Soy consumption for feed and fuel in the European Union

A research paper prepared for Milieudefensie (Friends of the Earth Netherlands)

Profundo
economic research

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Introduction

Fifteen NGOs across Europe are participating in a project to raise awareness of the social and environmental impacts of European consumption of animal feeds and agrofuels. The focus for initial awareness raising and campaigning will be soy - a crop used for both animal feed and agrofuels. This report provides information on the consumption of soy and agrofuels in the EU.

The following figures have been gathered:

- Import figures of soy (beans, meal and oil), divided by country of origin.
- Total and per capita consumption of soy (beans, meal and oil), where possible divided by industry (feed, fuel and others).
- Total and per capita consumption of relevant livestock products (pork meat, poultry meat, eggs, milk, cheese and beef);
- Total and per capita use of agrofuels, divided in biodiesel and fuel ethanol and, where possible, their origin;
- Approximate per capita land use abroad, based upon soy and agrofuel consumption figures and average yields per hectare of soy and the main types of agrofuels in the production countries;
- Projected use of transport fuels in 2010 & 2020, and total and per capita agrofuel consumption for three scenarios: 5% by energy content by 2010, 5% in 2020 and 10% by 2020.

In this report the findings for the EU as a whole are presented. Figures for individual EU-countries can be found in the spreadsheet provided separately.

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Chapter 1 Soy for feed in the EU-27

1.1 Soy imports

In 2007, the EU-27 countries together imported 24.8 million tonnes of soy meal, 15.5 million tonnes of soybeans and almost 1 million tonnes of soy oil (1.1). Most imports originated from Brazil and Argentina.

Table 1 EU-27 soy imports by country of origin in 2007

Country of origin	Soybeans*	Soy oil	Soy meal
	1,000 tonnes	1,000 tonnes	1,000 tonnes
United States	3,373	6	159
Canada	780		6
Norway		71	147
Argentina	193	221	15,185
Brazil	9,820	619	9,251
Paraguay	994		1
Uruguay	87		2
Other countries	213	44	74
Total	**15,460**	**961**	**24,827**

* Soybeans: September 2006 - August 2007.

Source: Oil World, May 2008.

In 1.1 we calculate the relative importance of the European Union as export destination for the different soy producing countries. As a first step we convert the amounts of imported soy meal and soy oil to their original amounts of soybeans (see 3.1 for more details on the calculation) and add these to the direct soybean imports.
More than 18 million tonnes of soybean equivalents were imported by the EU-27 from Brazil, equalling 32% of Brazil's soybean harvest in 2006/2007. Other countries that export a large part of their soybean harvest to the EU-27 are Argentina (25%) and Canada (23%).

Table 2 Share of soybean harvests exported to the EU-27

Country of origin	Soybean equivalent of EU-27 imports	Total soybean harvest in 2006/2007	Exports to EU-27 as % of total harvest
	1,000 tonnes	1,000 tonnes	%
United States	3,508	86,770	4%
Canada	785	3,466	23%
Argentina	12,365	48,700	25%
Brazil *	18,524	58,726	32%
Paraguay	995	5,856	17%
Uruguay	89	820	11%
Other countries	363	33,099	1%
Total	**36,628**	**237,437**	**15%**

* EU imports from Norway almost exclusively originate from Brazil and therefore are added to Brazil.

Source: Oil World, May 2008.

1.2 Soy meal and soy oil processing

96% of the whole soybeans imported into the EU were crushed into soy meal and soy oil.[1] In our calculations we assume that 100% is crushed, because about half of the soybeans that are not crushed are used in animal feed as well. Furthermore, the other half of the whole soybeans represents only 1% of the total amount of soy bean equivalents processed in the EU.
After the crushing of the imported soybeans, some of the soy meal and some of the soy oil was exported again to countries outside the EU. As the net result of imports, crushing and exports, in 2007 3.5 million tonnes of soy oil and 35.8 million tonnes of soy meal where available on the market to be processed further by industries in the EU-27 countries. This equals 7.0 and 72.4 kilogram per capita respectively.
As shown in 1.2, most soy oil processed in the EU-27 is originating from Brazil (66%), followed far behind by the United States (17%). Most soy meal processed in the EU-27 is also originating from Brazil (46%), but Argentina provides almost as much (41%).

Table 3 Soy processed in the EU-27 by country of origin (2007)

Country of origin	Soy oil		Soy meal	
	1,000 ton	%	1,000 ton	%
United States	575	17%	2,726	8%
Canada	132	4%	601	2%
Argentina	233	7%	14,854	41%
Brazil *	2,284	66%	16,591	46%
Paraguay	168	5%	759	2%
Uruguay	15	0%	68	0%
Other countries	76	2%	234	1%
Total processed	**3,482**	**100%**	**35,834**	**100%**
Processed per capita	7.0	kg/person	72.4	kg/person

* EU imports from Norway almost exclusively originate from Brazil and therefore are added to Brazil.
Source: Oil World, May 2008.

1.3 Soy meal conversion into animal feed

Although a few percent of all soy meal processed in the EU is used for food products, we assume that 100% of the soy meal processed in the EU is used in animal compound feed. Total compound feed production in the EU-27 amounted to 147.4 million tonnes in 2007.[2] With a total soy meal consumption of 35.8 million tonnes in 2007 (see 1.2), the average soy meal content of compound feed was 24.3%.

Soy meal is used relatively more in some types of animal feed than in others. Since there is no information available for the EU-27 as a whole on the percentages of soy meal used in different types of animal feed, we used Dutch figures on the soy meal content of different types of animal feed.[3] Using these figures we calculated that the average soy meal content of all compound feed produced in the Netherlands in the period 2001-2004 was 22.1%.[4]

To arrive at an EU-27 average soy content of 24.3% we slightly adjusted the Dutch percentages. The adjusted percentages for each compound feed category were then combined with the actual production figures for different types of compound feed in the EU-27 in 2007.[5]
Based on this calculation, we estimate that most soy meal in the EU-27 is used for pig feed, which takes up 41% of the soy meal processed in the EU-27. Also important is feed for broilers and other types of meat poultry, which takes up 32% of the soy meal processed in the EU-27. Feed for layer poultry contains 10% and cattle feed contains 13% of the soy meal processed in the EU-27.

Table 4 Soy meal used in types of animal compound feed in the EU-27 (2007)

Type of animal compound feed	Production volume	Estimated soy meal content	Volume of soy meal in compound feed	% of EU soy meal
	1,000 tonnes	%	1,000 tonnes	%
Cattle - meat	12,148	13.9%	1,683	5%
Cattle - dairy	27,852	10.4%	2,893	8%
Pigs	51,440	28.8%	14,815	41%
Poultry - broilers	30,929	36.8%	11,389	32%
Poultry - layers	15,532	22.4%	3,477	10%
Other animals (incl. pet food)	9,522	16.6%	1,577	4%
Total	**147,423**	**24.3%**	**35,834**	**100%**

Sources: Sojahandel- en ketenrelaties. Sojaketens in Brazilië, Argentinië en Nederland, S. van Berkum et al, LEI, October 2006; Feed & Food, Statistical Yearbook 2006, FEFAC, Brussels, January 2008; Industrial compound feed production, FEFAC Secretariat General, Brussels, May 2007.

Amounts of soy meal contained in types of animal feed (1.3) are combined with the volumes of livestock product produced in the EU to estimate the volume of soy meal needed to produce one unit of each livestock product (1.3).

Table 5 Amounts of soy meal used per livestock product (2006-2007)

Livestock product	Soy meal in compound feed (1,000 tonnes)	Production volume		Soy meal per unit	
Beef & veal	1,727	7,444	1,000 tonnes	232	grams/kg
Milk	2,849	133,000	million litres	21	grams/litre
Pork	14,815	22,851	1,000 tonnes	648	grams/kg
Poultry meat	11,389	11,773	1,000 tonnes	967	grams/kg
Eggs	3,477	108,700	million eggs	32	grams/egg

Source: Eurostat, figures 2006/2007.[6]

The production volume for beef and veal contains all cattle slaughtered in the EU. About 28% of this cattle meat is originating from dairy cows, which are processed in meat products such as hamburgers and sausages.[7] Therefore we assigned the feed for dairy cows to the EU-27 milk production as well as to 28% of the beef and veal production, on the basis of the volume of both categories. Part of the soy used to feed dairy cows was therefore added to the amount of soy used for beef and veal.

1.4 Consumption of relevant livestock products

1.4 provides figures on the consumption of the most important livestock products in the EU-27. All figures are for 2007, except for beef & veal which is for 2006.

Table 6 Consumption of relevant livestock products (2006-2007)

Product	Total consumption		Consumption per capita	
Beef & veal	8,704	1000 tonnes	17.6	kg
Milk	39,015	million litres	78.8	litre
Pork	20,693	1000 tonnes	41.8	kg
Poultry meat	10,641	1000 tonnes	21.5	kg
Eggs	131,697	million eggs	266	eggs
Cheese	8,070	1000 tonnes	16.3	kg

Source: Eurostat, figures 2006/2007.[8]

1.5 Soy meal needed for EU livestock consumption

The estimates on amounts of soy meal needed per unit of livestock product (1.3) are combined with the consumption of livestock products in the EU (1.4). For cheese a conversion factor was applied: 9 litres of milk are needed for 1 kg cheese.[9]
This calculation results in estimates for the amounts of soy meal needed for the EU consumption of different types of livestock products (1.5).

Table 7 Soy meal needed for the EU consumption of different types of livestock products

Livestock product	Total consumption	Soymeal per unit		Soy meal needed	
	1,000 tonnes*			1,000 tonnes	kg/person
Beef and veal	8,704	232	grams/kg	2,020	4.1
Milk	39,015	21	grams/litre	806	1.6
Pork	20,693	648	grams/kg	13,416	27.1
Poultry meat	10,641	967	grams/kg	10,294	20.8
Eggs	131,697	32	grams/egg	4,212	8.5
Cheese	8,070	186	grams/kg	1,500	3.0
Other products & exports**				3,586	7.2
Total				**35,834**	**72.4**

* Milk in million litres and eggs in million eggs.
** Other products: livestock products from all other animals (sheep, goats, ducks, etc.); Exports: all types of livestock products exported outside the EU-27.

For the individual EU-27 countries the same calculation is made (see separate spreadsheet). But for the category “other products”, the estimates are very rough and do not include intra-EU exports. The focus of this project is on soy needed for domestic consumption, not on soy needed for export products.

1.6 Soybean acreage needed for EU livestock consumption

In order to calculate the acreage needed to produce the soy meal used for the livestock products consumed in the EU-27, we have to convert the soy meal amounts into amounts of soybeans. For this purpose we assume that 1,000 tonnes of soy meal equals 771 tonnes of soybeans. See 3.1 for a detailed description of the calculation method.

Soybean amounts are then converted into acreage needed, using an average soybean yield of 2.61 ton per hectare.[10] This results in estimates for the soybean acreages needed abroad to make the European consumption of various livestock products possible. A total of 10.6 million hectares of soybeans is needed to enable the consumption of livestock products in the EU-27 (1.6). Most land is needed for pork and poultry meat with respectively 80 m^2 and 61 m^2 per EU-27 citizen.

Table 8 Soybean acreage needed for livestock consumption

	Soybean equivalent	Acreage	
Livestock product	**1000 tonnes**	**hectares**	**m^2/person**
Beef and veal	1,557	595,519	12
Milk	621	237,642	5
Pork	10,341	3,956,061	80
Poultry meat	7,934	3,035,314	61
Eggs	3,247	1,242,109	25
Cheese	1,156	442,402	9
Other products & exports*	2,764	1,057,330	21
Total	**27,621**	**10,566,377**	**213**

* Other products: livestock products from all other animals (sheep, goats, ducks, etc.);
Exports: all types of livestock products exported outside the EU-27.

This soybean acreage can be attributed do the different countries from which the soy meal processed in the European Union is originating (1.2). Annual EU livestock consumption demands a soybean acreage of 5.0 million hectares in Brazil and 4.2 million hectares in Argentina (1.6).

Table 9 Soybean acreage needed for livestock consumption by country of origin

	Soybean equivalent	Acreage	
Country of origin	**1000 tonnes**	**hectares**	**m^2/person**
United States	2,102	781,256	16
Canada	463	182,290	4
Argentina	11,450	4,240,559	86
Brazil	12,789	4,995,608	101
Paraguay	585	263,553	5
Uruguay	53	26,319	1
Other countries	180	76,791	2
Total	**27,621**	**10,566,377**	**213**

Chapter 2 Biofuels in the EU-27

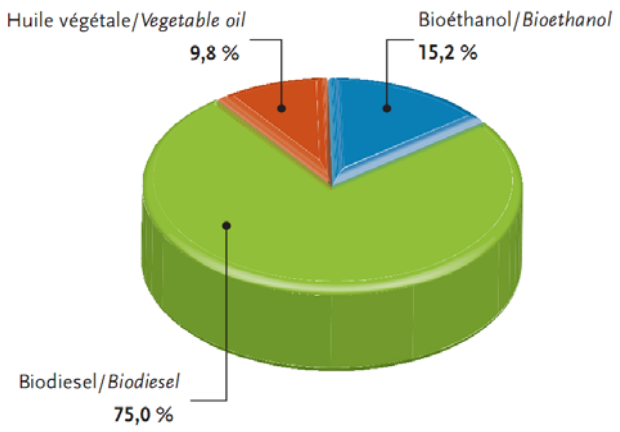
2.1 Overview of EU biofuel consumption

A biofuel is a solid, liquid or gaseous fuel produced from non-fossil plant or animal material, also known as "biomass". Because of its ease of use, the liquid form is by far the most widely used. 'First-generation biofuels' are biofuels made from sugar, starch, vegetable oil, or animal fats using conventional technology. The most common first generation biofuels are:[11]

- Biodiesel: produced from oils or fats. Most commonly used are soy oil, rapeseed oil and palm oil;
- Fuel ethanol: produced through the fermentation of sugars. Most commonly used are wheat, corn, sugar canes and sugar beets;

In Europe, biodiesel is by far the most used biofuel accounting for 75% of total biofuel consumption (see 2.1). Worldwide, however fuel ethanol is the most common biofuel, especially in Brazil, a major producer of fuel ethanol. In Europe, ethanol accounts for only 15.2% of total biofuel consumption. The remaining 9.8% of biofuels consumed in the EU-27 are vegetable oils - especially rapeseed oil - which are used as transport fuels in Germany without further processing.[12]

Figure 1.Biofuel consumption in the EU by type (in energy value, 2007) [13]



2.2 Biodiesel: production, imports and consumption

At the international level Europe remains the world's largest producer and consumer of biodiesel although other market players are emerging. In 2007, the EU produced 68% of biodiesel manufactured worldwide.[14]

Table 10 EU-27: Biodiesel production and consumption in 2007

	Indicator	Biodiesel production	Biodiesel imports	Biodiesel consumption
Total	1,000 tonnes	5,713	1,100	6,813
	million litres	6,492	1,250	7,742
Per capita	litre/person	13.1	2.5	15.6
Per diesel vehicle	litre/vehicle	61.3	11.8	73.1

Source: European Biodiesel Board (www.ebb-eu.org), Viewed in September 2008; ANFAC (figures for diesel cars and trucks in 2006).

Table 11 Main biodiesel producers in Europe in 2007

Biodiesel producer	Country	Number of plants	Production capacity (1,000 tonnes/year)
Diester Industries	France	7	1,240
Verbio AG	Germany	2	380
Cargill	Germany	2	370
Biopetrol	Germany	2	350
ItalGreen oil	Italy	1	300
Gate	Germany	2	260
Novaol	Italy	1	250
Saria Bio	Germany	3	212
Greenergy	UK	1	200
Petrotec	Germany	2	185
Total		**23**	**3,747**

Source: Biofuels Barometer, Systèmes Solaires, Le journal des énergies renouvelables, N° 185 - 2008, EurObserv'ER, Paris, June 2008.

In contrast to the United States, where the majority of biodiesel is produced from soybean oil, rapeseed oil forms the major feedstock in the EU. The use of soybean and palm oil is limited by the EU biodiesel standard DIN EN 14214. Soybean-based biodiesel does not comply with the iodine value prescribed by this standard (The iodine value functions as a measure for oxidation stability). Palm oil-based biodiesel reportedly does not provide enough winter stability in northern Europe. However, it is possible to meet the standard by using a feedstock mix of rapeseed oil, soybean oil, and palm oil.[15]

The USDA Foreign Agricultural Service gives the following estimates of feedstock used for biodiesel production in the European Union:[16]

Table 12 Feedstock use for biodiesel production in the EU-27 (in 1,000 tonnes)

	2006	2007e	2008e	2009f	2010f
Rapeseed Oil	3,150	3,550	3,700	4,900	5,650
Soybean oil	800	900	900	1,000	1,200
Palm oil	150	400	400	420	450
Sunflower	180	220	300	420	450
Other and not attributed	110	110	100	100	160
Subtotal Vegetable oils	**4,390**	**5,180**	**5,400**	**6,840**	**7,910**
Recycled Vegetable Oil	120	135	230	300	490
Animal Fats	10	35	130	160	200
Grand total	**4,520**	**5,350**	**5,760**	**7,300**	**8,600**

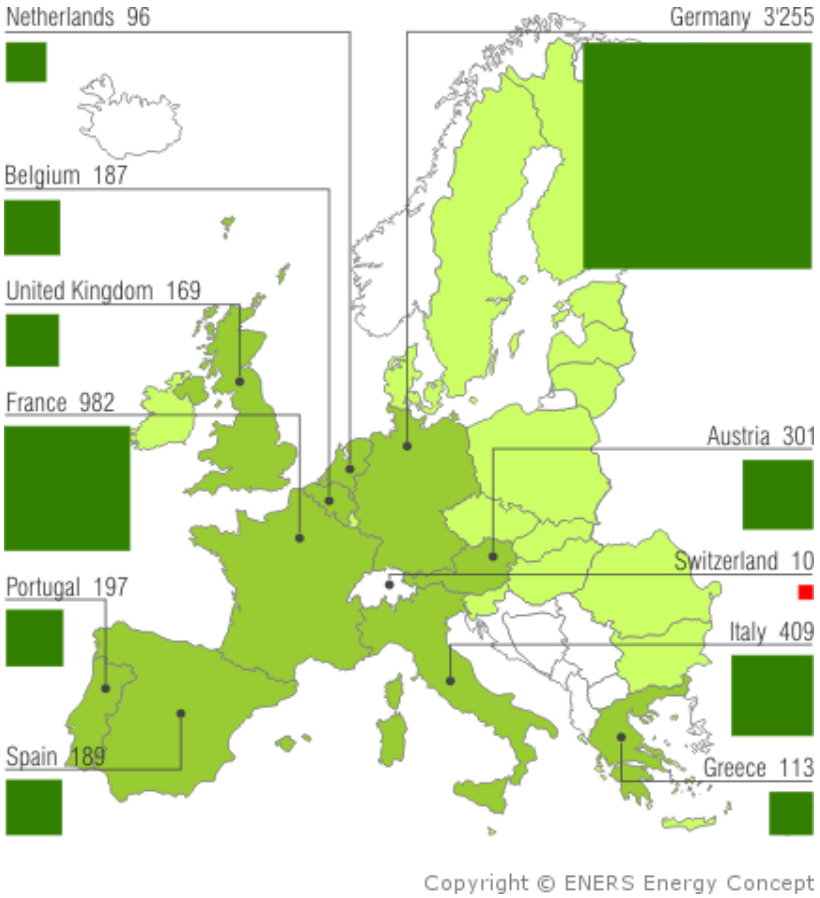
Note: Data for feedstock use is not available. The figures above represent estimates by EU FAS posts.

Source: USDA Foreign Agricultural Service, May 2008 (e = estimate; f = forecast)

In percentages, the figures in 2.2 equal 66% rapeseed oil, 17% soy oil, 7% palm oil and 9% other oils used for EU biodiesel production in 2007.

These estimates seem reasonable since most large biodiesel producers, listed in 2.2, claim to use mainly rapeseed. Furthermore in Germany, which accounts for more than half of total EU biodiesel production, rapeseed oil is the predominant feedstock. 71% of total rapeseed processed in Germany is used for biodiesel.[17]

Figure 2.Production of biodiesel in the EU in 2007 (in million litres) [18]



Imports of biodiesel into the EU market mainly come from the United States, with other imports accounting for a minor share of the market. Imports of biodiesel from the US have increased from about 7,000 tonnes in 2005 to more than 1 million tonnes in 2007.[19] 80% of the American biodiesel imports is produced out of soy oil. [20] According to the European Biodiesel Board, less than 10% of the American biodiesel imports consists of palm oil.[21] We therefore assign 8% to palm oil imported from Malaysia and Indonesia and 12% to other unknown oils.
Additionally to the biodiesel imports from the United States, we assume the EU imports 100,000 tonnes of biodiesel from other countries outside the EU. We do not know which feedstocks are used to produce these biodiesel imports.

2.2 shows our estimates for the countries of origin of the different feedstocks used for EU biodiesel consumption, based upon the sources mentioned above. This combines the feedstocks used for the EU biodiesel imports (1.1 million tonnes) and the feedstocks used for the EU biodiesel production (5.7 million tonnes). For the soy oil used in the EU for biodiesel production, we based the distribution over countries of origin on the distribution over countries of origin for all soy oil processed in the EU (see 1.2).
Overall, we estimate that rapeseed oil accounts for 56% of all EU biodiesel consumption, while soy oil accounts for 26% and palm oil for 7%. The soy oil used for EU biodiesel consumption mainly comes from the United States (both biodiesel imports and biodiesel produced in the EU) and Brazil (only biodiesel produced in the EU). We assume that all rapeseed oil originates from the European Union and all palm oil from Malaysia and Indonesia.

Table 13 Origin of feedstocks used for EU biodiesel consumption

Country of origin	Soy oil 1,000 tonnes	Rapeseed oil 1,000 tonnes	Palm Oil 1,000 tonnes	Other biodiesel feedstocks 1,000 tonnes	Total biodiesel feedstocks 1,000 tonnes
EU countries		3,791			3,791
United States	959				959
Canada	36				36
Argentina	64				64
Brazil	630				630
Paraguay	46				46
Uruguay	4				4
Indonesia/Malaysia			507		507
Unspecified	21			754	775
Total	**1,761**	**3,791**	**507**	**754**	**6,813**
	26%	**56%**	**7%**	**11%**	**100%**

Source: European Biodiesel Board (www.ebb-eu.org), Viewed in September 2008; GAIN Report EU-27 Biofuels Annual 2008, USDA Foreign Agricultural Service, Washington, 30 May 2008; EU launches investigation into US biodiesel imports, EU Directorate General Communication, Brussels, 13 June 2008; Sustainability Fact Sheet, National Biodiesel Board, Jefferson City, 21 April 2008; EBB strongly condemns the unfair subsidised US biodiesel exports and stands ready for legal action, European Biodiesel Board, Brussels, 16 October 2007.

2.3 Fuel ethanol: production, imports and consumption

In the EU, fuel ethanol is the second largest biofuel of the first generation. In 2007, fuel ethanol accounted for roughly 19% of total production of biofuels in the EU.

Table 14 EU-27: Fuel ethanol production and consumption in 2007

	Indicator	Fuel ethanol production	Fuel ethanol imports	Fuel ethanol consumption
Total	million litres	1,770	830	2,600
Per capita	litre/person	3.6	1.7	5.3
Per gasoline car	litre/car	11.2	5.2	16.4

Source: European Bioethanol Fuel Association (www.ebio.org), Viewed in September 2008; ANFAC (figures for gasoline cars in 2006).

In the EU, fuel ethanol is mainly produced from grains, predominantly wheat and to a lesser extent barley, rye and corn. A limited volume of fuel ethanol is produced from the surplus of wine alcohol in the EU.[22]

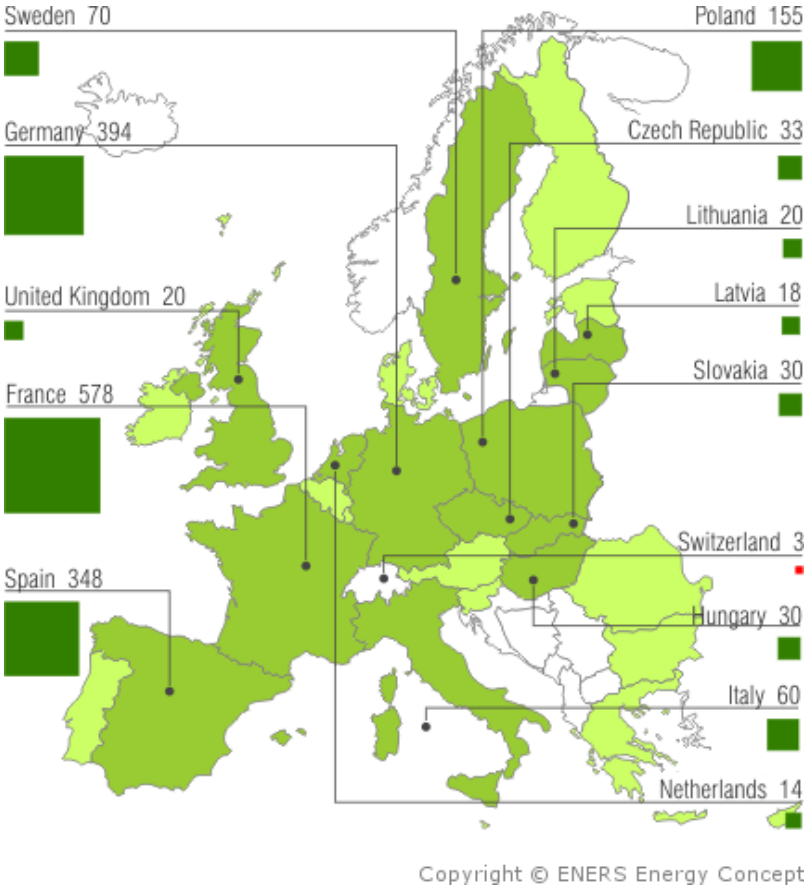
Table 15 Main fuel ethanol producers in Europe in 2007

Producer	Country	Number of plants	Production capacity (1,000 tonnes/year)	Input
Tereos	France	7	740	Wheat, sugar beets
Abengoa	Spain	3	520	Cereals, wine alcohol
Verbio	Germany	2	330	Cereals (rye, wheat and barley)
CropEnergies	Germany	1	300	Wheat, sugar beet
Cristanol	France	3	290	Sugar beet, wine alcohol
Agrana Bioethanol	Austria	1	240	Wheat, maize
IMA (Bertolino group)	Italy	1	200	Wine alcohol
Total		**18**	**2,620**	

Source: Biofuels Barometer, Systèmes Solaires, Le journal des énergies renouvelables, N° 185 - 2008, EurObserv'ER, Paris, June 2008.

98% of the EU imports of fuel ethanol originate from Brazil.[23] Brazil's bio-ethanol, produced from sugar cane, is principally consumed in Sweden, the United Kingdom and the Netherlands. It is consumed in smaller quantities in Denmark and Germany.[24]

Figure 3.Production of fuel ethanol in the EU in 2007 (in million litres) [25]



2.4 Acreage needed for biofuels

Additionally to our estimates for the countries of origin of the feedstocks needed for EU biodiesel consumption in 2007 (see 2.2), we have estimated the amount of Brazilian sugar cane needed for European fuel ethanol consumption.
Soy oil amounts were then converted into amounts of soybeans, assuming that 1,000 tons of soy oil equal 2,116 tons of soybeans (see 3.1).
Estimated soybean amounts were further converted into acreages needed, using the average soybean yield for each of the soy producing countries.[26] This results in estimates for the soybean acreage needed abroad (mostly in Latin America, see 1.1) to make the European consumption of biodiesel possible.
Similar conversions are made for rapeseed oil, palm oil and fuel ethanol.

Table 16 Acreage needed for EU biofuel consumption in 2007

Country of origin	Feedstocks for biofuels (hectares)					Total acreage (hectares)
	Soybeans	Rapeseed	Oil Palm	Other biodiesel feedstocks	Fuel ethanol	

EU-countries		2,180,203			unknown	2,180,203
United States	753,891					753,891
Canada	30,260					30,260
Argentina	50,459					50,459
Brazil	520,954				125,138	646,093
Paraguay	44,121					44,121
Uruguay	4,286					4,286
Indonesia/Malaysia			114,661			114,661
Unspecified	18,863			unknown		18,863
Total acreage	**1,422,834**	**2,180,203**	**114,661**	**unknown**	**125,138**	**3,842,836**
Acreage per capita (m^2/person)	**28.7**	**44.0**	**2.3**	**unknown**	**2.5**	**77.6**

As shown in 2.4, at least 3.8 million hectares were needed to produce the feedstocks for EU biofuel consumption in 2007. This is an underestimation, the actual figure probably is 20 to 40% higher: we have not calculated the acreages needed for the other feedstocks used for EU biodiesel production (accounting for 6% of EU biofuel consumption), for the production of fuel ethanol in the EU itself (10% of EU biofuel consumption) and for other biofuels (10% of EU biofuel consumption).
However, it is fairly certain that these three categories are feedstocks grown (almost) entirely in the EU itself. The acreage estimated in 2.4 for feedstocks grown outside the EU-27 - about 1.7 million hectares - therefore seems fairly accurate.

2.5 Projected use of transport fuel and biofuels in 2010 and 2020

2.5 shows the projected total use of transport fuels (gasoline and diesel) in the EU-27 in 2010 and 2020.[27]

Table 17 Projected use of transport fuels in 2010 and 2020

	Indicator	Use in 2010	Use in 2020
Total gasoline use	million litres	157,800	164,400
Total diesel use	million litres	178,700	206,300

2.5 shows the current use of biodiesel and the amounts needed to meet the scenarios set by the European Commission. Biodiesel consumption has to increase almost threefold to meet the 10% goal in 2020. [28]

Table 18 Current and projected use of biodiesel

		Current use	Scenario's:		
	unit	2007	5% in 2010	5% in 2020	10% in 2020
Required shares of fuel pool*	%		5.70%	5.70%	11.30%
Total	million litres	7,742	10,186	11,759	23,312
Per capita	litre/capita	15.6	20.6	23.8	47.1

* The goals are set in percentages of energy content. This means that in order to reach a 5% energy content, the total fuel pool of diesel needs to contain 5.70% of biodiesel.

Total consumption of fuel ethanol has to increase nine fold to reach the 10% goal in 2020 (2.5).[29]

Table 19 Current and projected use of fuel ethanol

		Current use	Scenario's:		
	unit	2007	5% in 2010	5% in 2020	10% in 2020
Required shares of fuel pool	%		7.20%	7.20%	14.10%
Total	million litres	2,600	11,362	11,837	23,180
Per capita	litre/capita	5.3	22.9	23.9	46.8

* The goals are set in percentages of energy content. This means that in order to reach a 5% energy content, the total fuel pool of gasoline needs to contain 7.20% of ethanol.

Chapter 3 Total soy consumption in the EU-27

3.1 Total acreage of soybeans needed for EU consumption in 2007

In 3.1 we have combined the data on soybean acreages needed for EU livestock consumption (1.6) and the data on soybean acreages needed for EU biodiesel consumption (2.4) with a similar calculation of soybean acreages needed for the EU consumption of other products containing soy oil.

Table 20 Total soybean acreage needed for EU consumption

Country of origin	Biodiesel	Livestock products	Soy oil used in other products	Total acreage	
	hectares	hectares	hectares	hectares	%
United States	753,891	781,256	327,205	1,862,353	13%
Canada	30,260	182,290	79,374	291,924	2%
Argentina	50,459	4,240,559	132,358	4,423,376	31%
Brazil	520,954	4,995,608	1,366,495	6,883,057	49%
Paraguay	44,121	263,553	115,731	423,405	3%
Uruguay	4,286	26,319	11,244	41,849	0%
Other countries	18,863	76,791	49,478	145,132	1%
Total soybean acreage	**1,422,834**	**10,566,377**	**2,081,885**	**14,071,096**	
Acreage per capita (m^2/person)	29	213	42	284	

As 3.1 shows, the consumption in 2007 by the European Union of products produced from soybeans (livestock products, biodiesel and other products containing soy oil) required a total acreage planted with soybeans of 14.1 million hectares. The largest acreage are needed in Brazil (6.9 million ha) and Argentina (4.4 million ha).

Appendix 1 Conversion of oils and meals into beans

Soybeans are processed into two primary products: soy meal and soy oil. Both products are sold on the market and together determine the return for the farmer, trader, crusher and other players early in the soybean chain. As soy meal can not be produced without producing soy oil, part of the acreage needed to grow soybeans has to be assigned to the production of soy meal and part to the production of soy oil. Otherwise we would count the same ground twice.

Each year all soy farmers take the decision to plant soy or something else (as soy is an annual crop). This decision is largely based on the expected financial proceeds of the soybean crop, which is determined for 61% by the financial return of the meal and by 39% by the financial return of the oil (financial return = volume * price). Therefore we believe that price has to be included when calculating acreage needed for soy meal and soy oil.
The alternative is to calculate on a weight basis only, which would mean that 1 ton soy meal equals 1 ton soybeans and 1 ton soy oil also equals 1 ton soybeans. But this approach ignores the price differences between the two products. The drive to produce more soybeans is primary the expected financial proceeds of the soybeans, so it would be wrong to ignore these price differences. The net value of soybean production is determined by production costs and the prices of both soy meal and soy oil, combined according to their relative weight share in soybeans.

Table 21 Conversion to soybean equivalents

Crushing	Global output (2007, 1,000 tonnes)	Crushing ratio	Price (in $, 2007)	Value ($ million)	%	Soybean equivalent (ton/ton)
Soybeans	201,756					
Soy meal	158,877	0.787	321	50,999	61%	0.771
Soy oil	37,482	0.186	881	33,021	39%	2.116
Total				**84,021**	**100%**	

3.1 shows that the global soybean harvest in 2007 (201.8 million tonnes) after crushing yielded 158.9 million tonnes of soy meal and 37.5 million tonnes of soy oil. That means that soybeans yield 18.6% of soy oil and 78.7% of soy meal. The rest is waste.
But because prices are very different, the contribution of soy meal and soy oil to the total value of the global soybean harvest is also different. 158.9 million tonnes of soy meal has a value of US$ 51 billion, while 37.5 million tonnes of soy oil has a value of US$ 33 billion. One can therefore assume that the total value of soybeans is determined for 39% by the soy oil and for 61% by the soy meal.

To produce 1,000 tons of soy meal you need 1,270 tons of soy beans (=1,000/0.787). Of the total value of this amount of soybeans, 61% is determined by the soy meal. We therefore assume that of these 1,270 tons of soy beans, 771 tons (61%) are exclusively used to produce soy meal. For conversion purposes, 1,000 tons of soy meal therefore equal 771 tons of soybeans.
To produce 1,000 tons of soy oil you need 5,383 tons of soy beans (=1,000/0.186). Of the total value of this amount of soybeans, 39% is determined by the soy oil. We therefore assume that of these 5,383 tons of soy beans, 2,116 tons (39%) are exclusively used to produced soy oil. For conversion purposes, 1,000 tons of soy oil therefore equal 2,116 tons of soybeans.

The same calculation method has been used for rapeseed and palm fruit (see 3.1 and 3.1).

Table 22 Conversion to rapeseed equivalents

Crushing	Output (in 1,000 tonnes)	Crushing ratio	Price (in $, 2007)	Value ($ million)	%	Rapeseed equivalent (ton/ton)
Rapeseeds	47,248					
Rapeseed meal	27,809	0.59	135	3,754	20%	0.344
Rapeseed oil	18,720	0.40	790	14,789	80%	2.013
				18,543	**100%**	

Table 23 Conversion to oil palm fruit equivalents

Milling & crushing	Output (in 1,000 tonnes)	Crushing ratio	Price (in $, 2007)	Value ($ million)	%	Oil palm fruit equivalent (ton/ton)
Oil palm fruits	192,490					
Palm oil	38,310	0.199	780	29,881	86%	4.302
Palm kernel oil	4,453	0.023	889	3,959	11%	4.903
Palm kernel meal	5,303	0.028	200	1,061	3%	1.103
				34,901	**100%**	

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