



EUROPEAN COMMISSION

DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT

Directorate G. Economic analysis, perspectives and evaluations

G.2. Economic analysis of EU agriculture

NOTE TO THE FILE

Subject: The impact of a minimum 10% obligation for biofuel use in the EU-27 in 2020 on agricultural markets

Rev: Impact assessment Renewable Energy Roadmap March 2007.

1. INTRODUCTION

In the context of the recent decision of incorporating a minimum of 10% biofuel by 2020 in total transport fuel use, this analysis aims at assessing the market impact. The main indicators are supply, demand, exports, imports, prices and public stocks as well as land use.

The new 10% minimum target in 2020 has also to be seen relative to the existing legislation which put the target at 5.75% in 2010. According to analysis of DG TREN the current biofuel directive would fail to produce an incorporation of 5.75% in 2010, because markets and technologies have too little time to react. Over the longer run however, an incorporation of 6.9% could be expected by 2020. The new legislation would therefore increase biofuel demand by 3.1 percentage points and lead to a more evenly spread consumption pattern across the EU Member States than the present biofuel directive. The points of comparison for the analysis therefore are the situations in 2006 as compared to 2020 as well as briefly the situation under the old biofuel directive and the new minimum target in 2020.

The analysis is following the baseline approach by keeping agricultural policies as seen in March 2007 and taken constant throughout the whole period. Therefore, any conclusion of the Doha Round and its consequences as well as recently tabled proposals like the withdrawal of maize from intervention as well as any modifications on the current set aside obligations are not taken into account. The note, though, takes these alternative policy scenarios qualitatively into account and briefly describes the impacts. The analysis covers the time until 2020.

The main work is therefore based on an updated baseline of the recently published "Prospects of agricultural markets and income in the European Union 2006-2013" of

January 2007. The main changes concern prolonging SAPS by two more years in the new Member States. The main macroeconomic assumptions remain similar as in the publication, this concerns in particular the declining and then rather stagnating population growth as well as the moderate prospects of economic growth for the period until 2020. The euro has been assumed to gradually decline to 1.15 USD/EUR by 2013 and remain on that level.

In order to illustrate better the impact of competitive second generation biofuel production, two scenarios have been created. One assumes a share of 30% of biofuel stemming from second generation, the other one assumes a lower contribution by 2020.

The imports of feedstock and ethanol are a result of the analysis and depend on a series of assumptions about the trade policies and the role of second generation technologies as well as with the domestic production potential which significantly increased with the accession of Bulgaria and Romania. Depending on these, the shares of imports could differ from those stated in earlier analysis around the Renewable Energy Roadmap which were based on an EU-25 vision.

The work has been carried out with a recursive dynamic partial equilibrium model (ESIM) currently in use in DG AGRI which analyses the commodity markets and land use as well as with the demand of biodiesel and bioethanol until 2020. The latter is based on energy projections of DG TREN's PRIMES model.

2. THE 10% MINIMUM REQUIREMENT BY 2020 AND KEY ASSUMPTIONS

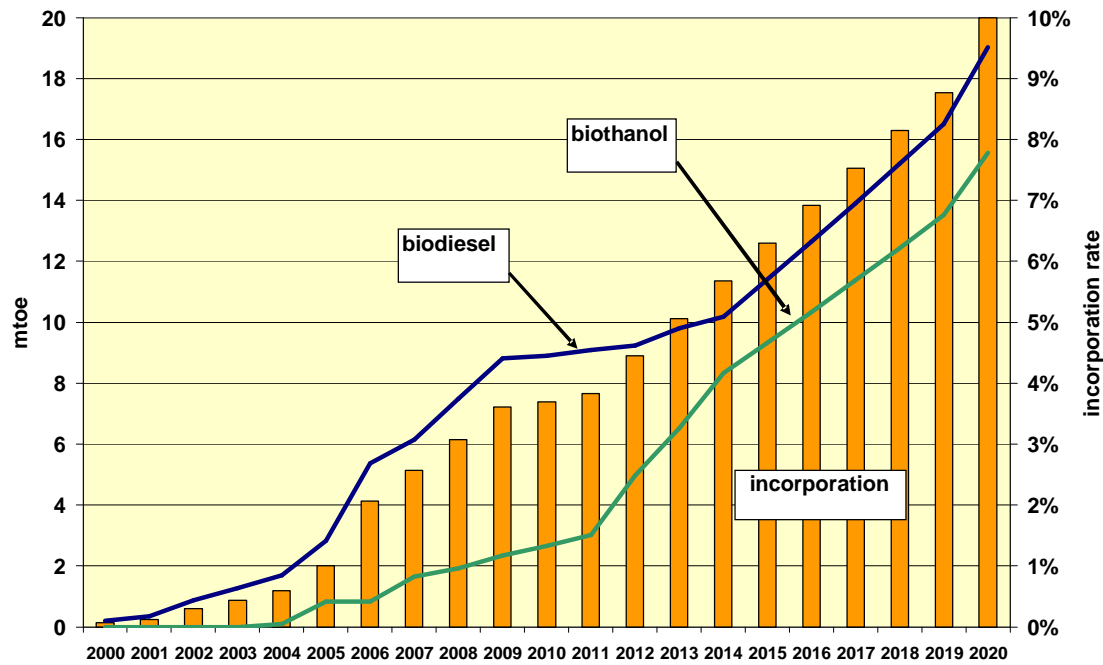
Basing the energy demand for the EU-27 on the projections of DG TREN for 2020 as well as taking into account current trends in developments of production capacities over the next couple of years, the following illustrative path of demand for biofuel would appear over the medium term as shown in figure 1. A significant increase of incorporation should be expected from 2012 onwards in order to be able to reach the 10% goal in 2020.

The biodiesel industry appears very well developed and would continue its development over the next few years, despite some recent readjustments of taxation of biofuels in some Member States. The increasing availability of second generation BTL (biomass to liquid) technology at industrial scale would boost developments in the sector from 2014 onwards. A similar take off could be expected by second generation technologies in the bioethanol industry. However, the build up of first generation bioethanol capacities would gradually kick in from 2007 onwards and is assumed to gain pace from 2011 to 2014. By 2013 a higher incorporation rate of around 5.5% could be reached if Member States stringently aim at meeting the 10% objective in 2020.

The target of 10% incorporation of biofuel in transport fuel use would require a more even spread use in the EU as compared to the current situation with a considerable gap between Member States with an already high and other Member States with a very low incorporation rate.

The continuation of the current biofuel directive would lead to an incorporation rate of 6.9% in 2020. Less biofuel would be used in the EU than under the new legislation, i.e. 23.8 mtoe as compared to 34.6 mtoe. The initiative therefore increases the biofuel demand by 10.8 mtoe in 2020. Production and consumption of biofuel in the EU would also be more evenly distributed under the new initiative.

Figure 1: Illustrative development of biodiesel and bioethanol demand and the incorporation rate until 2020 in the EU-27



Following the assumption on a binding goal and a serious commitment of Member States as well as the current trends in the development of production capacities in the biofuel industry, expansions of bioethanol and biodiesel demand as displayed in figure 1 appears possible. However different policy implementations might lead to different demand paths and incorporation rates. For example, a less energetic development of consumption and production capacities over the next 5 years would require additional efforts in the later years of the projection period. Thus the curve would be flatter at the beginning and much steeper at the end.

Assuming this development of biofuel demand in the EU-27, the main factors determining the impact on agricultural markets are:

- (1) **First and second generation biofuel technologies:** The outlook on this issue crucially depends on the future costs of production and speed of development of second generation technologies to industrial scale and not at least the possible cost improvements in production of first generation biofuels. Current estimates of costs show that second generation feedstock are 30% (second generation bioethanol) to 70% (BTL) more expensive than respective production of first generation fuels under present conditions and prices in the EU. Despite significant unknowns the assumed share of the contribution is assumed to be 30% of domestic needs by 2020.
- (2) **The available arable land:** Since agricultural production serves food, feed, industrial and also renewable energy use, any change in competitiveness of any of these four main outlets, leads to competition for arable land. These considerations also rely on the amount of total land available for cropping activities.
 - (a) The analysis assumes current policies in place also in future as regards the set aside requirement. Therefore, energy crops can be grown on set aside

land. However, the restrictions of the *Blair House Agreement* on the production of non-food oilseeds on set aside land remain constraining and limiting the oilseed production potential.

- (b) *Second generation biofuels and area requirement:* Second generation feedstock yield significantly higher energy per hectare. For example, energy yields per hectare of cereals would increase by 30%-40% if the straw and the grain would be used. One of the highest yielding energy crops is maize if the whole plant is used. Thus less area is needed to produce the same amount of energy. Moreover, non agricultural land could be used as well (e.g. for short term coppice, waste wood), as well as non land based sources such as animal waste and slaughtering residuals.
- (3) **The share of diesel and petrol in total transport fuel use:** In Europe diesel is more consumed than petrol. With tax policies assumed remaining constant some 55% of the consumption of transport fuel in 2020 would be diesel. Any change in fuel taxation policies in Member States which would swing the preference to petrol will bear significant consequences for the composition of feed stock demand for biofuel;
- (4) **The import policies as regards feedstock and biofuel:** The current state of policies result in an open market for biodiesel, oilseeds and vegetable oils. The ethanol market is currently protected. For the second generation feedstock, high transport costs rather than tariffs would be the limiting factor on the import side. For second generation feedstocks an import share of 25% has been assumed and would mainly be wood chips from temperate climate zones.
- (5) **The location of biofuel industries for the European market,** i.e. whether in Europe or in exporting nations such as Brazil or the US. Under the assumption of unchanged trade policies, this will mainly concern the question whether seeds or vegetable oils or biodiesel will be imported. This would bear consequences on the markets of by-products. The main driver here would be the relative opportunities on by-product markets, which also includes the question of GMO for biodiesel based on soybeans and ethanol based on cereals. The analysis assumes that production of biodiesel would remain in the EU considering its present international competitiveness.
- (6) **The level of world market and domestic** prices of feed stock determine the profitability of biofuels in the competition with fossil fuels and of production for other renewable energy uses such as heating and cooling. The analysis calibrates world market price developments on those of FAPRI and the OECD with appropriate adjustments for quality and transport costs. With this the projections incorporate also part of the biofuel policies of other countries such as the US. The latest world market price projections see prices of soft wheat (European qualities) at 175 USD/t (fob Rotterdam), barley at 130 USD/t (fob Canada) and maize at 180 USD/t (cif Western Europe) by 2020.
- (7) **The level of fossil oil prices:** The analysis bases itself on a price of 48 EUR per barrel. Higher prices will increase the competitiveness of biofuel, lower prices will have a negative impact. The assumed price level allows for a competitive biodiesel production in Europe over the medium term.

3. IMPACT ON AGRICULTURAL MARKETS IN 2020

3.1. Long term market trends in the EU-27

For analysing the effects of the additional biofuel feedstock demand in 2020 the following *long term market trends in the EU* need to be taken into account:

- (1) Arable production is expected to continue its moderate path of yield increases over the projected period. The growth of on average 1% to 2% per year would lead to increasing availabilities of cereals and oilseeds on EU markets. Long term productivity growth rates for cereals are at about 1%, for rapeseed these are close to 2% and sugar beets at rates slightly higher than 2%.
- (2) The increasing production of second generation biofuel would lead to higher energy yields per hectare such that less area is needed than with purely first generation feedstock. Moreover, biomass yield increases could be significantly higher than for cereals.
- (3) The possibility to grow energy crops on set aside land would leave considerable land resources available for the production. Nevertheless oilseed production could significantly increase without set aside obligation or without the restrictions of the Blair House Agreement.
- (4) The stagnating to declining population in the EU by the end of the projection period together with aging would lead to a limited increase of meat consumption in Europe. Growth of domestic meat markets would be significantly less than seen in the last 10 years. Another factor adding to the low growth and finally stagnation of the livestock sector is the declining level of exports and increasing levels of imports of the EU due to the limited competitiveness on world markets. This trend is already visible in some meat markets. The less growing domestic markets as well as the loss of world market shares for meat will lead to a limited growth to stagnation of feed demand in the EU and higher availabilities of feedstock and area for biofuel production by 2020.
- (5) As a result of increasing productivity and stagnating feed and food markets more production capacities would be available for biofuel production in 2020 than currently.

3.2. The 10% impact on agricultural markets as compared to 2006

Under a 10% minimum obligation about 59 mio t of cereals or about 18% of domestic use would be used as first and including straw also as second generation feed stock. Most of the cereals used would be soft wheat and maize, the rest would fall mainly on barley. The projected yield increases of about 1% per year would lead to 38 mio t more cereal production in 2020 than currently seen. Moreover 2 mio ha of additional cereals grown on set aside land could provide some 14 mio t.

Domestic use of cereals would significantly increase while exports would decrease over time. Cereal prices would appear stable and reach 120 EUR/t in real terms or 150 EUR/t in nominal terms. Maize prices would be significantly above intervention prices following the increase of domestic use and the subsequent real stabilisation of the cereal price

complex. The long run impact of biofuels on cereal prices is in the range of 3% to 6% as compared to 2006 prices. The second generation biofuel production would reach about a third of the domestic biofuel production largely by incorporating the straw and wood based cellulosic material into production. Of this wood based materials some imports of 1.75 mtoe equivalent could be expected.

Table 1: Cereal, oilseed and vegetable oil markets in 2020 under a 10% minimum incorporation obligation in the EU-27

	production	total domestic use			prices (real)	exports	imports
	mio t	mio t	of which biofuel feedstock %-of domestic use	mio t	€t	mio t	mio t
Cereals	317.3	303.72	11%	34.35	111.7	24.46	10.90
-soft wheat	143.59	132.95	17%	23.07	112.1	15.64	5.00
-maize	69.18	69.18	15%	10.18	103.1	2.50	2.50
Oilseeds	33.41	64.84	2%	1.10	237.3	0.30	39.97
-rapeseed	20.67	32.83	65%	21.21	201.4	0.10	12.26
-sunflowerseed	9.28	11.02	12%	1.29	335.2	0.20	1.94
-soybeanseed	3.46	20.99	38%	7.88	189.1	0	17.53
Sugar	16.95	19.07	12%	2.34	412.4	0	2.12
Vegetable oils	18.70	15.13	61%	9.87	922.8	3.84	1.16
-rapeseed oil	11.00	7.76	92%	7.11	729.4	3.33	0.09
-sunflower oil	4.06	4.75	10%	0.48	1764.8	0.00	0.39
-soybean oil	3.64	2.62	52%	1.37	568.3	1.82	0.80
-palmoil	0.00	3.62	10%	0.36	450.0	-	3.62

Oilseed markets would appear similarly firm, particularly the sunseed market which would see significant increases of prices (+15%) because of the small global production potential. The developing production of rapeseed in Russia and Ukraine would on the other hand keep rapeseed prices at moderate levels. Prices would increase between 8% and 10%. Soybean oil prices would see a significant increase due to the development of biodiesel industries in other parts of the world, in particular in Brazil and the US. The prices of by-products are economically best used as animal feed and second best as burning them in the biofuel production process. They would see a significant fall in prices.

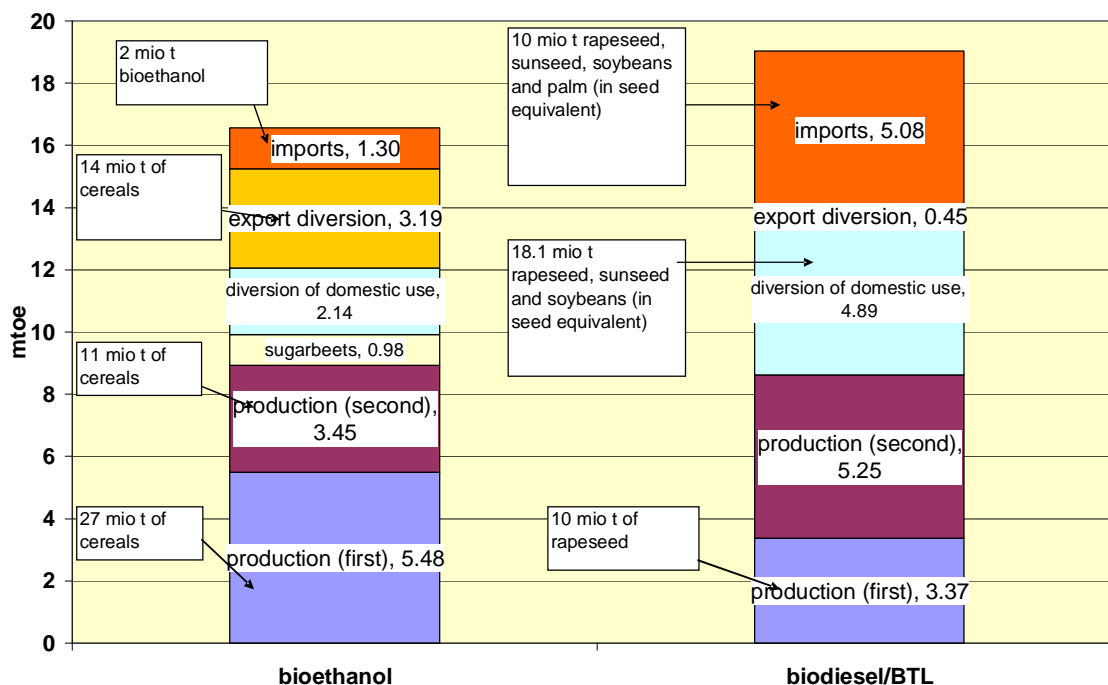
The consequences of these developments for the livestock sector would appear relatively moderate to neutral. The cattle production would benefit from the availability of dried distiller grain (DDG), the by-product of bioethanol production from cereals, at very competitive prices. DDG is protein, fibre rich and contains energy (based on the fats and oils in cereals) and could equally substitute some of the silage maize in cattle feed. The abundant availability of DDG would lead to prices which would rather reflect transport costs.

Pork and poultry production would equally benefit from cheaper protein feeds partly from bioethanol but more importantly from the biodiesel production. Similarly prices for rapeseed and partly also soybean meal would drop significantly as well by some 25% (soymeal) to 40% (rapemeal). This will partly offset the increasing feed costs caused by the price impact on the cereal complex. Shifting feed to a protein richer content would be another cost dampening factor. Livestock production itself could produce biogas using parts of the waste. This would open additional opportunities for livestock production.

Bioenergy production represents one of the major main stream opportunities for agriculture over the medium to long term in the EU. The 10% incorporation rate realised over this long period until 2020 together with newly available technologies assures a sustainable path in providing the EU with renewable transport fuels without disrupting

domestic and world markets. Imports would serve around 20% of the biofuel production. About half of them would be first generation feedstock and mainly oilseeds and vegetable oils.

Figure 2: Sources of feedstocks for bioethanol and biodiesel production in 2020 (mtoe)



3.3. Impact of 10% minimum requirement in 2020 as compared to the old biofuel directive on agricultural markets

The continuation of current biofuel policies through an unchanged biofuel directive would lead to a replacement of transport fuels of 6.9% in 2020. This would lead to a demand of 23.8 mtoe of biofuel as compared to 34.6 mtoe under the new legislation. Prices for agricultural raw materials would be similarly firm as under the 10% scenario, however with slightly lower increases. However, the uneven distribution of production and consumption would lead to greater price differentiation in the EU-27 than under the 10% minimum obligation.

4. THE IMPACT ON LAND USE OF A 10% MINIMUM INCORPORATION

4.1. The 10% impact on land use as compared to 2006

The increasing demand for first and second generation biofuel would affect land use in the EU in different ways. Biofuel demand adds another outlet to the food and feed production of agriculture. The development of relative prices between these market outlets is a main determining factor for the land use decision of farmers between individual crops but also between agricultural production and other uses such as land abandonment and to a more limited extend also the conversion to outside agricultural use.

The impact on land use in the EU-27 is relatively modest. About 15% of arable land would be used. The total land used for first and second generation biofuel production would then be 17.5 mio ha in 2020.

The main source of adding production potential would be the obligatory set aside, which is used as a supply control instrument requiring farmers to idle land in order to restrict production. This supply control instrument affects currently about 3.9 mio ha in the EU-27. From 2011 onwards about 1 mio ha will be added by those Member States which entered in 2004. About 0.5 mio ha will be added by Romania and Bulgaria in 2015. Once market opportunities arise farmers could use set aside land to grow non-food commodities, i.e. first and second generation biofuel feedstock. This is a provision of the 2003 CAP reform.

Table 2: Land use under 10% minimum incorporation in the EU-27 in 2020 (mio ha)

	2006*		2020		
	1.2% share in total area		share in total 10% area		
area bioethanol	1.0	1%	12.9	11%	
area biodiesel	2.1	2%	4.6	4%	
total area biofuels	3.1	3%	17.5	15%	
cereal area	59	52%	62.5	55%	
of which					
	bioethanol (1st gen.)	0.9	1%	7.1	6%
	bioethanol (2nd gen)	n.a.		5.2	5%
oilseed area	8.8	8%	8.5	8%	
of which					
	biodiesel (1st gen.)	2.1	2%	2.9	3%
BTL	n.a.		1.7	1%	
sugar beets	1.9	2%	1.43	1%	
of which					
	bioethanol	0.1	0%	0.6	1%
idle arable area					
	(idle + non used mandatory set aside)	7.2	6%	4.7	4%
other	36.9	32%	36.6	32%	
total arable land	113.8	100%	113.8	100%	

* including Bulgaria and Romania which joined during the campaign year 2006/07

4.2. Impact of 10% minimum requirement in 2020 as compared to the old biofuel directive on land use

The impact of the new legislation on land use for biofuel production is relatively modest. Only about 5 mio ha to 7 mio would be additionally used, depending on the share of contribution of second generation fuels. Therefore, the additional land use requirements would not overly draw on the land resources of the EU-27. Moreover, the more evenly distribution of production capacities over the EU assure that an overly concentration of biofuel feedstock production in only a few regions could be avoided.

5. CONCLUSIONS

In conclusion the 10% scenario does not overly stretch the land availability nor does it lead to a significant increase of intensities of production because of the limited pressure on markets. The long term until 2020 and the relatively small increase in cereal feed use in the EU over that time would leave enough possibilities for European farmers to support this new market outlet without a danger of returning to fertiliser and pesticide input patterns seen until the late 1980s. Farm employment could be expected to decline less than under a scenario without biofuel and additional jobs would be created in the downstream activities and processing of biofuel.

6. SENSITIVITY OF THE MARKET IMPACT ON THE MARKET SHARE SECOND GENERATION BIOFUELS

The analysis assumes a contribution of 30% of second generation biofuel in 2020. This assumption is attached to a number of uncertainties, which are mostly related to the production costs. Changing the assumed rate of contribution would significantly change the presented results. A lower share of second generation feedstock particularly in the BTL field would increase the reliance on imports of oilseeds and vegetable oils. It also would increase the area needs in the EU. In these considerations also the level of transport costs for second generation feedstock plays a role.

The following stylised type of reactions and numbers can be extracted from the sensitivity. For reasons of simplicity of argumentation a prohibitive level of transport costs for second generation feedstock is assumed, thus no imports of second generation feedstock would enter the EU markets:

- (1) Assuming all second generation feedstock for a *30% contribution to EU biofuel demand* would be produced in the EU, would lower the *import needs to 10%* (as compared to the nearly 20% in the analysis above). About 2 mio ha of additional area would be used for producing second generation biofuel. The results of this scenario has been placed into the annex.
- (2) A lower contribution of *second generation technologies at only 20% of biofuel demand* would increase *import needs to 30%*. The increasing rate of imports would be seen in the oilseed and vegetable oil markets.
- (3) The *import share would reach 50%* and agricultural prices would be significantly higher than those displayed in the analysis under the assumption that *no second generation biofuel would be produced*.

7. SENSITIVITY OF THE ANALYSIS ON AGRICULTURAL AND TRADE POLICY CHANGES

The analysis has been based on existing policies. However, a change in the most relevant agricultural trade and market policies would have an impact on the competitiveness of cereals and oilseeds for biofuel use:

- (1) **Modification of the cereal intervention system:** The decision to phase out maize intervention until 2009/10 would significantly increase the competitiveness of maize in biofuel use. In particular it would aid building up of such industries in Hungary, Bulgaria and Romania under competitive conditions in the short term and higher ethanol incorporation could be reached. The impact of the phasing out of maize intervention establishes market fluidity which without the reform would only materialise over the medium to long run. Market prices for maize would be well above intervention price levels in Hungary, Bulgaria and Romania by 2020.
- (2) **Set aside and Blair House agreement:** A withdrawal of set aside could lead to a freer allocation of land also in relation to the competitive oilseed production in the EU. Depending upon the use made of land previously under obligatory set-aside, this might lead to greater oilseed production which would serve the surging biodiesel demand. On the cereals side, high availability of cereals and somewhat

lower cereal market prices could provide incentives to build up ethanol processing capacities.

Annex:

Scenario: 30% second generation biofuels, no imports of second generation feedstock

Figure A-1: Sources of feedstocks for bioethanol and biodiesel production in 2020 (mtoe)

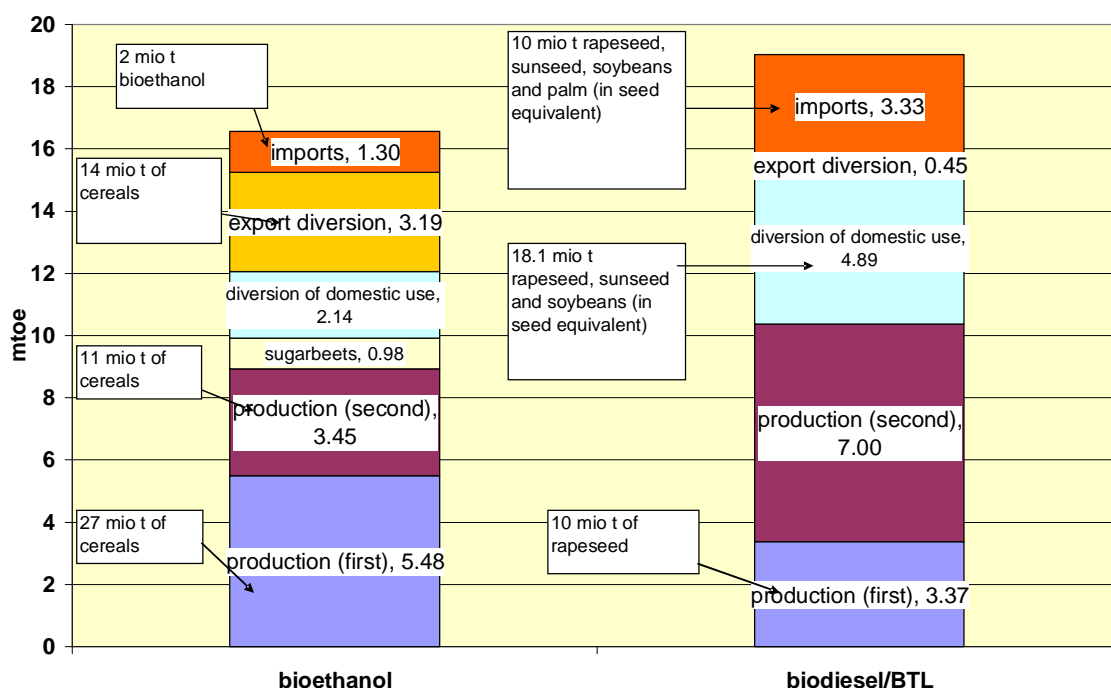


Table A-1: Land use under 10% minimum incorporation in the EU-27 in 2020 (mio ha), 30% second generation biofuel, no imports of second generation feedstock.

		10% share in total area	
area bioethanol		12.9	11%
area biodiesel		6.2	5%
total area biofuels		19.1	17%
cereal area		62.5	55%
of which			0%
	bioethanol (1st gen.)	7.1	6%
	bioethanol (2nd gen)	5.2	5%
oilseed area		8.5	8%
of which			0%
	biodiesel (1st gen.)	2.9	3%
BTL		3.3	3%
sugar beets		1.43	1%
of which			0%
	bioethanol	0.6	1%
idle arable area	(idle + non used mandatory set aside)	4.7	4%
other		36.6	32%
total arable land		113.8	100%