59%
2007	1.98	1.10	56%
2008	2.75	1.54	56%
2009	2.92	1.87	64%
2010	3.60	2.02	56%

[109] Source: EBB, 2013; ePURE, 2013

32. Flexi Fuel vehicle introduction (2.8.1.5, p22)

EC Claim

Future of ethanol blending is challenging due to the trend in the diesel/petrol split, but additional costs of flexifuel cars are €100 per vehicle or lower.

Ecofys Conclusion

Table 2 of the EC IA shows that the biodiesel to ethanol split is expected to develop towards a larger share of ethanol at the expense of biodiesel. In addition, new technologies to convert sugar and starch into biodiesel could make split between biodiesel and bioethanol irrelevant from a biofuel feedstock perspective. Until the moment these technologies become economically viable, flexi fuel cars can play a role in facilitating the use of higher bioethanol blends. Introducing flexi-fuel vehicles takes time, as retrofitting existing vehicles is expensive and renewing the passenger car fleet takes about 10-15 years.

Bioethanol is processed from sugar and starch containing crops, which are assumed to have lower indirect GHG emissions than oil crops used for biodiesel production. Recent developments show that the split between biodiesel and bioethanol might become obsolete in the mid-term future. Companies like Amyris and Solazymes already use microorganisms to process sugar and starch based feedstocks into biodiesel. BP and DSM have recently created a joint venture to convert sugar into biodiesel. Until this technology becomes commercially viable with significant volumes, the alternative is flexi fuel vehicles able to run on high bioethanol blends.

In order to turn Otto-engine (petrol) cars into flexi-fuel cars (able to drive on pure ethanol blends), only certain materials need to be changed in the car, like rubbers (fuel supply), plastics, and aluminium (only present in some vehicles). The material costs for this would indeed cost around €100 per vehicle, but only when performed at the factory, so this is valid for new cars. For existing fleets to be retrofitted however, much higher costs would apply, with costs getting closer to the €1000, as the operation would be much more time-consuming and bear large overheads.

As a reference, General Motors claims that "Adding the capability to run on E85 costs adds as much as $70 to the production cost of each vehicle".[110]

For biodiesel, apart from changing rubber fuel system components, other issues like the higher formation of ash particles for pure biodiesel (not the case for hydrogenated vegetable oils) make turning a car into flexi-fuel more expensive.

[110] http://www.reuters.com/article/2010/02/16/gm-ethanol-idUSN1619509020100216

38. Precautionary principle (2.9.1, p28)

EC Claim

Article 191(2) of the Treaty states that EU policy on the environment shall be based on the precautionary principle. In view of this, the Commission noted in its December 2010 report on indirect land-use change that action should be based on the precautionary approach.

Ecofys Conclusion

The precautionary principle is indeed included in the Lisbon Treaty and the EC indeed refers to it in its 2010 Communication on ILUC. See in annex for more information on the precautionary principle and the conditions that apply.

Principle 15 of the Rio Declaration (1992) states that "[…] Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

According to the EC guidelines on the precautionary principle[111] it may only be invoked when the three preliminary conditions are met:

- identification of potentially adverse effects;
- evaluation of the scientific data available;
- the extent of scientific uncertainty [is identified].

The precautionary principle shall be informed by three specific principles:

- the fullest possible scientific evaluation, the determination, as far as possible, of the degree of scientific uncertainty;
- a risk evaluation and an evaluation of the potential consequences of inaction;
- the participation of all interested parties in the study of precautionary measures, once the results of the scientific evaluation and/or the risk evaluation are available.

41. Threshold of 60% will likely exclude rapeseed (5.3.1, p42)

EC Claim

Rapeseed is likely to be excluded when the threshold reaches 60%.

Ecofys Conclusion

There is a significant potential to reduce GHG emission of rapeseed biodiesel in the cultivation and processing phase. A study for DG TREN states that rapeseed biodiesel could achieve 62% of GHG reduction by using biomethanol in the processing.

[111] http://europa.eu/legislation_summaries/consumers/consumer_safety/l32042_en.htm

FEDIOL members indicate 60% for rapeseed is possible. Without an ILUC factor rapeseed biodiesel could be below the 60% threshold according to FEDIOL members, as some farmers already managed to reduce GHG emissions in cultivation significantly. Sharing best practises on cultivation will enable to decrease GHG emissions from rapeseed, taken into account that around 70% of GHG is emitted in the cultivation phase.

Especially the use of GHG intensive nitrogen fertiliser often can be reduced without negative impacts on the yields. German rapeseed expert Professor Kage from University of Kiel revealed that farmers tend to use too much nitrogen fertiliser in the second fertilisation phase in spring thereby not taking into account nitrogen up take of the plant. Optimisation of nitrogen fertilisation will prevent an overuse of nitrogen without any positive effects on the yield. [112]

A study conducted by the COWI consortium for DG TREN concluded that rapeseed biodiesel could achieve a GHG reduction of 62% by implementing additional measures in the processing, e.g. the introduction of biomethanol instead of fossil methanol.[113]

[112] Kage et al. – Optimierung der N-Düngung von Raps durch Berücksichtigung der bereits aufgenommenen N-Menge, VDLUFA Schriftenreihe 66, 2010

[113] DG TREN – Technical assistance for an evaluation of international schemes to promote biomass sustainability, 2009

Appendix II Double and quadruple counting materials

This annex contains information on most of the materials included in the positive lists in Annex IX of the EC proposal positive. For each material, the available quantities in the EU are assessed where possible as well as the technical and economic feasibility to produce biofuels from the material by 2020.

Quadruple counting materials

Algae

The term "algae" covers macroalgae, which are cultivated in the sea, and microalgae, which can be cultivated in land-based system. Although macroalgae (like seaweed) seem very promising as well as a sustainable resource for food, feed and fuel, they mainly produce sugars that can be converted into ethanol as energy carrier. Microalgae are highly interesting (due to their high lipid content) because they can be converted into biofuels with specifications equal to diesel, gasoline or kerosene. Biofuel from microalgae has a higher density than ethanol, and can therefore not only be used in cars, but also in ships, airplanes and trucks. Global production volume of algal derived products is currently still less than 5,000 tons per year.[114] Because commercial-scale algae growing and harvesting is still in development, Ecofys in the Energy Report (2011) concludes that algae will deliver significant volumes of biofuels only from 2030 onwards. Currently production costs for energy products from aquatic biomass are still high, higher than fossil fuels and even higher than most conventional bio-energy products from resources cultivated on land. The total worldwide long-term energy potential from micro and macroalge cultivation was estimated at 6,000EJ.[115]

Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under Article 11(2)(a) of Directive 2008/98/EC

According to IEA Bioenergy[116], a tonne of municipal solid waste (MSW) has typically about one-third of the calorific value of coal (8-12 MJ/kg as received for MSW and 25-30 MJ/kg for coal) and can give rise to about 600 kWh of electricity. Traditionally, mixed waste is incinerated in mass burning facilities. Also, the composition of solid wastes can be highly variable. Some initiatives are using new technologies to produce advanced biofuels from MSW. A telling example is that of Solena, which is investing in Fischer Tropsch technology to produce biodiesel and aviation fuel[117]. Solena's technology can use various feedstocks including wood waste, agricultural waste, AND **municipal waste[118].** In its London plant "Around 500,000 tonnes of municipal waste normally sent to landfills will be converted

[114] Wageningen University (2012)
[115] Ecofys (2009)
[116] IEA 2003 - Position Paper - Municipal Solid Waste and its Role in Sustainability
[117] http://www.solenafuels.com/solution
[118] http://www.solenafuels.com/flexibility

annually into 50,000 tonnes of biodiesel, bionaphtha and renewable power at the facility as well as the 16 million gallons of jet fuel"[119] using its proprietary Integrated Biomass Gasification to Liquids (IBGTL) solution. Solena has already identified a site for its first production facility in Germany, situated not far from the border with Poland in the Schwedt/Oder region. The project will be the first of its kind in Central Europe to provide synthetic biofuels from large-scale waste from landfills and incinerators. It will provide Lufthansa with drop-in, certified jet fuel for prospective use on commercial flights.[120]

Biomass fraction of industrial waste

Industrial waste refers to waste not covered by the term municipal waste.[121] There were no data on quantities available.

Straw

The EU is a large producer of rapeseed straw and cereal straw produced from wheat, barley, rye and oat. The total quantity of straw produced in the EU-27 is 95.3 million tonne, assuming a situation in which 60% of cereal straw and 50% of rapeseed straw is left on the land for soil regeneration purposes. The five Member States with the largest straw production are France, Germany, Poland, United Kingdom, Spain, Italy and Romania. Straw is currently used as animal feed, for animal bedding, for frost prevention in horticulture, mushroom production, heat and power production and some other smaller uses. Promising initiatives exist using straw to produce biofuels.

Animal manure and sewage sludge

Manure is a scarce resource in some regions, while in others there is too much of it and farmers are obliged, under the Nitrate Directive in Nitrate Vulnerable Zones, to pay for the disposal of excess manure (above 170 kg N/Ha). In order to estimate the quantity of manure available for bioenergy, the Biomass Futures Projects[122] makes a couple of assumptions:

Farmers with excess manure are more likely to search for opportunities to produce biogas from it. This stimulus most certainly applies to farmers having higher manure production than 170 kg nitrogen per hectare as they have to make costs to dispose of their manure. The authors set the level at which farmers start searching for alternative uses for their manure at 100 kg nitrogen per hectare. Manure in excess of this 100 kg Nitrogen per hectare of forage area (fodder crops+grazing lands) is therefore the first to be used for bioenergy generation and the cost of using it could be negative since the farmer saves himself disposal costs.

In areas in which there is no manure potential above the 100 kg Nitrogen per hectare it is assumed that there is not enough stimulation to put it into a biogas installation. The potential is assumed to be

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119 http://www.solenafuels.com/sites/default/files/greenaironline.com%20-%20British%20Airways%20pledges%2010-year%20off-take%20agreement%20as%20GreenSky%20project%20with%20Solena%20gathers%20momentum.pdf

120 http://www.solenafuels.com/sites/default/files/Lufthansa%20turns%20to%20algae%20and%20municipal%20solid%20waste%20in%20quest%20for%20new%20sources%20of%20sustainable%20jet%20biofuel%20-%20greenaironline.pdf

121 Personal communication with DG Energy

122 See deliverable 3.3 http://www.biomassfutures.eu/work_packages/work_packages.php

zero, although it is acknowledged that even in these regions there could be some potential to convert manure into energy.

The result of the study shows that in the EU 27, about 46.7 Mt of manure is potentially available for bioenergy use. Currently manure is mainly used as fertilizer and for biogas production.

Palm oil mill effluent and empty palm fruit bunches
Palm oil mill effluent is generated in the milling of palm together with solid wastes and gaseous emissions. Usually the palm oil mill effluent is used for cropland applications, but could also be used for biogas production.

Tall oil pitch
Crude Tall Oil (CTO) is a by-product of paper manufacture when pulping pine trees for paper. It is obtained from black liquor soap that is being acidified to produce CTO. CTO can be either used directly, generally as heating fuel, or fractionally distilled into tall oil rosin (TOR), distilled tall oil (DTO), tall oil fatty acids (TOFA) and tall oil pitch as a residue. The CTO CN code is 38030010.

No statistics were found on Crude Tall Oil (CTO) production quantities but several industry experts estimate current European production at 500 to 600kton.[123]. Most of this, some 450 kton, is generated and processed in Sweden and in Finland. In addition, some refining capacity also exists in France and Austria.[124] Tall oil pitch is considered to be a residue of CTO refining.

CTO use towards biodiesel production is currently relatively small and might increase in the near future. However CTO is considered to be a valuable feedstock with many well established other uses, especially in the chemical industry that do not depend on government incentives. Biodiesel use therefore has to compete with other CTO-uses and it is hard to tell to what extend biodiesel production from CTO will increase in the future. A large CTO processing company has recently decided not to start producing biodiesel from CTO.[125]

Crude glycerine
Crude glycerine is a residue from biodiesel production. From the vegetable oil biodiesel feedstock, 10% ends up as crude glycerine.

Bagasse
Bagasse is a by-product of sugarcane production consisting of the fibrous material left after pressing sugar out of sugarcane in a mill. Per tonne sugarcane around one third of bagasse becomes available. Bagasse is often burned for energy to power sugarcane mills; it could also be used as animal feed.

Grape marcs and wine lees

[123] Interviews with SunPine and Arizona Chemical; according to SunPine global production is approximately 2mln tonnes.
[124] Interviews with Forchem, CEPI and Arizona Chemical
[125] Interview with Arizona Chemical

Grape marc or pomace is the residue from the pressing of fresh grapes, whether or not fermented.[126] It is a solid residue containing the grape skins, pulp seeds and part of the stalks. Most stalks are being removed during the de-stemming phase of wine production and further used separately. The composition of grape marc depends largely upon what kind of wine is being made and at what stage of processing the liquid has been pressed out. Grape marc can consist of around 8% seeds, 10% stems, 25% skins and 57% pulp.[127]

Wine lees are the residue accumulating in vessels containing wine after fermentation, during storage or after authorised treatment; the residue obtained from filtering or centrifuging wine.[128]

Total EU wine production in 2010 stood at 156mln hectolitres.[129] Assuming 4% stems, 18.5% grape marc excluding stems and 3.5% lees residues the total amounts of residues generated in the EU in 2010 would be 880,000 tonnes of stalks, 4.1mln tonnes of grape marc (rest) and 780,000 tonnes of wine lees.

Grape marc and lees and exhausted grape marc are sometimes used to produce bio-energy through anaerobic digestion.[130] And in recent years biofuel production has become a new and growing use for distilled grape marc and lees.[131]

Nut shells

EUBIONET identified that 780 kt of nutshells, from walnut, almond and hazelnut could be potentially available in Greece, Italy and Spain, representing about 2.4 PJ per year[132]. However, these streams are sometimes already used for energy production in combustors or even in small scale boilers instead of wood pellet. The suitability of these products for combustion, may compete for its use as a feedstock for advanced biofuels.

Husks

Within wheat, barley and corn maize production the husks are leftovers in the harvesting process and remain on the field. Husks become part of the straw, when the harvesting residues are collected. Still remaining husk on field, not included in the straw, is needed for humus reproduction.[133] The EU uses the same CN-code, used to trace trade in goods in the EU and with outside-EU countries, for husks and straw.

For rice the situation is different. According to the International Rice Research Institute (IRRI) 100kg of paddy rice will generate 20kg of husk, so the ratio for main-product and residue is 20%. However

[126] Based on Council Regulation (EC) no 479/2008, Annex 1, definition nr. 10.
[127] http://pomace.net/grape-pomace/
[128] Based on Council Regulation (EC) no 479/2008, Annex 1, definition nr. 9.
[129] USDA Foreign Agricultural Service, *EU-27 wine annual. Wine annual report and statistics*, (2011), p. 4, see: http://www.calwinexport.com/files/Wine%20Annual_Rome_EU-27_3-1-2011.pdf
[130] http://pomace.net/grape-pomace/
[131] http://pomace.net/grape-pomace/
[132] EUBIONET 3 (2011)
[133] Personal communication with Arno Becker, AFC Consulting GmbH

as rice production is dominated by Asia, rice husks will only become available in significant quantities here. There is almost no potential for rice husk biofuel production in the EU.

Cobs

Cobs from maize are produced in large quantities. From an EU27 production of over 67 Mt of grain maize in 2011[134], and a residue to product ratio of 0.273[135], yields a total maize-cob output of 18.4 Mt in 2011. See also the table above for other residues from maize.

Corn cobs are already used in the USA as a feedstock for cellulosic ethanol. The heat value of corn cobs is between 18.4-18.7 MJ/kg. A general rule is that cobs represent about one-third of corn grain harvested. Although biofuel production for cob is technically feasible there are some challenges:

- Logistics and transportation problem: Due to relatively low yield of cobs per ha, feedstock has to be gathered from a larger are than other feedstocks;
- Economic challenge: Cob-collection harvest machines cost approx. 130k$. Cob collection could double harvest costs.

Nutrient removal from cob harvest is low, so there is almost no impact on soil organic matter. Cobs could contain 35% moisture at a corn grain moisture level of 20%.[136] According to Purdue University an ethanol plant should pay at least 100$ per dry ton cobs to make the harvesting interesting for the farmer.

Bark, branches, leaves, saw dust and cutter shavings

Forestry products are the largest component of today's biomass supply, totalling approximately 770 TWh of primary energy per year. About half is by-products from the industry (such as black liquor, sawdust, and bark), 360 TWh (70 million dry tons or 140 million m^3), 3 is roundwood and 30 TWh (6 million dry tons) from forest residues (branches, tops, and stumps).

The big bioenergy growth opportunity in forestry is to increase the capture of forest residues. These residues are only captured to any significant extent in Scandinavia today; in the rest of Europe these fractions are largely left in the forest. The assumption in the aggressive mobilization scenario is that continental Europe could by 2020 get to half of the capture rates that Scandinavia is expected to have (i.e. 20% in continental Europe, 40% in Scandinavia, resulting in an average of 30% across Europe). This would result in a growth of 170 TWh from forest residues. Environmental organizations have sustainability concerns regarding some of the forestry practices in Scandinavia, and their impact on biodiversity and carbon emissions. This topic is further discussed in the Sustainability chapter of this report. The assumption in the supply mobilization scenario is that these concerns would be manageable in the rest of Europe at the assumed capture rates (which are only half of those in Scandinavia). For instance, these capture rates are attainable without using stumps. In addition to

[134] Eurostat 2012
[135] From Koopman and Koppejan 1998
[136] http://www.extension.org/pages/26619/corn-cobs-for-biofuel-production

the growth potential in forest residues, there is an estimated 50 TWh potential from increasing the net harvesting of roundwood. For industry by-products such as saw-dust and black liquor, no growth potential has been assumed as almost all of these by-products are already being utilized.

It is feasible to produce biofuels form forest residues, but Hydrogenated Pyrolysis Oils (HPO) produced from lignocellulosic biomass is still in its infancy and needs more research in order to complement to become a commercial viable alternative.

Double counting materials

Used cooking oil

Used Cooking Oils (UCO) are oils and fats that have been used for cooking or frying in the food processing industry, restaurants, snack shops and at a consumer level. UCO can be collected and recycled to be used for other purposes. UCO can originate from both vegetable and animal fats and oils. It is estimated that currently around 90% of cooking oils and fat used in the EU is produced from vegetable oils, whereas in countries such as Belgium relatively much animal fats are used.[137] According to conservative estimates it would be possible to collect around 8 litres of UCO per capita per year.[138] Extrapolated to the total EU population of around 500mln, this would mean that 4mln tonnes of UCO are potentially available annually in the EU, seven times more than the current collected amount. This potential probably increases with around 2% per year, following the annual increase of cooking oil usage in the EU-15.[139] In order to achieve this level of collection, the collection infrastructure in especially central European Member States would have to be improved.[140] In the Netherlands currently around 70% of all potentially available UCO is being collected, mainly from restaurants and snack shops.[141]

In 2011 Ecofys concluded that in 2020 2.3 million tonnes of UCO could be used for biofuel production, taking into account cost restrictions, which lead to the fact that max. 50% of the available UCO will be used for biofuels production.

Animal fats classified as category I and II in accordance with EC/1774/2002 laying down health rules concerning animal by-products not intended for human consumption

Animal Fats are fats from slaughtered animals that are rendered into a variety of products. Animal fats can be general fats and tissues or be rendered from internal organs, bones, heads and to a small extent from hides or skins. Animal fats are part of the wider group of animal by-products (ABPs).

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[137] Interview with with OleoConsult.
[138] BioDieNEt, *'The future of small scale, localised biodiesel production from used cooking oil and its use in higher blends'* (London, 2010), p 18.
[139] BioDieNEt, p 20.
[140] BioDieNEt, p 20.
[141] Elbersen et. al, *'De beschikbaarheid van biomassa voor energie in de agro-industrie'* (Wageningen, 2010).

- Category 1: Animal fats that have a high risk for human health, for example animals suspected of being infected by a TSE[142] or in which the presence of a TSE has been officially confirmed; specified risk material. Fats in this category can be used for energy purposes and are not allowed to enter the human or animal food chains
- Category 2: Animal fats that can be used for soil enhancement and for technical puposes, such as oleochemical products and special chemicals, as well as cosmetics. Examples of this category fats include manure and digestive tract content, (parts of) animals that have died from other causes than by being slaughtered for human consumption, including animals killed to eradicate an epizootic disease

In 2010 the EU produced 3.2mln tonnes of animal fats production, an increase of 3.5% compared to 2009 and equal to the 2008 production level. Looking at the sources of the EU production of animal fats 62% comes from pigs, 34% from bovine[143] and other animals such as sheep and 4% from fish. The largest EU producers of pig fat are Germany, Spain, Poland and Italy. For bovine animals France, United Kingdom, Germany and the Netherlands are the largest producers, while Denmark is the largest fish oil producer in the EU. Animal fat production per animal species remained rather stable during the years 2006-2010. The trends in 2009-2010 shows that 10% more animal fats went to pet food production and biodiesel use grew from 8 to 15%, in total 410.000 ton.

Non-food cellulosic material
Obtaining data and information proved difficult.

Ligno-cellulosic material except saw logs and veneer logs
Obtaining data and information proved difficult.

[142] Transmissible Spongiform Encephalopathy, group of diseases affecting the brain and nervous systems of animals
[143] cattle

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