Biodiesel production and marketing in Germany

the situation and perspective

ufop

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1.1 Introduction

Out of all the renewable raw material products, Biodiesel is by far the most important for German agriculture. Now after 12 years of intensive product assessment by UFOP and its member federations, Biodiesel made from rapeseed oil is beginning to establish itself as a technically developed alternative in the fuel market. For the practical use of alternative fuels practically only pure Biodiesel fulfills the set requirements.

While the UFOP essentially financed and carried out public relations and sales promotion measures etc., the vehicle industry and Biodiesel manufacturers developed the technical and normative prerequisites for lasting market entry for rapeseed oil methyl esters. This could not have been done without financial support from the federal state governments, the Federal Government and the European Union.

Studies published in the meantime and the creation of a European standard for Biodiesel (DIN EN 14214) is impressive proof of this.

Alternative fuels and drives – valuation criteria

	Vehicle technique	selling/ handling	security	tank time	radius of action	lubrication	availability	costs[1]
hydrogen	♦♦♦	♦♦♦	♦♦	♦♦	♦♦	♦	♦♦♦	♦♦♦
liquefied natural gas	♦♦♦	♦♦♦	♦♦	♦♦	♦	✓	♦♦	♦♦
compressed natuaral gas	♦♦	♦♦	✓	✓	♦♦	✓	♦	♦
liquid gas	♦♦	♦	♦	✓	♦	✓	♦	♦
methanol	♦	♦	♦	✓	♦	♦	♦♦	♦
ethanol	♦	♦	✓	✓	♦	✓	♦♦	♦♦
vegetable oil (e. g. biodiesel)	✓	♦	✓	✓	✓	✓	♦♦	♦♦
electric vehicles	♦♦♦	♦	✓	♦♦♦	♦♦♦	✓	♦	♦♦♦
gas cell vehicles								[3]
- hydrogen operation	♦♦♦	♦♦♦	♦♦	♦♦	♦♦	✓	♦♦♦	♦♦♦
- fuel operation [2]	♦♦♦	✓	♦	✓	✓	✓	✓	♦♦♦

♦ some restrictions
♦♦ restrictions
♦♦♦ substantial restrictions
✓ no restrictions

[1] vehicles and fuel
[2] gasoline as source of hydrogen
[3] in development

Source: Shell PKW-Szenarien; 1999

European standard for biodiesel: DIN EN 14214

Property	Unit	Limits Min.	Limits Max.	Testing method
Ester content	% (m/m)	96,5		pr EN 14103
Density at 15 °C	kg/m³	860	900	EN ISO 3675 EN ISO 12185
Viscosity at 40 °C	mm²/s	3,5	5,0	EN ISO 3104
Flash point	°C	120	-	ISO/CD 3679
Sulfur content	mg/kg	-	10	
Carbon residue (on 10% distillation residue)	% (m/m)	-	0,3	EN ISO 10370
Cetane number		51,0		EN ISO 5165
Sulfated ash content	% (m/m)	-	0,02	ISO 3987
Water content	mg/kg	-	500	EN ISO 12937
Total contamination	mg/kg	-	24	EN 12662
Copper strip corrosion (3h at 50 °C)	rating	1		EN ISO 2160
Oxidation stability, 110 °C	hours	6,0	-	pr EN 14112
Acid value	mg KOH/g		0,5	pr EN 14104
Iodine value			120	pr EN14111
Linolenic acid methyl ester	% (m/m)		12	pr EN 14103
Polyunsaturated (>=4 double bonds) methyl esters	% (m/m)		1	
Methanol content	% (m/m)		0,2	pr EN 14110
Monoglyceride content	% (m/m)		0,8	pr EN 14105
Diglyceride content	% (m/m)		0,2	pr EN 14105
Triglyceride content	% (m/m)		0,2	pr EN 14105
Free glycerol	% (m/m)		0,02	pr EN 14105 pr EN 14106
Total glycerol	% (m/m)		0,25	pr EN 14105
Alkaline metals (NA+K)	mg/kg		5	pr EN 14108 pr EN 14109
Phosphorus content	mg/kg		10	pr EN 14107

1.2 Development of Biodiesel production capacity

Until 1998 the structure of Biodiesel production capacity advanced sluggishly, due to uncertainties on the market and the calculation risks connected to this.

But after the plant at Leer with Ochsenfurt and Wittenberge another two industrial plants went into operation. High prices in 1999/2000 for fossil Diesel fuel improved the economy of Biodiesel production substantially, so that the production capacity in the year 2003, compared with the year 1997, almost increased tenfold, from 100.000 t to approx. 1 million tons.

As a function of the regional conditions for production and marketing as well as the given investment possibilities, the transesterification capacity for each system varies substantially. Independent of how big the system is the quality requirements are in accordance with the E DIN 51606 or DIN EN 14214 standard for performance requirement and the selection of procedure technology. Practice acknowledges that also with small systems the placed request can be fulfilled.

No matter what size the plant, the E DIN 51606 or DIN EN 14214 standards is the guideline for the performance requirement and technology used. Experience has shown that also with small systems the required standards can be fulfilled.

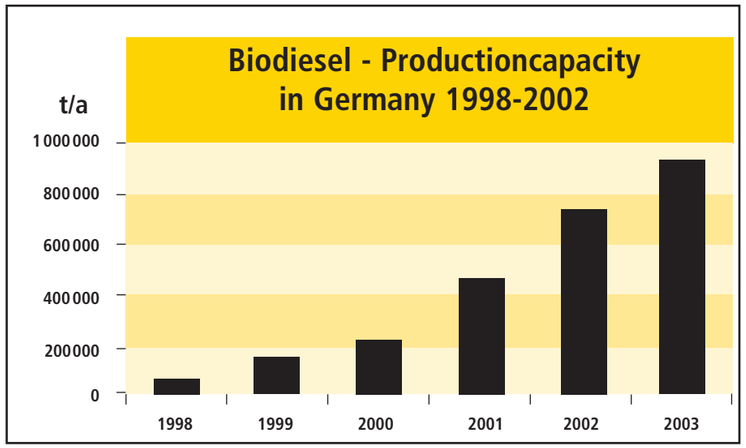
UFOP has been monitoring with some concern the growing number of Biodiesel production plants in Germany, which has happened very rapidly compared on an international level. The lasting development of this recent economic sector is possible only if the demand for the now strongly growing supply holds. On the other hand the structure of capacity leads to an excellent supply position in the future European Union market for bio fuels. Germany will at any time be able to play a role as a Biodiesel exporter and the structure of capacity will also contribute to making sure locations are available in which to produce the raw material.

Biodiesel-Capacity 2002

Firm	Location	Capacity (t/a)	Production since
In Production:			
Oelmühle Hamburg AG	Hamburg	120 000	09/2001
Oelmühle Leer Connemann GmbH & Co.	Leer / Niedersachsen	100 000	09/1996
Mitteldeutsche Umesterungswerke Bitterfeld	Bitterfeld / Sachsen-Anhalt	100 000	09/2001
Natur Energie West	Marl / Nordrhein-Westfahlen	100 000	04/2002
Campa Biodiesel GmbH	Ochsenfurt / Bayern	75 000	01/2000
Biodiesel Wittenberge GmbH	Wittenberge / Brandenburg	60 000	08/1999
Thüringer-Methylesterwerke GmbH & Co. KG	Harth-Pöllnitz / Thüringen	45 000	01/2002
Petrotec GmbH	Südlohn / NRW	35 000	05/2002
SARIA Bio-Industries GmbH & Co. Verw. KG	Malchin / Meckl. Vorpommern	12 000	10/2001
Hallertauer Hopfen-Verwertungsgesellschaft	Mainburg / Bayern	8 000	04/1995
Landwirtschaftl. Produkt- Verarbeitungs GmbH	Henningsleben / Thüringen	5 000	04/1998
PPM Umwelttechnik GmbH & Co.KG	Oranienburg / Brandenburg	5 000	11/2001
BKK Biodiesel GmbH	Rudolstadt/Thüringen	4 000	12/2001
Verwertungsgenossenschaft Biokraftstoffe	Großfriesen / Sachsen	2 000	04/1996
Total		**671 000**	
Up coming factories:			
Nevest AG	Schwarzheide / Brandenburg	100 000	
Rheinische Bioester GmbH	Neuss / Nordrhein-Westfahlen	100 000	
Bio-Oelwerke Magdeburg	Magdeburg / Sachsen-Anhalt	50 000	
BioDiesel Bokel GmbH	Bokel / Niedersachsen	10 000	
Kartoffelverwertungsgesellschaft Cordes &Stoltenburg GmbH & Co.	Schleswig/Schleswig-Holstein	10 000	
Total		**270 000**	

Source: D. Bockey, UFOP, Juni 2002

Situation

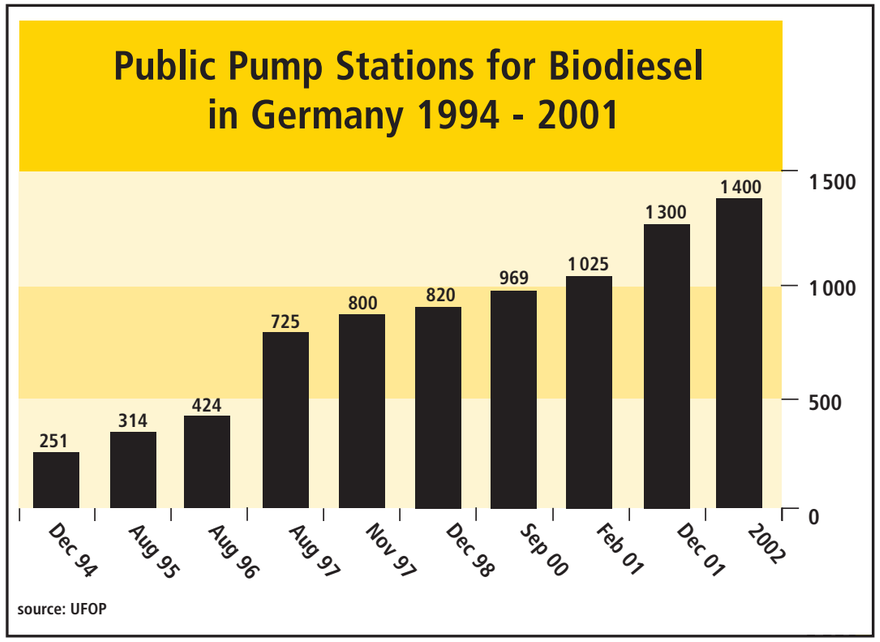


1.3 Sales Development

Contrary to France and Italy, Biodiesel in Germany and Austria is sold almost exclusively via petrol stations, contractors, the taxi trade and so on. Ten years ago Biodiesel was in the truest sense, a "no name product", but today the fuel is known everywhere and is naturally associated with the glowing yellow oilseed rape fields of "Germany's most beautiful oil fields."

The image campaigns and advertising measures of UFOP are basically based on three central points:

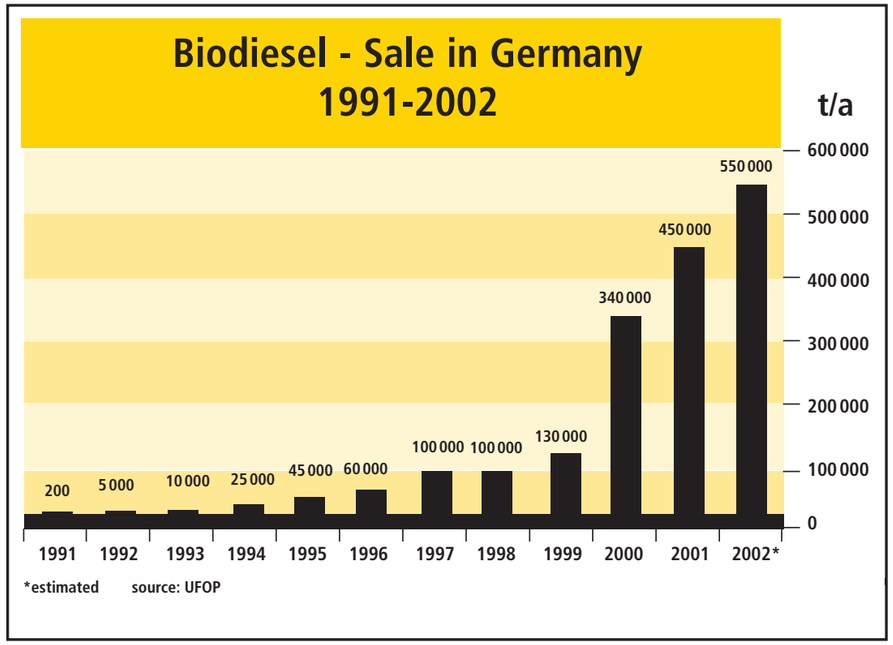
- Biodiesel is produced from native oilseed rape and is an economic alternative to the grain markets
- Pure Biodiesel offers a set of environmental advantages: biologically degradable, a decrease in waste gas emissions, no danger to property etc.
- Biodiesel is a technically mature and high-quality fuel, which is constantly subject to quality controls, from the manufacturer up to the petrol station



The number of petrol stations has increased continuously in the past years. Biodiesel in Germany is now available at more than 1,400 petrol stations - and this number is rising. The average distance between each Biodiesel petrol station is about 30 km – however with substantial regional differences. In particular for the so-called "free petrol stations" – company-independent petrol stations – Biodiesel is an important supplement product, which allows them to survive destructive competition. Realistically estimated there is potential for a further 1,000 petrol stations. UFOP and the Biodiesel economy aim therefore at further closer cooperation with the professional associations and media of the petrol station trade. Each petrol station contributes something to public relations. The Biodiesel petrol stations become therefore, from the viewpoint of the UFOP and the Working Group for Quality Management of Biodiesel (AGQM), merged into an appropriate information system. Biodiesel petrol stations establish a sales basis, because in comparison to fleet operators the product does not get substituted so easily depending on the function of the market and price history. About 40 % of the Biodiesel supply is sold via petrol stations and 60% via fleet operators for transport or goods vehicles.

In recent years UFOP has succeeded in distributing the same information across the country to market participants, which can be used for public relations and sales promotion. Up until now UFOP has concentrated on prioritizing general and national measures, whereas the Biodiesel manufacturers and raw material producers aim to reach the regional customer or the media with their sales promotion activities. Thereby in view of the scarce financial resources, substantial synergies are obtained for all involved. The UFOP and above all the rapeseed oil producers have proved they have staying power despite difficult phases in the past. A "network", ranging from professional associations to government ministries, authorities and research institutes is beginning to build up. This network is the basfor the qualitative and technical advancement of this alternative fuel and thus for further openings in the market.

Despite numerous Biodiesel sales promotion activities, increase in demand did not progress at the same



rate as capacity increased. In fact fast capacity increase substantially intensified alongside competition. Those new to the business underestimate the expenditure of gaining new customers. Biodiesel is still a product that needs to be explained, and requires intensive customer chaperonage. Market competition has the consequence that the production plants will not always be charged to full capacity - a reason for the industry to intensify and coordinate salepromotion activities.

Basically it needs to be stated that Biodiesel development in Germany, and the raw material oilseed rape, have acquired a certain degree of recognition nationwide and internationally, as numerous inquiries confirm.

Above all the east European candidate countries see the structure of sales markets for biogenous fuels as an important possibility for rapidly creating a surface-effective and thus for the food market exculpatory sales alternative. The entry candidates will substantially increase available surface area.

At the same time pressure on the grain market rises due to the constant technical progress in grain production - 1% grain yield increase corresponds in Germany alone to a surface equivalent of approx. 70,000 hectares. The surface and raw material potential rises constantly, which means the yield progress in oilseed rape production should likewise be considered. But what are the reasons for this internationally recognized development?

2. Basic conditions for development

2.1 Technical aspects:

Compared with other alternative fuels, vegetable oil fuels, and in particular Biodiesels, fulfill the most important technical requests as a prerequisite for market access, e. g. into public petrol stations. The transesterification process from rapeseed oil to rapeseed oil methyl ester produces a result with only one processing step, and in the context of a quality-monitored production this becomes a standardized fuel.

The vehicle industry, and above all the enterprises belonging to the Volkswagen group, i. e. Volkswagen AG, Skoda, AUDI and Seat, have adapted all their passenger car models from 1995 for use with Biodiesel, i. e. approved rapeseed oil methyl ester. The vehicle manufacturers will only release and distribute such models with a raw material specification. Volkswagen AG insists, as a prerequisite for release distribution, that the available technical experience is exclusively collected with RME. The German and the future European standard, DIN EN 14214, opens the possibility for different raw materials to be processed, however the problem-free use of Biodiesel must be proven on the base of other vegetable oils, from the point of view of Volkswagen AG. The fuel manufacturer has to provide this proof. Volkswagen AG is understandably not ready, according to its own specification, to finance the appropriate investigations and fleet test.

Meanwhile Biodiesel manufacturers and distributors in Germany have united as shown by the strong number of market participants in the Association Quality Management Biodiesel reg. Ass.

The working group was created on the initiative of UFOP in December 1999 with the target of maintaining the quality control not only with the manufacturer and in trade but in particular at petrol stations. The basis of quality production and monitoring is in each case the valid standard as well as additional self-obligations, which are decided with the vehicle industry. Technical usage experience or conditions for research and development requirement are also decided upon, which are of strategic importance for the market position. This ranges from technical engine requirements to the fulfillment of the legally given terms of legal emission (EURO IV and V), up to aspects of Biodiesel logistics and storage conditions at petrol stations (e. g. how the fuels are separated).

Development

2.2 Agra-political aspects

The agrarian reform in 1992 and also the obligation to set-aside land in the agenda for 2000, was basically the impulse that opened new sales markets for vegetable raw materials. The surface potential for the production of renewable raw materials in the European Union, due to technical progress, (grain yield increase) and particularly by the forthcoming extension of the European Union, has substantially increased. With a set-aside rate of 10 % of the area of arable land, this amounts to approximately 1.2 million hectares in Germany. In the current European Union this amounts to about 7 million hectares and in the future European Union roughly 12 million hectares will be set-aside.

Set-Aside Land by 10 % of the Arable Land

Characteristic Data of the Relation Agricultural Area / Population

Germany: rd. 1 200 000 ha, EU (15): rd. 7 000 000 ha; EU (27): rd. 12 000 000 ha

	Arable Land in 1.000 ha	Arable Land/ Person in qm	Agric Area in 1.000 ha	Agric Area/ Person in qm	Land Surface in 1.000 ha	Population in Mio.
D	11.084	1.437	17.067	2.077	34.099	82,2
EU (15)	76.087	2.024	136.249	3.624	313.169	376,0
EU (27)	118.707	2.464	196.644	4.082	419.350	481,7
World	1.376.437	2.294	4.926.805	8.211	13.048.407	6000,0

References: D. Bockey, UFOP, calculation on database of the Bavarian Ministry for Agriculture and Forestry

In particular Central and Eastern European countries, which will enter the EU in a few years, are understandably interested in absorbing some of the expected market and quantity demand for the production of renewable raw materials. The production of renewable raw materials for the extraction of fuels has the advantage over the traditional use of renewable raw materials because a large surface potential can be relatively quickly linked to necessary investments. Besides this the possibility exists for these countries of exporting raw material to be processed into Biodiesel, and we must ready ourselves for this competition. So that the raw material in the production country can have the value added necessary for agriculture, the necessary national basic conditions must be created. These regulations should be made before entry into the European Union.

The ifo-Institut for economic research in Munich has recently published a study /1/ entitled "Macro-oeconomic evaluation of rape cultivation for Biodiesel production", which calculated examples of added value and the effect on the job market for Biodiesel production starting from 2003. Regarding the supply of raw materials it calculated that for a capacity of 1 million tons of Biodiesel roughly 700,000 hectares are needed. This focus on turnover relieves the grain market, without burdening the vegetable oil market. The study implies that the mineral oil tax failure will be compensated by the inclusion of the additional social security income by up to approx. 80 %, and that within this area about 19,000 jobs will be created - with

priority in agriculture - and also created or secured in rural areas. This effect is very much welcomed by political parties for structural-political reasons. As is well known agriculture or rural space urgently needs income or acquisition alternatives.

Assumptions and data on agricultural production

Cultivation area for rape	On 350,000 ha of set-aside areas (non-food areas) 350.000 ha on food areas
Marketable rape yields	3.5 tons per ha in total, 2.45 million tons
Competing production processes	On set-aside areas: active greening On food areas: winter wheat
Prices and performance of rape on set-aside areas	Producer price m of € 181.51/ton from farm Producer price h of € 232.64/ton from farm Pre-fruit value of € 153.39/ha Margin m of € 274.82/ha including pre-fruit value Margin h of € 453.77/ha including pre-fruit value
Performance of active greening on set-aside areas	Pre-fruit value of € 76.69/ha Margin of € – 105.33/ha including pre-fruit value
Prices and performance for rape on food areas	Producer price m of € 186.62/ton from farm Producer price h of €237.75/ton from farm Pre-fruit value of € 153.39/ha Margin m of € 269.71/ha including pre-fruit value Margin h of € 448.66/ha including pre-fruit value
Prices and performance for wheat on food areas	Marketable yield of 7 tons/ha Producer price of € 102.26/ton from farm Margin of € 194.29/ha
Transport and commercial services	Rape: € 20.45/ton (difference between mill cost price and from-farm price) Wheat: € 20.45/ton (using the transportation lump sums employed by the BLE).

Source: ifo-Institut, München

Combined results

	Price scenario m	Price scenario h
Income from employment	€ 462.16 million	€ 499.69 million
Income from property and entrepreneurship	€ 345.48 million	€ 530.62 million
Depreciation	€ 341.54 million	€ 355.96 million
Additional gains of the state (tax refluxes)	€ 154.67 million	€ 193.98 million
Savings from intervention costs	€ 50.11 million	€ 50.11 million
Shortfalls in state revenue [a)]	€ 501.22 million	€ 501.22 million
Net flows/savings in% of t ax shortfalls	41%	49%
Social insurance income	€ 134.37 million	€ 147.35 million

[a)] Mineral oil tax shortfall, correction for local puclic transport, revenue shortfalls in import levies.

Source: ifo-Institut, München

2.3 Environmental Political Aspects

The use of alternative fuels, and in particular vegetable oil fuels, has an increasingly positive response from politics and society, mainly for environmental reasons. The ratification of the Kyoto Protocol, which is based on the resolutions of the Rio environment summit, plays a decisive role in national and European environmental policy. The European union has committed itself to reducing its output of fossil CO_2 by 8 %, as of 1990. Germany has even agreed on its own initiative to reduce fossil CO_2 output by 25 %, by the year 2005.

The energy and CO_2 balance of Biodiesel is positive. Each liter of Biodiesel produces as by-products oilseed rape pellet (a substitute for soy meal pellets) and glycerin (which substitutes synthetic glycerin gained from natural gas) and saves approx. 3.5 kg fossil of CO_2 /2/. Each hectare "yields" on average 1,600 liters of Biodiesel.

The Diesel-scenario			
	Product	Fossil energy expenditures [GJ]	Climatic gas emissions [t CO_{2eq}]
1.030 l (869 kg DK)	Fossil diesel fuel	43,93	3,27
1.103 kg	Soybean meal	4,01	0,39
93,1 kg	Synthetic glycerin	19,43	0,84
0,76 ha	Set aside land	1,89	0,13
TOTAL		69,26	4,63

The Biodiesel-scenario			
	Product	Fossil energy expenditures [GJ]	Climatic gas emissions [t CO_{2eq}]
1.136 l (1.000 kg)	BIODIESEL corresponds energetically to 869 kg diesel fuel	16,85	0,81
1.570 kg	Rapeseed meal	7,66	0,45
93,1 kg	Glycerin	0,70	0,03
TOTAL		25,21	1,29

- Saving of fossil sources of energy with the BIODIESEL-scenario, for each litre of fossil diesel replaced by BIODIESEL: 42,8 MJ/l DKÄ or 50,7 MJ/kg DKÄ
- Saving of climatic gas emissions for each litre of fossil diesel replaced by BIODIESEL: 3,24 kg CO_{2eq}/l DKÄ or 3,84 kg CO_{2eq}/kg DKÄ

Source: K. Scharmer, GET-Gesellschaft für Entwicklungstechnologie mbH

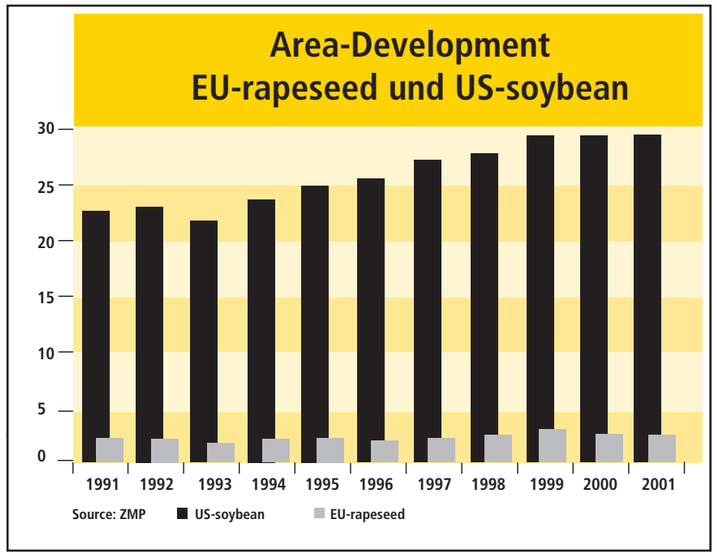
This corresponds to a saving of approximately 5.6 tons of CO_2 per hectare of oilseed rape. If the national Biodiesel production potential or the production capacity available is used, as of 2003, approx. 5, 6 million tons of fossil CO_2 could be saved annually. Thus a substantial contribution for reducing climatic-greenhouse gases could be achieved. The pursuit of this environmental political strategy is however possible only if the raw material is actually produced and processed in the country. In the context of the globalization of the worldwide flow of goods the climatic protection discussion inevitably leads to the question,

where environmental political boundaries are achieved, if the conversion of national strategies is taken into account. Environmental policy that targets greenhouse gas reduction, is thus first a question of national priorities and should not be solved by trading emission credits or measures such as joint implementation. The industrial nations must as the main offenders assume a role model function here. Independently of this, world-wide co-operation is necessary, in order to reduce wasting resources and above all to transfer technology for the efficient use of fossil raw materials and in addition to accelerate the use of renewable raw materials for energy production.

An important strategic item for the social acceptance and advancement of Biodiesel production or of bio fuels in the European Union is the fact that areas which are not needed anymore for food production, can be used for the production of energy raw materials. Meanwhile after ten years of agrarian reform, society has accepted that set-aside is a better alternative to surplus production both for ecological and economic reasons. This means that also in the future the cultivation of energy plants on set-aside land or other areas that are not needed for food crops will and must be a priority. In view of the substantial efforts for Biodiesel's market development on one hand, and on the other hand the environmental political requirements posed, German and European farmers do not understand why the Blair House Agreement and the sanctioning of more than one million tons of soy meal equivalent is predetermined as the growth or development boundary of this alternative product.

This aspect must be considered in the World Trade Organization negotiations, because above all urgent environmental political reasons speak against maintaining the Blair House Agreement. The U.S. must also recognize this view, even if the world's largest industrial nation does not feel obliged to hold to the Kyoto Protocol. On the occasion of the ratification of the Kyoto Protocol in Johannesburg the advancement of this branch of production in the extending European Union may not be determined any longer by the restrictions of the Blair House Agreement. At the same time since the agrarian reform of 1992 the cultivation of oil seed was expanded in North America alone by a surface which corresponds to the entire cultivated area of the European Union.

With the current agrarian turning point it becomes clear that the new U.S. farm bill, passed by the senate, has in principle declared the collapse of past efforts for free trade and a complete liberalization of the markets. The necessary return to direct, thus product-related, balance payments, acknowledges the fact that a certain framework of order for agriculture is indispensable, and that a fully liberalized world market is not alone the basis for rural agriculture. Despite this criticism it should be stated nevertheless that in a positive sense Biodiesel production and bio fuels, especially bioethanol, have progressed enormously in the U.S., supported by substantial financial advancement programs and legal basic conditions. The protection of interests on this side of and beyond the Atlantic looks likely to create the necessary basic conditions. This is a good base for a co-operation between experts in the European Union and the U.S.



2.4 The European Union's Action Plan

In connection with the discussion over the Blair House Agreement it must be pointed out likewise that in November 2001 the European Commission put forward an environmentally motivated so-called action plan, for the market introduction of bio fuels. At least 2 % of fossil fuels are to be replaced by biogenous fuels and this proportion should be gradually increased up to the year 2010 by 5,75 %, as of 2005. For the first time bio fuel production has extraordinary support in the form of the European Union Commission's plan of action. The German and likewise the European farmer's association has welcomed this plan of action and asked that it be put into practice as soon as possible. The given quantity targets can be fulfilled with consideration of the crop rotation conditions. The cultivated area for the production of Biodiesel would amount in Germany in the year 2005 to at least 450,000 hectares, and in the year 2010 about 1.3 million hectares. The expected yield progress is not considered with the cultivation of oilseed rape.

At the same time the conversion of the plan of action would mean a substantial relief for the international markets and in principle world-wide oil seed production would benefit in this sense. These efforts must be recognized internationally and not be obstructed by unneces-

Fuel Consumption (in 1.000 t Crude Oil Unit) of the EU Traffic Sector 1988

Nation	Gasoline Consumption	Diesel-Consumption	Total
Austria	2130	3224	5354
Belgium	2514	4852	7366
Denmark	2016	1711	3727
Finland	1846	1776	3622
France	14554	26603	41157
Germany	30080	24834	54914
Greece	3106	2245	5351
Irland	1307	1429	2736
Italy	17880	16138	34018
Luxembourg	541	685	1226
The Netherlands	4112	5067	9179
Portugal	2030	2863	4893
Spain	9018	16215	25233
Sweden	4021	2374	6395
Great Britain	21882	16597	38479
Total	117 037	126613	243650

All notes in 1000 t, Basis: Fuel Consumption 1998
References: D. Bockey, UFOP, own calculation on database of the EU-Commission (KOM (2001) 547 fin.)

sary restrictions. Retaining the Blair House Agreement would mean disadvantages for all those on the market. The future common emphasis must therefore depend on the development of new sales markets.

The current international political position and connected dependency on fossil resources indicate that cooperation should be accelerated, in particular as regards the creation of renewable energy sources in the western world – for the good of the economy and the environment – this is the common perspective.

Actionplan of the EU-Commission: Bio Fuel Production in the EU

Year/ Minimum Share (each 1998)	Gasoline-Consumption	Diesel-Consumption	Total
2005/2,00%	2341	2532	4873
2006/2,75%	3219	3482	6701
2007/3,50%	4096	4431	8527
2008/4,25%	4974	5381	10355
2009/5,00%	5852	6331	12183
2010/5,75%	6730	7280	14010

All notes in 1000 t, Basis: Fuel Consumption 1998
References: EU-Commission (KOM (2001) 547 fin.)

Actionplan Bio Fuel of the EU-Commission Development of Bio Fuel Production in Germany from 2005–2010

Year	2005	2006	2007	2008	2009	2010
Intended Quantity	2%	2,75%	3,5%	4,25%	5%	5,75%
Otto Fuel	26,9	26,3	25,7	25,1	24,5	23,9
Ethanol/ETB	0,538	0,723	0,899	1,066	1,225	1,37
Hectar Equivalent	0,269	0,362	0,45	0,533	0,613	0,685
Diesel Fuel	31,3	31,3	31,3	31,2	31,2	31,2
Bio Diesel/ Rapeseed Oil	0,63	0,861	1,01	1,32	1,55	1,79
Hectar Equivalent	0,45	0,615	0,721	0,943	1,11	1,30
Total:						
Bio Fuel Production	1,168	1,584	1,909	2,386	2,775	3,168
Hectar Equivalent	0,719	0,977	1,171	1,426	1,723	1,985

average yield of rapeseed oil/ha: 1,4 t; average yield of bio ethanol/ha of wheat: 2 t;
All notes in Mio. t or ha

References: D. Bockey, UFOP, EU-Commission, MWV and own valuations

Literature

Literature:

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