European Commission

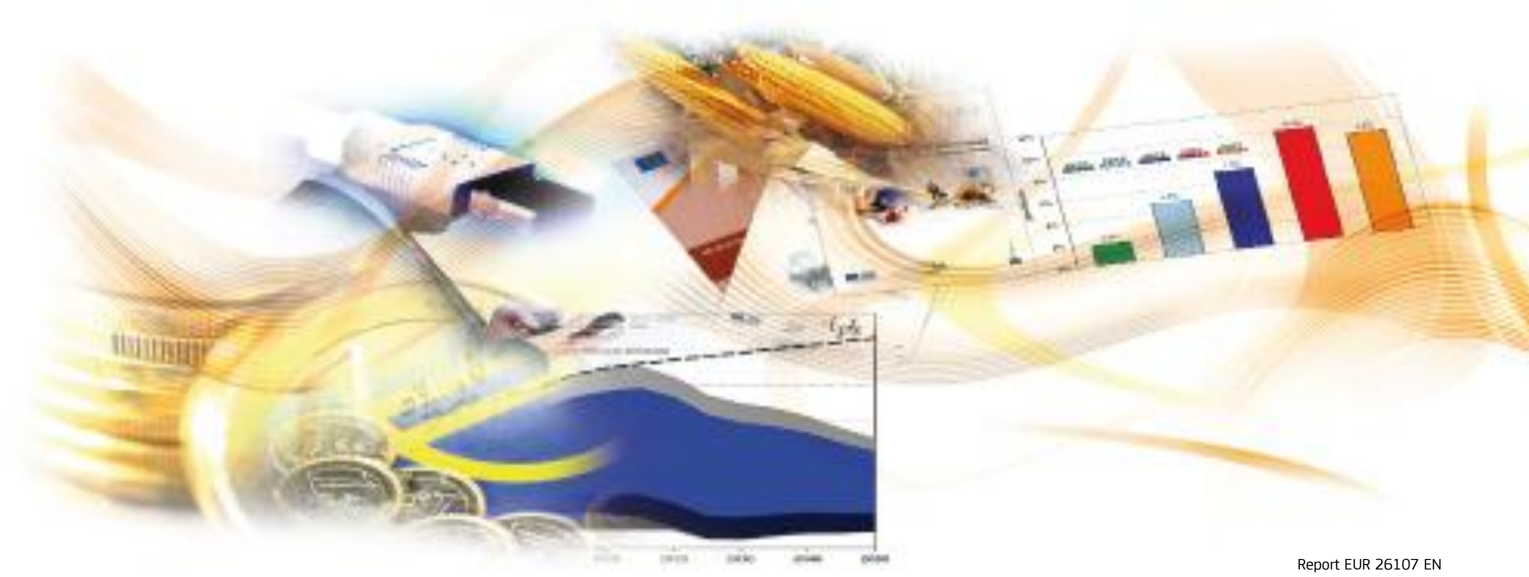
JRC SCIENTIFIC AND POLICY REPORTS

# Impacts of the EU biofuel policy on agricultural markets and land use

## Modelling assessment with AGLINK-COSIMO (2012 version)

Sophie Hélaine
Robert M'barek
Hubertus Gay

2013



Report EUR 26107 EN

Joint Research Centre

European Commission
Joint Research Centre
Institute for Prospective Technological Studies

Contact information
Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: jrc-ipts-agrilife-secretariat@ec.europa.eu
Tel.: +34954488318
Fax: +34954488434

http://ipts.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

This publication is a Scientific and Policy Report by the Joint Research Centre of the European Commission.



JRC83936

EUR 26107 EN

ISBN 978-92-79-32649-3 (pdf)

ISSN 1831-9424 (online)

doi:10.2791/20985

Luxembourg: Publications Office of the European Union, 2013



Printed in Spain

# Acknowledgements

We would like to thank all the JRC IPTS staff who have been successively involved in this work as well as the EC Inter-service Group on biofuels/ILUC for their comments.

We are grateful to Anna Atkinson from the JRC IPTS for the language editing and formatting of the report.

# Contents

# 1. Introduction

The European Union's Renewable Energy Directive (RED)[1] sets an overall target of 20% of the EU's energy used to come from renewable sources by 2020. As part of this target, at least 10% of total transport fuel consumption is to come from renewable energies (RE). In parallel, the Fuel Quality Directive (FQD)[2] requires fuel suppliers to reduce the carbon intensity of road fuels they supply by 6% in 2020. The EU Member States were required to report their expectations and plans on how to meet these targets in National Renewable Energy Action Plans (NREAP) by 30 June 2010, including the technology mix and the trajectory to reach them.

However, in the end the extent to which the 2020 mandate will be met is uncertain. During the 2012 Workshop on 'Commodity Market Development in Europe – Outlook'[3], held in Brussels, many participants highlighted the difficulty to reach such a level of biofuel consumption. In addition, according to the 2012 ECOFYS report on renewable energy progress and biofuels' sustainability, in 2012 the objectives for transport were already not being met. The European car industry is indeed not ready to use blends with high shares of biodiesel and ethanol. Moreover the contribution of second-generation biofuels towards meeting the target is expected to remain small.

Furthermore the repeated droughts in recent years have put pressure on food prices and put forward the world food security debate. The use of food crops to produce biofuels instead of feeding the world has been criticised. Sustainability of biodiesel is especially questioned. In order to reduce the indirect land use change (ILUC) which may be caused by higher demand for food and feed crops for biofuel, on 17 October 2012 the European Commission (EC) published a proposal to amend the RED (COM(2012)595). It proposed to cap the amount of first-generation biofuels that can count towards the 10% renewable energy target at 5%[4]. In addition, the use of advanced biofuels, with no or low ILUC emissions, would be promoted by weighting their contribution towards fulfilling the target more favourably. The estimated ILUC emissions are also included in the greenhouse gas balance of biofuels for the purpose of compliance with the reporting obligations under the RED and FQD.

Therefore the development of the biofuel market is highly uncertain, especially in the European Union (EU). This report aims to analyse different scenarios that could occur in the EU in the years to come. First is an assumed situation in which by 2020 biofuels would contribute 8% towards the RE transport target; other RE in transport such as renewable electricity would have to fill the remaining gap. Secondly the EC's ILUC proposal is analysed. Finally a complete removal of the biofuel policy in the EU is simulated. All scenarios are compared to a situation without any change in policy.

The simulations are run with the AGLINK-COSIMO model, described in Chapter 2. The consequences of these scenarios on the EU biofuel market are analysed in Chapter 3, the impacts on feedstock prices and balances in the EU are presented in Chapter 4, and on world prices in Chapter 5. Chapter 6 presents the main changes in land use worldwide.

---

[1] Directive 2009/28/EC on the promotion of the use of energy from renewable sources.
[2] Directive 2009/30/EC.
[3] The proceedings are available at: http://ftp.jrc.es/EURdoc/JRC76028.pdf
[4] This limit includes also bioliquids from food crops when it is applied towards the overall 20% RED target.

# 2. Model description, baseline and scenarios

### *2.1 The AGLINK-COSIMO model*

AGLINK-COSIMO is a global recursive-dynamic, partial equilibrium, supply-demand model covering the main agricultural products (see OECD, 2006). AGLINK has been developed by the OECD Secretariat[5] in close co-operation with OECD member countries and, thanks to its linkage with FAO's COSIMO model, it incorporates the major non-OECD member countries and other regions of the world. The version of the model used for this paper identifies 52 countries or regions in total and covers all major temperate zone agricultural commodities as well as rice and vegetable oils. Sugar and sweeteners are fully integrated into the model. Biofuels (ethanol and biodiesel) are modelled in most regions but with greater details on policy only for the US, the EU, Brazil and Canada[6]. Prices are cleared domestically and standard trade functions are used to link the domestic markets with the world markets. This mechanism permits imports and exports to be modelled separately while the model remains a net trade one, considering domestically produced and imported commodities as homogenous.

The AGLINK-COSIMO model used to build the 'OECD-FAO Agricultural Outlook 2012-2021' (OECD, 2012) was later modified to build the 'EU Prospects for Agricultural Markets and Income in the EU 2012-2022' (DG AGRI, 2012). In this modified version, cereals and oilseeds are disaggregated in the EU. In addition the biofuel modelling and database were updated as well as the sugar module to better depict the sugar and isoglucose quotas' expiry after the marketing year 2014/2015. The depiction of the land allocation was also modified.

### *2.2 The biofuel market in AGLINK-COSIMO*

In the AGLINK-COSIMO model, the consumption of biofuels is mandate driven. In other words biofuel consumption is modelled so that a specific share of biofuels in transport fuel is reached. The contribution of ethanol or biodiesel towards meeting this target depends on their relative competitiveness towards petrol and diesel prices respectively. In the EC's updated EU module ethanol is used in blends, as an additive to petrol, and other uses like alcohol production are also considered because of the impact on land use.

The domestic production of biofuels depends on the production capacity and on the capacity use rate of the biofuel factories. The use rate is a function of the profitability of biofuel production from the different feedstocks. Given the share of the EU in global biodiesel consumption and the huge quantity of vegetable oils required to produce this biodiesel, the vegetable oil price is very sensitive to the biofuel demand and as a consequence biodiesel can become uncompetitive very fast.

The production of biofuels from waste oils[7] is set exogenously as a share of the biodiesel production from vegetable oils. The contribution of the other second-generation biofuels to the target is also set exogenously. The development of the production of second-generation biofuels is uncertain and consists mainly of biodiesel from waste oils; the figures in this exercise rely on the knowledge available in September 2012. Evidence of possible higher production has been identified by the Directorate-General for Energy

[5] The results of any analysis based on the use of the AGLINK-COSIMO model by parties outside the OECD are outside the responsibility of the OECD Secretariat. Conclusions derived by third party users of AGLINK-COSIMO should not be attributed to the OECD or its member governments.

[6] OECD (2008) gives more details on the modelling of biofuels in AGLINK-COSIMO, however in 2012 the method for modelling the US biofuel policy was significantly modified.

[7] Biofuels are produced from used cooking oil and animal fats. These feedstocks will hereafter be referred to as 'waste oils'.

based on information of actual production figures and capacities: the contribution of biofuels which qualify for double counting (i.e. mainly waste oils) would currently be already 1.4% if they were actually all double counted whereas in the baseline, double counted biofuels are only assumed to contribute 0.7% in 2012. Nevertheless, the contribution of these types of biofuels towards meeting the target will remain small. Furthermore, in this simulation all the biodiesel issued from waste oils is accounted for at twice its energy content towards meeting the target despite some Member States not applying the double counting for this biodiesel. Finally, it is assumed that second-generation biofuels do not have any land use implications, although this is not the case for those derived from energy crops.

Ethanol imports in the EU consist of undenatured ethanol which is subject to a specific tariff of €19.2/hl and biodiesel imports face an applied tariff of 6.5%. Imports depend on the price relationship between the EU price and the world prices plus tariffs.

Renewable electricity and other biofuels of minor importance in the EU market such as biomethane and pure plant oil fuels are not covered by this assessment.

### *2.3 The baseline*

For the purpose of this analysis, a baseline and counterfactual scenarios have been developed.

The **baseline (BASE**) assumes the continuation of existing policy measures for the period 2012-2022. In particular, sugar and isoglucose quotas expire after the marketing year 2014/2015. Macroeconomic assumptions on economic growth, exchange rate developments, population growth and world crude oil prices are set out in DG AGRI (2012).

Table 2.1 summarises the assumptions on EU biofuel policies and the most relevant macroeconomic assumptions for this analysis. The consumption projections of diesel and petrol originate from a recent baseline developed at the JRC-IPTS with the POLES model. The taxes on fuels are based on the German rates.

The yield projections are presented in Annex 1 and are based on the OECD-FAO Agricultural outlook 2012-2021 for the non-EU countries and on the Prospects for Agricultural Markets and Income in the EU 2012-2022 (DG AGRI, 2012) for the EU. The magnitude of the changes in land use depends significantly on these yield assumptions.

**Table 2.1: BASE assumptions**

| | 2010 | 2012 | 2014 | 2016 | 2018 | 2020 |
|---|---|---|---|---|---|---|
| **Transport fuel consumption in million t.o.e.** | | | | | | |
| Diesel | 201.5 | 203.7 | 206.9 | 210.5 | 215.4 | 218.5 |
| Gasoline | 96.6 | 93.7 | 91.8 | 90.2 | 89.6 | 88.5 |
| Total fuel | 298.1 | 297.4 | 298.6 | 300.7 | 305.0 | 307.1 |
| | | | | | | |
| **Crude oil price in USD/barrel** | | | | | | |
| Oil price | 79.5 | 108.4 | 90.0 | 90.0 | 98.0 | 105.0 |

The baseline is based on a specific set of assumptions regarding the future economic, market and policy environment. In addition, the baseline assumes normal weather conditions, steady yield trends and no disruptions caused by factors like e.g. food safety issues. In this analysis, the impact of different assumptions regarding in particular the biofuel policy in other regions, the oil price, total fuel consumption or yield developments is not quantified. For example, in a context of higher oil prices biofuels would be more competitive than in this analysis. With higher (lower) yields, potential land use changes could be smaller (higher). These uncertainties are to be kept in mind while reading the analysis.

In the baseline scenario it is assumed that with biofuels alone Member States would achieve 10% renewable energy in transport by 2020. With the additional use of renewable electricity (which represents 1.4% of the target in NREAPs) Member States would achieve more than the mandatory 10% renewable energy in transport. The development of biofuel use in the EU by 2020 is based on expert advice and on the projections reported in the NREAPs (Beurksens and Hekkenberg, 2010) (see Table 2.2).

It is to be noted that in Europe, the biodiesel production capacity is already well-developed and under-used (ECOFYS, 2012). The current rate of use of the ethanol processing capacity is higher at around 60% (ECOFYS, 2012).

By 2020, the share of biodiesel in biofuel consumption is 62%. It is not as high as could be expected based on the information provided in the NREAP's and compared with the impact assessment because of a technical constraint: very few cars can use blends with more than 10% biodiesel and, as stated in the ECOFYS 2012 report, the car industry and governments have lost their interest in higher blends of biodiesel. For example, the German government is gradually reducing the tax advantage for pure biodiesel. In addition biodiesel profitability is rapidly at risk depending on the prices of crude oil and vegetable oils; given the share of vegetable oils used for biofuels, any increase in demand for biodiesel production translates in a rapid increase in vegetable oil price. The same report quoted above mentions several cases of biodiesel processors' bankruptcy. Furthermore the sustainability of biodiesel feedstocks is particularly questioned.

In this baseline, the share of ethanol is therefore assumed to be quite high and the E15 blend (fuel mixture of 15% ethanol) wall[8] is reached: the volume share of ethanol in petrol is 18.3% by 2020 (see the full biofuel balance sheet in Annex 2). As a consequence this base scenario implies that more cars would be adapted to be able to use E15 blends and that flexible-fuel cars which can use E85 (fuel mixture of 85% ethanol) would spread beyond Sweden and France where they are currently mostly found. Despite ECOFYS (2012) reports that more and more car makers produce flexible-fuel cars, reaching such a level of ethanol use by 2020 is not very likely. It is therefore more appropriate to consider this base scenario as a basis for comparing the counterfactual scenarios.

[8] Blend walls are not explicitly modelled as a technical constraint.

**Table 2.2: Projected development of biofuel use in the EU in the BASE**

| | 2010 | 2012 | 2014 | 2016 | 2018 | 2020 |
|---|---|---|---|---|---|---|
| **Energy shares in total transport fuel (in %)** | | | | | | |
| 1st-generation | 4.1 | 4.0 | 4.9 | 6.1 | 7.4 | 8.5 |
| From waste oils | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 |
| Other 2nd-gen. | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| | | | | | | |
| Ethanol/biodiesel* | 21/79 | 22/78 | 27/73 | 31/69 | 34/66 | 38/62 |
| | | | | | | |
| **Total Biofuel (in % RED counting)** | **4.6** | **4.7** | **5.8** | **7.2** | **8.7** | **10.0** |

*share in biofuel consumption

### *2.4 The scenarios*

The **Counterfactual Scenarios** are described below:

**SC1 – 8% biofuels** assumes that by 2020 only 8% of transport fuel comes from biofuels (applying the RED counting, i.e. the double counting of second-generation biofuels). In this scenario, it is assumed that the use of renewable electricity would help reaching the 10% renewable energy in transport target. Given the difficulties outlined above in reaching the biofuels shares assumed in the baseline, this scenario may seem more realistic than the base. This is also the central scenario in the 'Prospects for Agricultural Markets and Income in the EU 2012-2022' (DG AGRI, 2012).

**SC2 – EC's proposal** assumes that the Directive proposed by the EC in October 2012 is implemented from 2013:

- The share of first-generation is set at a 5% maximum.
- For the calculation of the target fulfilment, the share of biodiesel produced from waste oils is calculated as double its energy content (as currently) but the share of the other second-generation biofuels is weighted by a factor of four.

**SC3 – No policy** simulates the absence of any domestic EU policies on biofuels:

- There is no blending obligation in the EU for ethanol and biodiesel and thus the demand for each type of biofuel is regulated only through the market mechanism.
- The tax rebates for the consumption of both ethanol and biodiesel are eliminated. The biodiesel tax is set to the same level as the diesel tax and the ethanol tax to the level of the gasoline tax (times the energy content). In the baseline and the other scenarios the tax rebates account for about 30 EUR/hl.

# 3. Effects on the biofuel market

### *3.1 Lower ethanol use if only 8% of transport fuel originates from biofuels (in % RED counting)*

Assuming Member States were to reach an 8% share of biofuels in transport fuel by 2020, it would correspond to a 7.2% share of biofuels in real energy terms of fuel use without double counting of second-generation biofuels, i.e. 2 percentage points less than in the base (see Table 3.1). The share of second-generation is assumed to be unchanged at 0.8%[9]. The energy share of biodiesel in diesel use is only 0.8 points lower than in the base whereas the share of ethanol in petrol use, at 7.8%, is 4.4 points lower than in the base.

The 8% biofuels scenario with a share in volume of 11.7% ethanol in petrol requires less adaptation of the European car fleet and fuel infrastructure. In addition, while in the base close to 50% of the ethanol used is imported; if only 8% of transport fuel originates from biofuels ethanol imports could be reduced significantly (the full balance sheet is available in Annex 2).

**Table 3.1 EU-27 biofuels energy shares, 2020 (%)**

| | BASE | 8% biofuels | EC's proposal | No policy |
|---|---|---|---|---|
| Biofuels (in fuel use) | 9.2 | 7.2 | 6.1 | 2.0 |
| 1st-generation | 8.5 | 6.3 | 5.0 | 1.9 |
| based on waste oil | 0.7 | 0.7 | 0.9 | 0.1 |
| other 2nd-generation | 0.1 | 0.1 | 0.2 | 0.0 |
| Ethanol (in petrol use) | 12.2 | 7.8 | 5.7 | 3.2 |
| Biodiesel (in diesel use) | 8.0 | 7.2 | 6.2 | 1.5 |
| Biofuels in fuel use (% RED accounting) | 10.0 | 8.0 | 7.5 | 2.1 |

Notes: According to the current RED accounting methodology, the energy content of biofuels other than first-generation biofuels counts twice towards meeting the target. In the Commission's proposal, second-generation biofuels other than those using waste oils will be counted four times.
The share of renewable electricity (which represents 1.4% of the target in NREAPs) is to be added to the share of biofuels to get the total share of renewable energy in transport.

The adjustment to the 33% lower use of ethanol takes place mainly via lower imports which are 59% below the base level (see Figure 3.1). In addition the production is 8% lower as well as the ethanol producer price, at 13% below the base.

The domestic production is significantly lower than the base (-12%). The imports are 27% below the base level but, with 2.4 million t.o.e. in the base, they are not very significant. Biodiesel consumption is 14% inferior to the base. As for ethanol, the producer price is 13% lower than in the base.

### *3.2 With the EC's proposal, 7.5% biofuels in transport*

If the European Commission proposal was to be implemented, a 5% maximum of the first-generation biofuels could be counted towards the 10% renewable energy target. This is why in this scenario the first-generation biofuel share in fuel is set at 5%, although MS could overshoot the 5% in real energy terms the same way they expect to overshoot the 10% target in their NREAPs. The use of advanced biofuels is promoted by a favourable weighting: the biodiesel produced from waste oils continues to be accounted for at twice its energy content but the other second-generation biofuels are weighted by a factor of four.

In this scenario, by 2020 the total energy share of second-generation in fuel use is 1.1% (see Table 3.1). This is only 0.3 percentage points above the base. In this simulation, industrial investments and innovation are assumed insufficient for a second-generation production significantly higher than in the base despite the additional incentives which the ILUC proposal would establish for the use of these biofuels. In total, the biofuels' share in real energy terms of fuel use is 6.1% in 2020. In the end it corresponds to 7.5% biofuels in transport applying the RED counting. The use of renewable electricity could

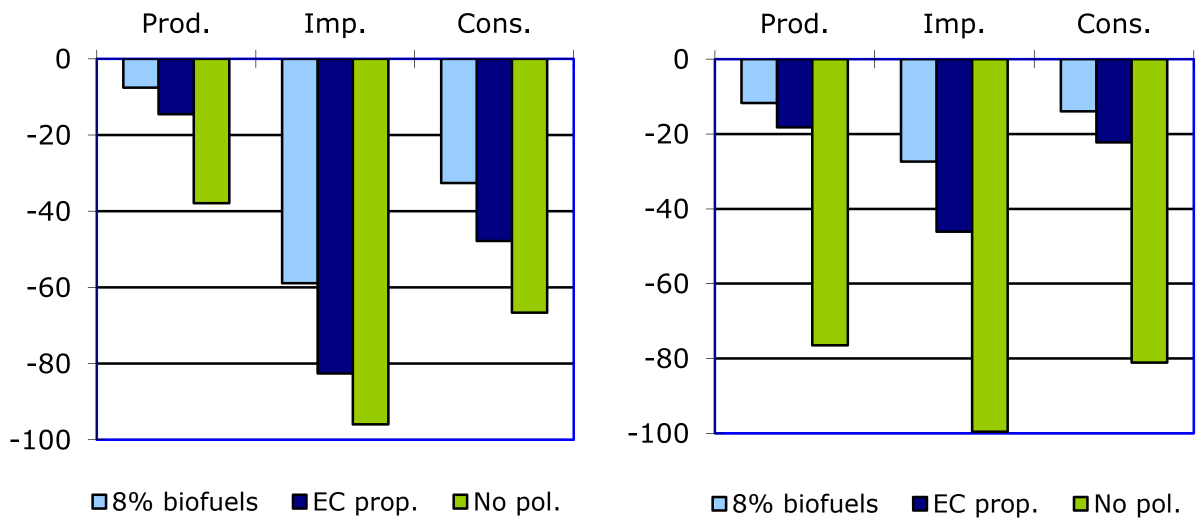
[9] As mentioned already in Chapter 2.2, the development of second-generation biofuels could be faster than assumed in the baseline leading to a higher share of biofuels in transport fuel.

help getting close to reaching the 10% renewable energy in transport target. In addition second-generation biofuels could develop faster than assumed in this analysis.

Except for the slight increase in use of second-generation biofuel, this scenario is close to the previous one, 8% biofuels, but with lower obligations in first-generation biofuel use. Therefore the consequences on the biofuel market are quite similar but with a wider magnitude: producer prices of biodiesel and ethanol are 23% below the base level, biodiesel consumption is 22% below and the production is 18% lower (see Figure 3.1). To reach that level of production the necessary capacity of production is already in place. The ethanol use is 48% below the base, allowing for significantly lower imports (-83%) and a 14% lower domestic production than in the 2020 base. In this scenario the share in volume of ethanol in petrol is 8.6%. Such blend levels (up to 10%) can be used in the current car fleet.

**Figure 3.1 Change in EU biofuel market in comparison to base in 2020 (%)**

**Ethanol** **Biodiesel**




### *3.3 A very low biofuel production if no biofuel policy*

In absence of a RE target for transport, the demand for biodiesel and the producer price would decrease drastically with levels 81% and 64% below the base in 2020 respectively. At this price level the incentive to produce biodiesel from waste oils and other second-generation biofuels is very low. The energy share of biodiesel in diesel use is very small at 1.5%; i.e. 3.4 points below the 2012 level, before the simulated removal of the biofuel policy (see Table 3.1).

For ethanol, in 2020 the use is 67% below the baseline level at 3.9 million t.o.e.. Even without any renewable energy target for transport, a certain level of ethanol consumption would remain because of the lower producer price (37% below the base in 2020). In addition the use of ethanol for alcohol production increases. Moreover the use as an additive to petrol blends is assumed to remain at the 2012 level over the projection period. Finally just after the simulated removal of the tax rebate in 2013, the ethanol consumer price loses competitiveness against petrol but after a few years of the ethanol producer price decreasing and the petrol price increasing ethanol progressively regains competitiveness. In the end in this scenario, the ethanol production is 38% below the base level while imports are almost zero.

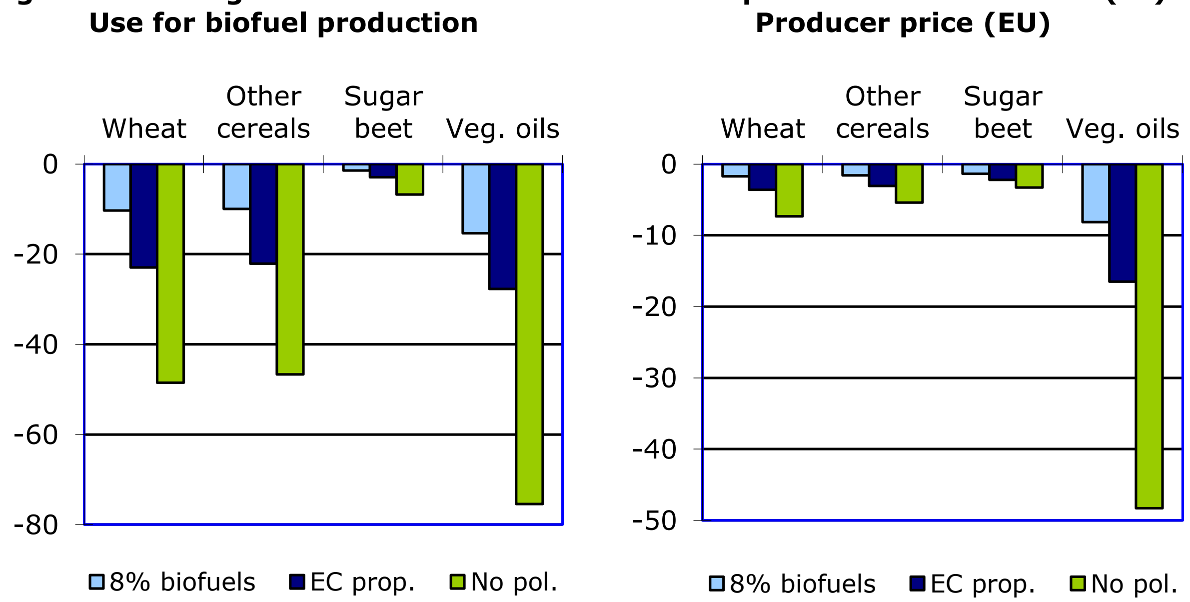
# 4. Effects on feedstock prices and EU commodity balances

### *4.1 Less cereals and vegetable oils used for biofuel production*

In the three scenarios, the decrease in ethanol production translates into a lower use of cereals for biofuel production: around -10% in the first scenario, -25% with the EC's proposal and close to -50% without any biofuel policy (see Figure 4.1). The resulting decrease in EU cereal producer prices is fairly small in all the scenarios because in the base only 6% of the wheat and 8% of the other cereals are used for biofuel production. EU cereal prices are 2% below the base in 2020 in the first scenario and 4% for wheat, 3% for maize and 2% for barley in the second scenario. If no biofuel policy applies, the wheat price could be 7% lower in comparison to the base in 2020, the maize price by 6% and the barley price by 4%.

By contrast, the use of sugar beet remains almost unchanged, even in the third scenario. Industrial plants dedicated to ethanol production from sugar beet have little possibility of switching production, thus at maximum, in the third scenario, the use of sugar beet for ethanol production is 7% below the base level.

**Figure 4.1 Change in EU feedstocks market in comparison to base in 2020 (%)**




Given that more than half of the vegetable oils are used for biodiesel production in the base in 2020, any decrease in biodiesel production strongly affects the vegetable oil market. Biodiesel is mainly produced from rapeseed oil (up to 83% in the base). In the event of only 8% of biofuels in transport fuel the use of vegetable oils for biofuels would be 15% lower the base level. With the EC's proposal, this use could be 28% below the base. Finally, if there is no policy the decrease in vegetable oils use for biodiesel could reach 75% in comparison to the base in 2020. As a consequence, the EU price for vegetable oils could be below the base level by 8%, 17% and 48% in scenarios one, two and three respectively[10]. The no policy scenario would lead to a very significant decrease in vegetable oil price because of the strong reduction in total demand for vegetable oil

[10] The price reaction of vegetable oils in the EU might be over-stated because of imperfect price transmission in the model.

(up to 31%) and especially for rapeseed oil (-51%). The 16% increase in food use of vegetable oils induced by the price drop is not enough to compensate for the reduction in biodiesel production. It should be noted that the world price decrease of vegetable oil with less than 15% is significantly lower than in Europe (see chapter 6).

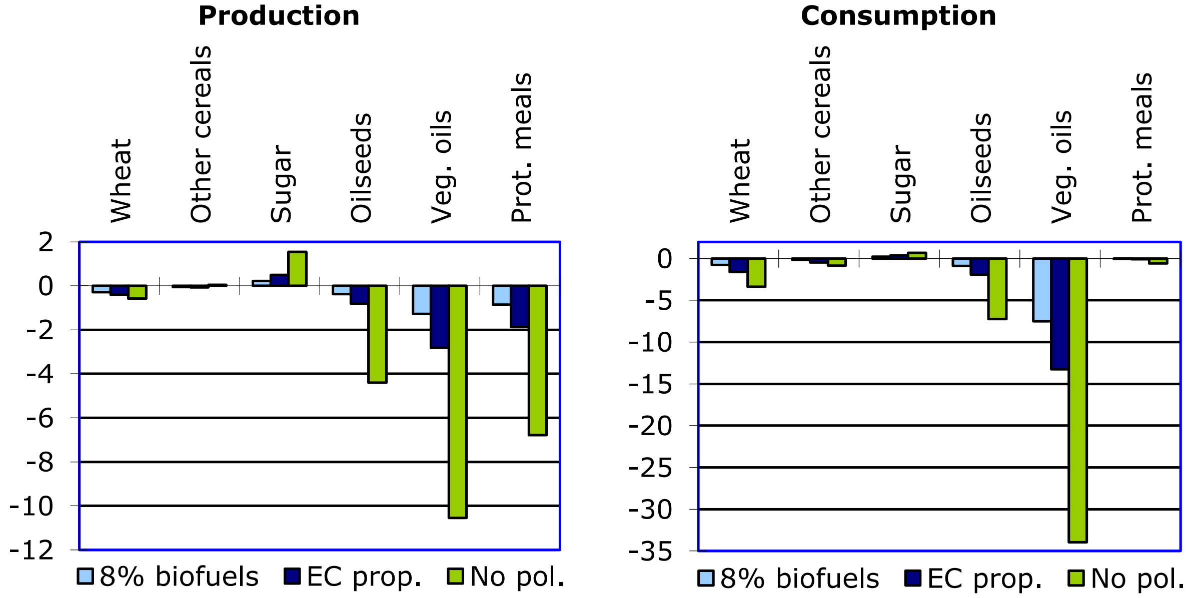
### *4.2 Mainly oilseeds, oils and meals production affected*

The production and total consumption of coarse grains remain unchanged in all scenarios (see Figure 4.2) because the fall in the use of cereals for biofuel production and the corresponding decrease in the production of dried distillers' grains (ranging between about 10% lower for the first scenario and nearly 50% lower for the third scenario) imply an increase in the feed use of coarse grains and lower imports (see Figure 4.3).

Moreover, the feed use of wheat decreases slightly (to 2% in the third scenario) leading to a lower total consumption of wheat given the food use remains unchanged. Exports are higher than in the base by 3%, 8% and 19% in the first, second and third scenarios respectively driven by higher wheat competitiveness on the world market. Wheat production is little affected, at most it is 840 000 tonnes below the base level in 2020 when the biofuel policy is removed.

Because less sugar beet is required for ethanol production, domestic production of sugar increases and the trade position of the EU improves, especially in the third scenario.

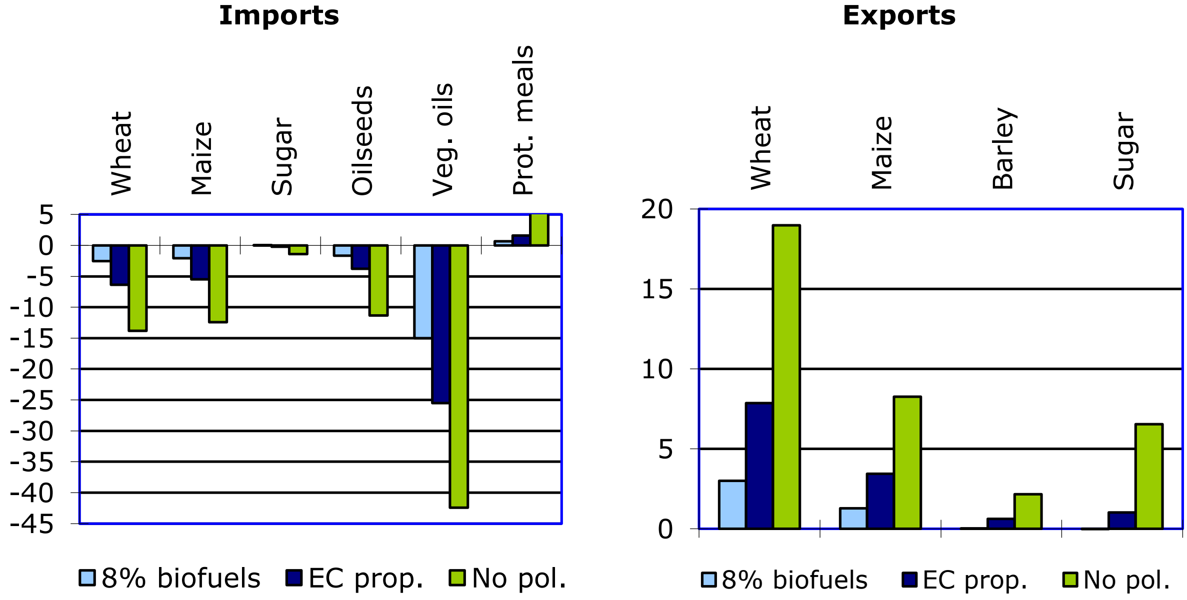
**Figure 4.2 Change in feedstock production and consumption in comparison to base in 2020 (%)**




The reduction in biodiesel production implies an increase in the food use of vegetable oils by around 2% in the first scenario, 4% in the second scenario and 16% in the third scenario in comparison to the base in 2020. As a result the decrease in total consumption of vegetable oils ranges between 8% if biofuels represent 8% of transport fuels and 34% if no biofuel policy applies (see Figure 4.2).

Smaller oilseeds' domestic production (at 4% in the no biofuel policy scenario) and imports (ranging between 2% and 11% depending on the scenario) lead to a decrease in oilseed crushing and consequently a decline in protein meal production (to 7% in the third scenario) and higher meal prices. Despite the increase in protein meal prices, ranging between 2% and 13% according to the scenario, the feed use remains unchanged and imports are higher than in the base.

**Figure 4.3 Change in feedstock trade in comparison to base in 2020 (%)**




### *4.3 Feed costs prices only slightly affected*

In the first and second scenarios feed costs are slightly below the base (ranging between 0.5% and 2% lower) in 2020 both in the EU-15 and EU-N12 given the decrease in cereal prices. However if no biofuel policy applies, feed costs could be 1% above the base for ruminants in the EU-15 given the increase in protein meal prices.

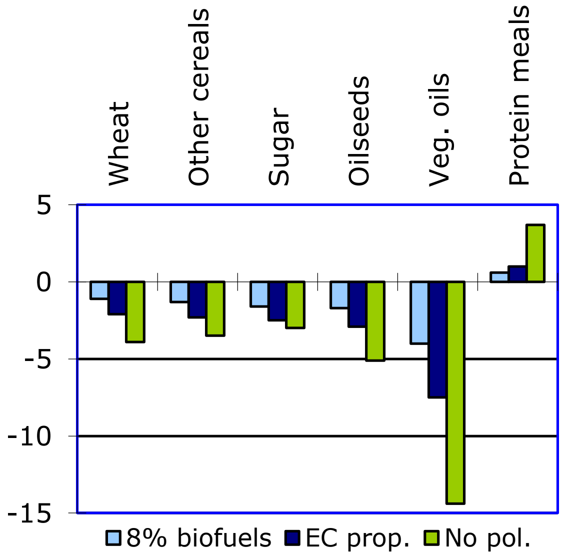
Nevertheless, the meat and dairy sectors are not significantly affected by the change in biofuel policy except butter. The fall in the use of vegetable oils for biodiesel production and the implied decrease in producer prices lead to a higher food use of vegetable oils and a decrease in the food use and producer price of butter (3% and 8% respectively in the third scenario). Thus butter exports are higher than in the base in 2020 (by 15% if no biofuel policy applies).

# 5. Effects on World prices

The impact on world prices is particularly significant for vegetable oils given that in the third scenario (no biofuel policy in the EU) the world price is 15% below the base. Otherwise, the other feedstock prices are at most 5% below the base in the third scenario. If in the EU only 8% of transport fuel were to originate from biofuels or if the EC's proposal was to be implemented, except for vegetable oils, world prices would not be significantly lower and would stand at most 3% below the base (see Figure 5.1).

The world price decrease of vegetable oil is significantly lower than in Europe because at world level only 17% of vegetable oils are used to produce biofuels. In addition the reported world vegetable oils price is a production weighted average of rapeseed oil, soy oil, sunflower oil and palm oil. Rapeseed oil represents much less of the total vegetable oils (around 15%) than in the EU. By contrast palm oil and soy oil constitute close to 60% of the total. Therefore the world price is strongly driven by the food use of these two oils.

**Figure 5.1 Change in world feedstock prices in comparison to base in 2020 (%)**




# 6. Effects on land use in Europe and in the rest of the World

If no biofuel policy was in place from 2013 in the EU, close to 6 million hectares (0.7% of world total) less cereals, oilseeds, sugar crops and palm oil would be harvested in the world in 2020 in comparison to the base (see

Table 6.1). If the EC's proposal was implemented 2.7 million hectares less could be harvested and 8% biofuels in transport fuels instead of 10% (RED counting) would lead to 1.8 million hectares less being harvested.

Focusing on the no policy scenario, half of the reduction in harvested area would come from oilseeds, 25% from cereals, 16% from palm oil and 8% from sugar beet and sugar cane (see Figure 6.1). For palm oil two countries are principally concerned; Indonesia and Malaysia.

Given that without any biofuel policy the EU-27 can export more wheat and needs less maize imports, it appears that Africa would harvest 0.8 million hectares less cereals. In Canada, the removal of the policy would lead to a decrease in oilseed area which would not be entirely compensated by a higher wheat area.

A change in policy would affect Brazil, where less sugar cane and oilseeds would be harvested, and Argentina, where oilseed area would decrease the most. Without any biofuel policy, in the EU-27, the oilseed area would decrease by close to 3%, the slight increase in cereal area would not compensate for that fall and the harvested area of cereals, oilseeds and sugar beet would be 0.4% below the base level.

The details by country of the changes in area harvested for cereals and oilseeds are displayed in Table 6.2 and Table 6.3.

Table 6.4 illustrates the change in feedstock use, i.e. the lower use for biofuel production, the increase in food and feed use as well as the net effect. For sugar cane the higher demand for food and feed is very small in comparison to the decrease in biofuel use. By contrast the other crops are largely redirected towards non-biofuel uses.

The results of this updated exercise compare very well with the results of the JRC 2010 report. In the latter, the estimated reduction in area harvested in 2020 amounted to 5.2 million hectares but palm oil was not accounted for. Without the change in area harvested for palm oil, the reduction in the harvested area is estimated at 5.0 million hectares in this simulation.

**Table 6.1 Impact of the biofuel policy on the harvested area of cereals, oilseeds, sugar crops and palm oil in the world in 2020**

| | | BASE million ha | 8% biofuels | EC's proposal | No policy |
|---|---|---|---|---|---|
| **EU-27** | | **70.0** | **-0.1%** | **-0.1%** | **-0.4%** |
| Russia and Ukraine | | 78.5 | -0.1% | -0.1% | -0.3% |
| Canada and US | | 119.9 | -0.1% | -0.1% | -0.3% |
| Brazil | | 59.7 | -0.6% | -0.9% | -1.6% |
| Argentina | | 34.1 | -0.4% | -0.6% | -1.6% |
| China | | 89.8 | 0.0% | 0.0% | -0.1% |
| Indonesia and Malaysia | | 16.1 | -1.1% | -1.7% | -4.5% |
| Other Asia | | 176.1 | -0.1% | -0.2% | -0.5% |
| Africa | | 128.0 | -0.3% | -0.4% | -1.0% |
| Rest of the World | | 77.9 | -0.3% | -0.5% | -0.6% |
| **WORLD** | % | | -0.2% | -0.3% | -0.7% |
| | **million ha** | **850.0** | **-1.8** | **-2.7** | **-5.9** |

**Figure 6.1 Distribution of the 5.9 million hectares reduction in area harvested by crops without any biofuels policy**

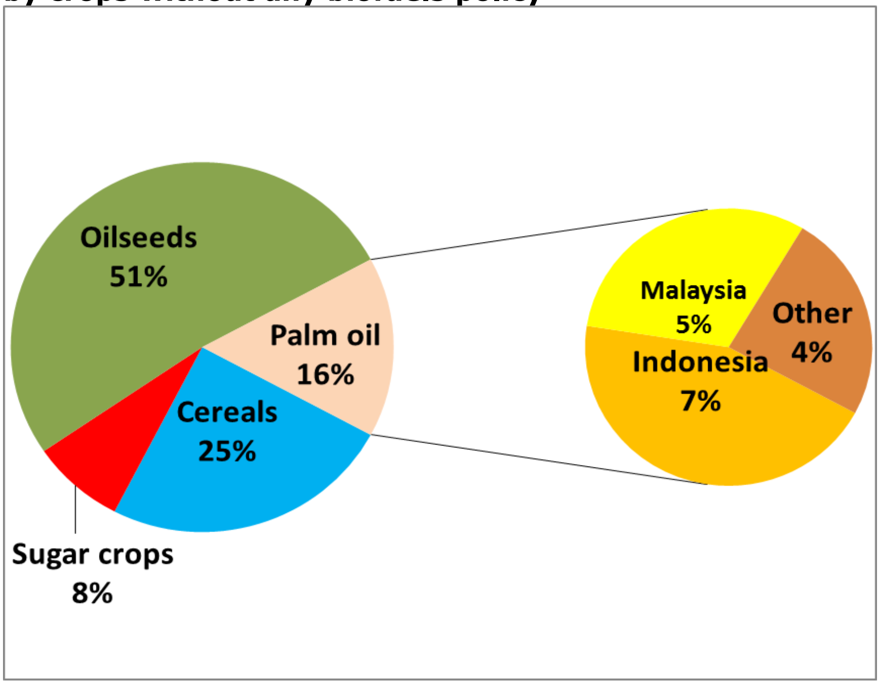


**Table 6.2 Impact of the biofuel policy on the harvested area of cereals in 2020**

| | | BASE million ha | 8% biofuels | EC's proposal | No policy |
|---|---|---|---|---|---|
| **EU-27** | | **56.5** | **-0.1%** | **-0.1%** | **0.1%** |
| Russia and Ukraine | | 60.0 | 0.0% | 0.1% | 0.2% |
| Canada | | 16.1 | 0.1% | 0.2% | 0.7% |
| US | | 55.5 | 0.0% | 0.0% | 0.1% |
| Brazil | | 17.2 | -0.2% | -0.3% | -0.5% |
| Argentina | | 11.0 | 0.1% | 0.2% | 0.5% |
| China | | 60.6 | 0.0% | 0.1% | 0.2% |
| Other Asia | | 120.3 | -0.1% | -0.2% | -0.5% |
| North Africa | | 12.5 | -0.4% | -0.5% | -1.2% |
| Other Africa | | 91.9 | -0.3% | -0.4% | -0.7% |
| Rest of the World | | 64.8 | -0.2% | -0.1% | -0.4% |
| **WORLD** | % | | -0.1% | -0.2% | -0.3% |
| | **million ha** | **566.3** | **-0.7** | **-0.9** | **-1.5** |

**Table 6.3 Impact of the biofuel policy on the harvested area of oilseeds in 2020**

| | | BASE million ha | 8% biofuels | EC's proposal | No policy |
|---|---|---|---|---|---|
| **EU-27** | | **11.9** | **-0.2%** | **-0.4%** | **-2.8%** |
| Russia and Ukraine | | 17.1 | -0.5% | -0.9% | -2.1% |
| Canada | | 9.5 | -0.8% | -1.4% | -3.5% |
| US | | 38.0 | 0.0% | -0.1% | -0.5% |
| Brazil | | 30.3 | -0.2% | -0.5% | -1.5% |
| Argentina | | 22.7 | -0.6% | -1.0% | -2.7% |
| China | | 27.0 | -0.2% | -0.3% | -0.7% |
| Other Asia | | 51.8 | -0.1% | -0.2% | -0.5% |
| Africa | | 16.9 | -0.2% | -0.4% | -0.9% |
| Rest of the World | | 12.6 | -0.4% | -0.7% | -1.6% |
| **WORLD** | % | | -0.3% | -0.5% | -1.3% |
| | **million ha** | **237.8** | **-0.6** | **-1.1** | **-3.0** |

**Table 6.4 Change in feedstock use in 2020 in million tonnes**

| | | BASE | 8% biofuels | EC's proposal | No policy |
|---|---|---|---|---|---|
| | | | Change | | |
| Wheat | Biofuel use | **11.2** | **-0.9** | **9.2** | **-4.0** |
| | Other use | 736.8 | 0.3 | 0.6 | 1.8 |
| | Total use | 748.0 | -0.6 | 9.9 | -2.2 |
| Other cereals | Biofuel use | 179.1 | -4.3 | -6.8 | -9.9 |
| | Other use | 1158.2 | 2.5 | 4.3 | 7.1 |
| | Total use | 1337.2 | -1.8 | -2.5 | -2.8 |
| Sugar beet | Biofuel use | 16.9 | -0.2 | -0.5 | -1.1 |
| | Other use | 253.7 | -0.1 | 0.1 | 1.2 |
| | Total use | 270.6 | -0.4 | -0.4 | 0.0 |
| Sugar cane | Biofuel use | 653.5 | -29.9 | -40.1 | -50.1 |
| | Other use | 1392.8 | 4.3 | 7.4 | 6.2 |
| | Total use | 2046.3 | -25.6 | -32.7 | -43.9 |
| Vegetable oils | Biofuel use | 29.7 | -3.0 | -5.2 | -13.5 |
| | Other use | 150.1 | 1.2 | 2.3 | 5.6 |
| | Total use | 179.8 | -1.8 | -2.9 | -7.9 |

# References


Atlass consortium (2011): Assessing the land use change consequences of European biofuel policies. Available from http://trade.ec.europa.eu/doclib/docs/2011/october/tradoc_148289.pdf

Beurksens, L. W. M. and M. Hekkenberg (2010): Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States, Database. ECN-E-10-069, Energy research Centre of the Netherlands (ECN) and European Environment Agency. Available from http://www.ecn.nl/nreap

DG AGRI (2012). Prospects for Agricultural Markets and Income in the EU 2012-2022. Directorate-General for Agriculture and Rural Development, European Commission (Brussels).

ECOFYS, Fraunhofer, Becker Büttner Held, Energy Economics Group, Winrock International (2012): renewable energy progress and biofuels sustainability. Report for the European Commission. Submission September 2012. Tender number: ENER/C1/463-2011-Lot2. Available from http://ec.europa.eu/energy/renewables/reports/doc/2013_renewable_energy_progress.pdf

European Commission: Commission staff working document, Impact assessment accompanying the document Proposal for a directive of the European Parliament and of the Council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Available from http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/swd_2012_0343_ia_en.pdf

JRC-IPTS (2010): Impacts of the EU biofuel target on agricultural markets and land use: a comparative modelling assessment. JRC Reference Report. Institute for Prospective Technological Studies, Joint Research Centre, European Commission.

OECD and FAO (2012). OECD-FAO agricultural outlook 2012-2020. Organisation for Economic Cooperation and Development (OECD), Paris and Food and Agricultural Organisation of the United Nations (Rome).

OECD (2008). Biofuel Support Policies, an economic assessment. Organisation for Economic Cooperation and Development (OECD).

OECD (2006). Documentation of the AGLINK-COSIMO model. Organisation for Economic Cooperation and Development (OECD).

# Annex 1

Yields in 2020 in t/ha in the base scenario

| | Wheat | Coarse grains | Total oilseeds | Sugar Beet | Sugar Cane | Palm oil |
|---|---|---|---|---|---|---|
| EU-27 | 5.5 | 5.3 | 2.8 | 75.1 | | |
| Brazil | 2.9 | 4.6 | 3.1 | | 79.8 | |
| Argentina | 3.0 | 6.3 | 3.0 | | 86.0 | |
| Canada | 2.9 | 4.7 | 2.2 | 63.2 | | |
| United States | 3.2 | 10.8 | 2.9 | 60.1 | 76.2 | |
| Indonesia | | 4.8 | 1.7 | | 60.9 | 5.2 |
| Malaysia | | 4.1 | 4.7 | | 19.2 | 5.3 |
| Nigeria | 1.7 | 1.4 | 1.0 | | 20.5 | 0.3 |

# Annex 2

## Biofuels balance sheet in the EU, 2009-2020 (million tonnes oil equivalent)

### BASE scenario

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Usable production** | **10.6** | **11.5** | **11.6** | **11.8** | **12.9** | **13.6** | **14.6** | **15.8** | **17.3** | **18.5** | **19.5** | **21.2** |
| Ethanol | 2.8 | 3.2 | 3.3 | 3.4 | 3.6 | 3.7 | 3.9 | 4.2 | 4.6 | 5.0 | 5.5 | 6.1 |
| *based on wheat* | *0.7* | *1.0* | *0.9* | *0.8* | *0.9* | *0.9* | *1.0* | *1.0* | *1.2* | *1.3* | *1.5* | *1.6* |
| *based on other cer.* | *0.8* | *0.9* | *1.0* | *1.3* | *1.3* | *1.4* | *1.5* | *1.7* | *1.9* | *2.1* | *2.5* | *2.8* |
| *based on sugar beet* | *0.7* | *0.7* | *0.7* | *0.7* | *0.7* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* | *0.9* |
| *2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.2* |
| Biodiesel | 7.8 | 8.4 | 8.3 | 8.3 | 9.4 | 9.8 | 10.7 | 11.6 | 12.7 | 13.6 | 13.9 | 15.1 |
| *based on veg. oils* | *7.2* | *7.6* | *7.5* | *7.4* | *8.2* | *8.6* | *9.3* | *10.1* | *11.0* | *11.8* | *11.9* | *12.9* |
| *based on waste oils* | *0.5* | *0.8* | *0.8* | *0.9* | *1.1* | *1.2* | *1.3* | *1.4* | *1.6* | *1.7* | *1.9* | *2.1* |
| *other 2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* |
| | | | | | | | | | | | | |
| **Consumption** | **13.0** | **14.0** | **14.7** | **14.4** | **15.3** | **17.0** | **19.0** | **21.0** | **23.4** | **25.5** | **26.9** | **29.2** |
| Ethanol | 3.6 | 3.9 | 4.1 | 4.4 | 4.5 | 5.5 | 6.3 | 7.3 | 8.4 | 9.5 | 10.7 | 11.8 |
| **Ethanol for fuel** | **2.3** | **2.7** | **3.0** | **2.9** | **3.4** | **4.3** | **5.2** | **6.1** | **7.3** | **8.4** | **9.5** | **10.6** |
| Non-fuel use of Ethanol | 1.3 | 1.1 | 1.1 | 1.6 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| **Biodiesel** | **9.4** | **10.1** | **10.6** | **9.9** | **10.8** | **11.6** | **12.7** | **13.7** | **15.0** | **16.0** | **16.3** | **17.4** |
| **Consumption for fuel** | **11.7** | **12.8** | **13.6** | **12.8** | **14.2** | **15.9** | **17.8** | **19.9** | **22.3** | **24.4** | **25.8** | **28.0** |
| Share of Ethanol (%) | 19 | 21 | 22 | 22 | 24 | 27 | 29 | 31 | 33 | 34 | 37 | 38 |
| Share of Biodiesel (%) | 81 | 79 | 78 | 78 | 76 | 73 | 71 | 69 | 67 | 66 | 63 | 62 |
| | | | | | | | | | | | | |
| **Net trade** | **-2.4** | **-2.5** | **-3.1** | **-2.5** | **-2.4** | **-3.5** | **-4.4** | **-5.3** | **-6.1** | **-7.0** | **-7.5** | **-8.0** |
| Ethanol imports | 0.8 | 0.8 | 0.9 | 1.1 | 1.0 | 1.8 | 2.4 | 3.1 | 3.9 | 4.6 | 5.2 | 5.7 |
| Biodiesel imports | 1.7 | 1.8 | 2.3 | 1.6 | 1.5 | 1.8 | 2.1 | 2.2 | 2.4 | 2.4 | 2.4 | 2.4 |
| Share of imports in use (%) | | | | | | | | | | | | |
| Ethanol | 24 | 20 | 22 | 24 | 22 | 32 | 38 | 43 | 46 | 48 | 48 | 49 |
| Biodiesel | 18 | 18 | 22 | 16 | 14 | 16 | 16 | 16 | 16 | 15 | 15 | 14 |
| | | | | | | | | | | | | |
| **Energy share (%)** | **3.9** | **4.3** | **4.6** | **4.3** | **4.8** | **5.4** | **6.0** | **6.7** | **7.4** | **8.1** | **8.5** | **9.2** |
| 1st-gen | 3.7 | 4.1 | 4.3 | 4.0 | 4.4 | 4.9 | 5.5 | 6.1 | 6.8 | 7.4 | 7.8 | 8.5 |
| based on waste oils | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 |
| other 2nd-gen. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Ethanol (in petrol use) | 2.3 | 2.9 | 3.2 | 3.1 | 3.7 | 4.8 | 5.8 | 6.9 | 8.3 | 9.6 | 10.9 | 12.2 |
| Biodiesel (in diesel use) | 4.8 | 5.0 | 5.2 | 4.9 | 5.3 | 5.6 | 6.1 | 6.5 | 7.1 | 7.4 | 7.5 | 8.0 |
| | | | | | | | | | | | | |
| **Volume shares (%)** | | | | | | | | | | | | |
| Ethanol (in petrol use) | 3.5 | 4.3 | 4.8 | 4.6 | 5.5 | 7.1 | 8.7 | 10.4 | 12.3 | 14.3 | 16.3 | 18.3 |
| Biodiesel (in diesel use) | 5.2 | 5.5 | 5.7 | 5.3 | 5.8 | 6.1 | 6.6 | 7.1 | 7.7 | 8.1 | 8.2 | 8.7 |
| | | | | | | | | | | | | |
| Petrol consumption | 100 | 97 | 95 | 94 | 93 | 92 | 91 | 90 | 90 | 90 | 89 | 89 |
| Diesel consumption | 199 | 201 | 203 | 204 | 205 | 207 | 208 | 210 | 213 | 215 | 217 | 219 |
| **Total fuel consumption** | **299** | **298** | **298** | **297** | **298** | **299** | **299** | **301** | **303** | **305** | **306** | **307** |

Biofuels balance sheet in the EU, 2009-2020 (million tonnes oil equivalent)

8% biofuels scenario

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Usable production** | **10.6** | **11.5** | **11.6** | **11.8** | **12.5** | **13.0** | **13.7** | **14.6** | **15.6** | **16.6** | **17.8** | **18.9** |
| Ethanol | 2.8 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.8 | 4.0 | 4.3 | 4.6 | 5.1 | 5.6 |
| *based on wheat* | *0.7* | *1.0* | *0.9* | *0.8* | *0.8* | *0.9* | *0.9* | *1.0* | *1.1* | *1.1* | *1.3* | *1.5* |
| *based on other cereals* | *0.8* | *0.9* | *1.0* | *1.3* | *1.3* | *1.3* | *1.4* | *1.6* | *1.7* | *1.9* | *2.2* | *2.5* |
| *based on sugar beet* | *0.7* | *0.7* | *0.7* | *0.7* | *0.7* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* | *0.9* |
| *2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.2* |
| Biodiesel | 7.8 | 8.4 | 8.3 | 8.3 | 9.0 | 9.3 | 9.9 | 10.6 | 11.3 | 12.0 | 12.6 | 13.3 |
| *based on veg. oils* | *7.2* | *7.6* | *7.5* | *7.4* | *7.9* | *8.1* | *8.5* | *9.0* | *9.5* | *10.0* | *10.4* | *10.9* |
| *based on waste oils* | *0.5* | *0.8* | *0.8* | *0.9* | *1.1* | *1.2* | *1.4* | *1.5* | *1.7* | *1.9* | *2.1* | *2.3* |
| *other 2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* |
| | | | | | | | | | | | | |
| **Consumption** | **13.0** | **14.0** | **14.7** | **14.4** | **14.7** | **15.8** | **16.9** | **18.0** | **19.1** | **20.2** | **21.6** | **22.9** |
| Ethanol | 3.6 | 3.9 | 4.1 | 4.4 | 4.4 | 4.9 | 5.3 | 5.7 | 6.1 | 6.5 | 7.2 | 7.9 |
| **Ethanol for fuel** | **2.3** | **2.7** | **3.0** | **2.9** | **3.2** | **3.8** | **4.2** | **4.5** | **5.0** | **5.4** | **6.1** | **6.8** |
| Non-fuel use of Ethanol | 1.3 | 1.1 | 1.1 | 1.6 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| **Biodiesel** | **9.4** | **10.1** | **10.6** | **9.9** | **10.4** | **10.9** | **11.5** | **12.3** | **13.0** | **13.7** | **14.4** | **15.0** |
| **Consumption for fuel** | **11.7** | **12.8** | **13.6** | **12.8** | **13.6** | **14.7** | **15.7** | **16.8** | **18.0** | **19.1** | **20.4** | **21.8** |
| Share of Ethanol (%) | 19 | 21 | 22 | 22 | 24 | 26 | 27 | 27 | 28 | 28 | 30 | 31 |
| Share of Biodiesel (%) | 81 | 79 | 78 | 78 | 76 | 74 | 73 | 73 | 72 | 72 | 70 | 69 |
| | | | | | | | | | | | | |
| **Net trade** | **-2.4** | **-2.5** | **-3.1** | **-2.5** | **-2.2** | **-2.8** | **-3.2** | **-3.4** | **-3.5** | **-3.6** | **-3.8** | **-4.0** |
| Ethanol imports | 0.8 | 0.8 | 0.9 | 1.1 | 0.9 | 1.3 | 1.6 | 1.7 | 1.8 | 1.9 | 2.2 | 2.4 |
| Biodiesel imports | 1.7 | 1.8 | 2.3 | 1.6 | 1.4 | 1.6 | 1.7 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Share of imports in use (%) | | | | | | | | | | | | |
| Ethanol | 23.5 | 19.6 | 21.8 | 23.8 | 20.8 | 27.2 | 29.7 | 30.3 | 29.9 | 29.8 | 29.7 | 29.6 |
| Biodiesel | 18.2 | 18.2 | 22.0 | 15.6 | 14.0 | 15.0 | 15.0 | 14.6 | 13.7 | 13.1 | 12.5 | 11.7 |
| | | | | | | | | | | | | |
| **Energy share (%)** | **3.9** | **4.3** | **4.6** | **4.3** | **4.6** | **5.0** | **5.3** | **5.6** | **6.0** | **6.3** | **6.7** | **7.2** |
| 1st-gen | 3.7 | 4.1 | 4.3 | 4.0 | 4.2 | 4.5 | 4.8 | 5.1 | 5.4 | 5.6 | 6.0 | 6.3 |
| based on waste oils | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 |
| other 2nd-gen. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Ethanol (in petrol use) | 2.3 | 2.9 | 3.2 | 3.1 | 3.5 | 4.2 | 4.7 | 5.1 | 5.6 | 6.1 | 7.0 | 7.8 |
| Biodiesel (in diesel use) | 4.8 | 5.0 | 5.2 | 4.9 | 5.1 | 5.3 | 5.6 | 5.9 | 6.1 | 6.4 | 6.6 | 6.9 |
| | | | | | | | | | | | | |
| **Volume shares (%)** | | | | | | | | | | | | |
| Ethanol (in petrol use) | 3.5 | 4.3 | 4.8 | 4.6 | 5.3 | 6.3 | 7.0 | 7.7 | 8.4 | 9.1 | 10.4 | 11.7 |
| Biodiesel (in diesel use) | 5.2 | 5.5 | 5.7 | 5.3 | 5.5 | 5.7 | 6.0 | 6.4 | 6.7 | 6.9 | 7.2 | 7.5 |
| | | | | | | | | | | | | |
| Petrol consumption | 100 | 97 | 95 | 94 | 93 | 92 | 91 | 90 | 90 | 90 | 89 | 89 |
| Diesel consumption | 199 | 201 | 203 | 204 | 205 | 207 | 208 | 210 | 213 | 215 | 217 | 219 |
| **Total fuel consumption** | **299** | **298** | **298** | **297** | **298** | **299** | **299** | **301** | **303** | **305** | **306** | **307** |

Biofuels balance sheet in the EU, 2009-2020 (million tonnes oil equivalent)

EC's proposal scenario

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Usable production** | **10.6** | **11.5** | **11.6** | **11.8** | **12.2** | **12.5** | **13.0** | **13.7** | **14.5** | **15.1** | **15.5** | **16.1** |
| Ethanol | 2.8 | 3.2 | 3.3 | 3.4 | 3.2 | 3.2 | 3.2 | 3.3 | 3.4 | 3.4 | 3.6 | 3.8 |
| *based on wheat* | *0.7* | *1.0* | *0.9* | *0.8* | *0.8* | *0.8* | *0.9* | *0.9* | *1.0* | *1.1* | *1.2* | *1.2* |
| *based on other cereals* | *0.8* | *0.9* | *1.0* | *1.3* | *1.2* | *1.3* | *1.4* | *1.5* | *1.7* | *1.8* | *2.0* | *2.2* |
| *based on sugar beet* | *0.7* | *0.7* | *0.7* | *0.7* | *0.7* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* | *0.8* |
| *2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.2* | *0.2* | *0.3* |
| Biodiesel | 7.8 | 8.4 | 8.3 | 8.3 | 9.1 | 9.3 | 9.8 | 10.4 | 11.1 | 11.7 | 11.9 | 12.3 |
| *based on veg. oils* | *7.2* | *7.6* | *7.5* | *7.4* | *7.9* | *7.9* | *8.2* | *8.6* | *8.9* | *9.2* | *9.2* | *9.3* |
| *based on waste oils* | *0.5* | *0.8* | *0.8* | *0.9* | *1.1* | *1.3* | *1.5* | *1.8* | *2.0* | *2.3* | *2.5* | *2.8* |
| *other 2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.2* | *0.2* | *0.2* |
| | | | | | | | | | | | | |
| **Consumption** | **13.0** | **14.0** | **14.7** | **14.4** | **14.5** | **15.5** | **16.3** | **17.3** | **18.2** | **18.9** | **19.3** | **19.7** |
| Ethanol | 3.6 | 3.9 | 4.1 | 4.4 | 4.1 | 4.7 | 5.0 | 5.2 | 5.5 | 5.7 | 6.0 | 6.1 |
| **Ethanol for fuel** | **2.3** | **2.7** | **3.0** | **2.9** | **2.9** | **3.5** | **3.8** | **4.1** | **4.3** | **4.6** | **4.8** | **5.0** |
| Non-fuel use of Ethanol | 1.3 | 1.1 | 1.1 | 1.6 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| **Biodiesel** | **9.4** | **10.1** | **10.6** | **9.9** | **10.4** | **10.8** | **11.4** | **12.0** | **12.7** | **13.2** | **13.3** | **13.6** |
| **Consumption for fuel** | **11.7** | **12.8** | **13.6** | **12.8** | **13.3** | **14.3** | **15.2** | **16.1** | **17.0** | **17.8** | **18.1** | **18.5** |
| Share of Ethanol (%) | 19 | 21 | 22 | 22 | 22 | 25 | 25 | 25 | 25 | 26 | 27 | 27 |
| Share of Biodiesel (%) | 81 | 79 | 78 | 78 | 78 | 75 | 75 | 75 | 75 | 74 | 73 | 73 |
| | | | | | | | | | | | | |
| **Net trade** | **-2.4** | **-2.5** | **-3.1** | **-2.5** | **-2.0** | **-2.6** | **-2.8** | **-2.9** | **-2.8** | **-2.7** | **-2.5** | **-2.2** |
| Ethanol imports | 0.8 | 0.8 | 0.9 | 1.1 | 0.7 | 1.1 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.0 |
| Biodiesel imports | 1.7 | 1.8 | 2.3 | 1.6 | 1.5 | 1.6 | 1.7 | 1.7 | 1.6 | 1.6 | 1.5 | 1.3 |
| Share of imports in use (%) | | | | | | | | | | | | |
| Ethanol | 23.5 | 19.6 | 21.8 | 23.8 | 17.6 | 24.2 | 25.9 | 25.2 | 23.5 | 22.2 | 19.3 | 16.2 |
| Biodiesel | 18.2 | 18.2 | 22.0 | 15.6 | 13.9 | 14.8 | 14.5 | 13.9 | 12.8 | 12.0 | 11.0 | 9.6 |
| | | | | | | | | | | | | |
| **Energy share (%)** | **3.9** | **4.3** | **4.6** | **4.3** | **4.5** | **4.8** | **5.1** | **5.4** | **5.7** | **5.9** | **6.0** | **6.1** |
| 1st-gen | 3.7 | 4.1 | 4.3 | 4.0 | 4.1 | 4.4 | 4.6 | 4.7 | 4.9 | 5.0 | 5.0 | 5.0 |
| based on waste oils | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.8 | 0.9 |
| other 2nd-gen. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| Ethanol (in petrol use) | 2.3 | 2.9 | 3.2 | 3.1 | 3.2 | 3.9 | 4.3 | 4.6 | 4.9 | 5.2 | 5.5 | 5.7 |
| Biodiesel (in diesel use) | 4.8 | 5.0 | 5.2 | 4.9 | 5.1 | 5.2 | 5.5 | 5.7 | 6.0 | 6.2 | 6.1 | 6.2 |
| | | | | | | | | | | | | |
| **Volume shares (%)** | | | | | | | | | | | | |
| Ethanol (in petrol use) | 3.5 | 4.3 | 4.8 | 4.6 | 4.8 | 5.8 | 6.4 | 6.9 | 7.3 | 7.7 | 8.3 | 8.6 |
| Biodiesel (in diesel use) | 5.2 | 5.5 | 5.7 | 5.3 | 5.5 | 5.7 | 6.0 | 6.2 | 6.5 | 6.7 | 6.7 | 6.8 |
| | | | | | | | | | | | | |
| Petrol consumption | 100 | 97 | 95 | 94 | 93 | 92 | 91 | 90 | 90 | 90 | 89 | 89 |
| Diesel consumption | 199 | 201 | 203 | 204 | 205 | 207 | 208 | 210 | 213 | 215 | 217 | 219 |
| **Total fuel consumption** | **299** | **298** | **298** | **297** | **298** | **299** | **299** | **301** | **303** | **305** | **306** | **307** |

Biofuels balance sheet in the EU, 2009-2020 (million tonnes oil equivalent)

No policy scenario

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Usable production** | **8.9** | **9.6** | **9.8** | **9.3** | **7.4** | **6.2** | **5.5** | **5.3** | **5.1** | **5.1** | **5.0** | **5.1** |
| Ethanol | 1.1 | 1.2 | 1.5 | 1.0 | 1.0 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.5 | 1.5 |
| *based on wheat* | *0.7* | *1.0* | *0.9* | *0.8* | *0.7* | *0.7* | *0.7* | *0.7* | *0.7* | *0.7* | *0.8* | *0.8* |
| *based on other cereals* | *0.8* | *0.9* | *1.0* | *1.3* | *1.1* | *1.1* | *1.1* | *1.2* | *1.2* | *1.3* | *1.4* | *1.5* |
| *based on sugar beet* | *0.7* | *0.7* | *0.7* | *0.7* | *0.7* | *0.8* | *0.7* | *0.7* | *0.8* | *0.8* | *0.8* | *0.8* |
| *2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* |
| Biodiesel | 7.8 | 8.4 | 8.3 | 8.3 | 6.4 | 5.1 | 4.2 | 3.8 | 3.6 | 3.5 | 3.5 | 3.5 |
| *based on veg. oils* | *7.2* | *7.6* | *7.5* | *7.4* | *5.7* | *4.5* | *3.8* | *3.4* | *3.2* | *3.1* | *3.1* | *3.2* |
| *based on waste oils* | *0.5* | *0.8* | *0.8* | *0.9* | *0.7* | *0.6* | *0.5* | *0.4* | *0.4* | *0.4* | *0.4* | *0.4* |
| *other 2nd-gen.* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* | *0.0* |
| | | | | | | | | | | | | |
| **Consumption** | **13.0** | **14.0** | **14.7** | **14.4** | **10.4** | **8.7** | **7.7** | **7.2** | **7.0** | **6.9** | **7.0** | **7.2** |
| Ethanol | 3.6 | 3.9 | 4.1 | 4.4 | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.8 | 3.9 |
| **Ethanol for fuel** | **2.3** | **2.7** | **3.0** | **2.9** | **2.5** | **2.4** | **2.4** | **2.4** | **2.4** | **2.4** | **2.6** | **2.8** |
| Non-fuel use of Ethanol | 1.3 | 1.1 | 1.1 | 1.6 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| **Biodiesel** | **9.4** | **10.1** | **10.6** | **9.9** | **6.7** | **5.1** | **4.1** | **3.6** | **3.4** | **3.3** | **3.3** | **3.3** |
| **Consumption for fuel** | **11.7** | **12.8** | **13.6** | **12.8** | **9.2** | **7.5** | **6.5** | **6.0** | **5.8** | **5.7** | **5.9** | **6.0** |
| Share of Ethanol (%) | 19 | 21 | 22 | 22 | 27 | 32 | 37 | 40 | 41 | 42 | 44 | 46 |
| Share of Biodiesel (%) | 81 | 79 | 78 | 78 | 73 | 68 | 63 | 60 | 59 | 58 | 56 | 54 |
| | | | | | | | | | | | | |
| **Net trade** | **-2.4** | **-2.5** | **-3.1** | **-2.5** | **-0.8** | **-0.4** | **-0.2** | **-0.1** | **0.0** | **0.1** | **0.1** | **0.1** |
| Ethanol imports | 0.8 | 0.8 | 0.9 | 1.1 | 0.5 | 0.5 | 0.4 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 |
| Biodiesel imports | 1.7 | 1.8 | 2.3 | 1.6 | 0.4 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Share of imports in use (%) | | | | | | | | | | | | |
| Ethanol | 23.5 | 19.6 | 21.8 | 23.8 | 14.3 | 13.1 | 12.0 | 9.4 | 7.6 | 7.1 | 6.3 | 5.9 |
| Biodiesel | 18.2 | 18.2 | 22.0 | 15.6 | 6.6 | 2.7 | 1.5 | 0.9 | 0.5 | 0.4 | 0.4 | 0.3 |
| | | | | | | | | | | | | |
| **Energy share (%)** | **3.9** | **4.3** | **4.6** | **4.3** | **3.1** | **2.5** | **2.2** | **2.0** | **1.9** | **1.9** | **1.9** | **2.0** |
| 1st-gen | 3.7 | 4.1 | 4.3 | 4.0 | 2.9 | 2.3 | 2.0 | 1.9 | 1.8 | 1.8 | 1.8 | 1.9 |
| based on waste oils | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| other 2nd-gen. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Ethanol (in petrol use) | 2.3 | 2.9 | 3.2 | 3.1 | 2.8 | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 3.0 | 3.2 |
| Biodiesel (in diesel use) | 4.8 | 5.0 | 5.2 | 4.9 | 3.3 | 2.5 | 2.0 | 1.7 | 1.6 | 1.5 | 1.5 | 1.5 |
| | | | | | | | | | | | | |
| **Volume shares (%)** | | | | | | | | | | | | |
| Ethanol (in petrol use) | 3.5 | 4.3 | 4.8 | 4.6 | 4.1 | 4.0 | 4.0 | 4.0 | 4.1 | 4.1 | 4.4 | 4.7 |
| Biodiesel (in diesel use) | 5.2 | 5.5 | 5.7 | 5.3 | 3.6 | 2.7 | 2.1 | 1.9 | 1.8 | 1.7 | 1.6 | 1.6 |
| | | | | | | | | | | | | |
| Petrol consumption | 100 | 97 | 95 | 94 | 93 | 92 | 91 | 90 | 90 | 90 | 89 | 89 |
| Diesel consumption | 199 | 201 | 203 | 204 | 205 | 207 | 208 | 210 | 213 | 215 | 217 | 219 |
| **Total fuel consumption** | **299** | **298** | **298** | **297** | **298** | **299** | **299** | **301** | **303** | **305** | **306** | **307** |

European Commission
EUR 26107 – Joint Research Centre – Institute for Prospective Technological Studies

Title: Impacts of the EU biofuel policy on agricultural markets and land use

Author(s): Sophie Hélaine, Robert M'barek, Hubertus Gay

Luxembourg: Publications Office of the European Union

2013 – 21 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series –ISSN 1831-9424 (online)

ISBN 978-92-79-32649-3 (pdf)

doi:10.2791/20985

Abstract

The European Union's Renewable Energy Directive (RED) sets an overall target of 20% of the EU's energy used to come from renewable sources by 2020. As part of this target, at least 10% of total transport fuel consumption is to come from renewable energies (RE). However, the extent to which these 2020 targets will be met is uncertain. On 17 October 2012, the European Commission published a proposal to amend the RED to improve the sustainability of biofuels. Therefore the development of the biofuel market is highly uncertain, especially in the EU. This report aims to analyse different scenarios that could occur in the EU in the years to come. First is an assumed situation in which by 2020 biofuels would contribute 8% towards the RE transport target. Secondly the EC's proposal is analysed. Finally a complete removal of the biofuel policy in the EU is simulated. All scenarios are compared to a situation with biofuels contributing 10% towards the target. The simulations are run with the AGLINK-COSIMO model.
The simulations show that less ethanol would be used if only 8% of transport fuel was to originate from biofuels (in % RED counting), and that with the EC's proposal biofuels would represent 7.5% of transport fuel. In these two cases, the use of renewable electricity could improve the chances of reaching the 10% RE in transport target. A no biofuel policy in the EU would result in a very low biofuel production. The impact of a no policy scenario on world prices is particularly significant for vegetable oils. The other feedstock prices are at most 5% below the base. In addition, if no biofuel policy was in place in the EU, close to 6 million hectares (0.7% of world total) less cereals, oilseeds, sugar crops and palm oil would be harvested in the world in 2020 in comparison to the base.

LF-NA-26-107-EN-N

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

Publications Office

ISBN 978-92-79-32649-3