

Bioethanol

REPORT

— THE FUEL OF THE FUTURE.



BIOETHANOL – FOR THE FUTURE OF OUR MOBILITY

BIOETHANOL – FUEL FROM EUROPE FOR EUROPE

BIOETHANOL – CERTIFIABLY SUSTAINABLE

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CROPENERGIES – INNOVATIVE, SUSTAINABLE, AND PROFITABLE

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BIOETHANOL – FOR THE FUTURE OF OUR MOBILITY

BIOETHANOL IS A BIOFUEL MADE FROM RENEWABLE RAW MATERIALS SUCH AS GRAIN OR SUGAR BEETS. WORLDWIDE, BIOETHANOL IS BY FAR THE MOST FREQUENTLY USED BIOFUEL. IT PREDOMINANTLY SUBSTITUTES REGULAR PETROL IN ROAD TRAFFIC. THROUGH THE INCREASED USE OF BIOETHANOL, GREENHOUSE GAS EMISSIONS IN THE TRANSPORT SECTOR CAN BE REDUCED SIGNIFICANTLY. AS A RENEWABLE ENERGY SOURCE, BIOETHANOL HAS ALREADY BECOME A GENUINE ALTERNATIVE TO FOSSIL FUELS WITH WHICH THE FUTURE OF MOBILITY CAN BE SECURED.

“For the German automobile industry, the blending of ethanol on the basis of sustainable biofuel production is a step away from the use of fossil fuel. The decisive advantage of E10 is that the CO₂-reductions take effect immediately in the entire petrol-powered fleet on German roads.”

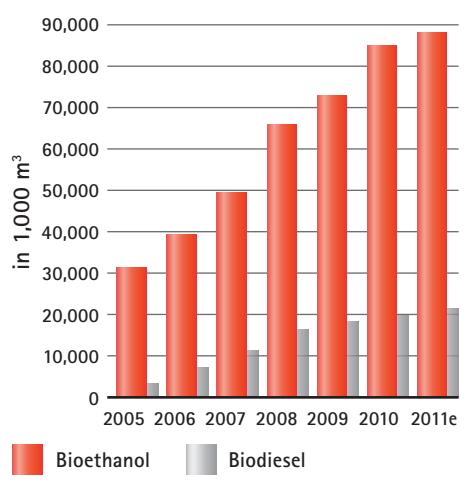
Joint statement by the Development Board of the German Automobile Manufacturers on the introduction of the new fuel E10 on 28 March 2011.

Whereas green house gas emissions in the EU have been generally reduced over the past few years, emissions in the transport sector have been on the rise since 1990. About 20 percent of the greenhouse gas emissions have to be ascribed to the area of mobility. In order to reduce these, the EU is setting framework conditions as well as specific targets. Bioethanol plays an important part in the achievement of these targets, as with bioethanol, greenhouse gas emissions in the transport sector can be reduced sustainably and economically.

LESS GREENHOUSE GAS EMISSIONS THROUGH BIOETHANOL FUELS

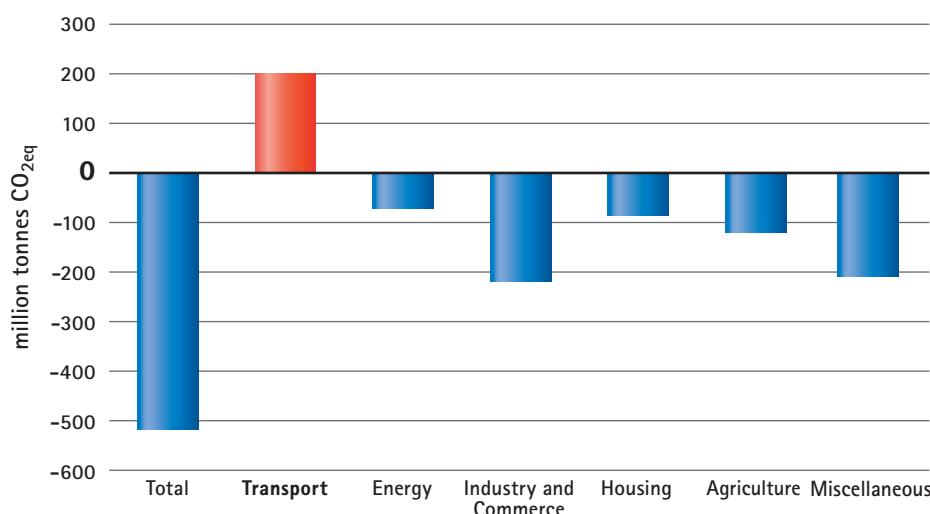
The raw materials from which bioethanol is obtained bind the same amount of CO₂ during their growth as the amount that is released when the fuel is burned. The amount of energy needed for the cultivation of the raw materials and production of the bioethanol needs to be taken into account, but if the entire value-added chain is taken into perspective, bioethanol saves a large amount of CO₂ in comparison with fossil fuels. In the EU this is guaranteed because all biofuels are required to prove through independent audition that they were produced sustainably and that they reduce CO₂ emissions by at least 35 percent in comparison with fossil fuels. When bioethanol is in the tank instead of petrol, less greenhouse gases are emitted, litre by litre. Thus, use of bioethanol in road traffic is an active contribution towards climate protection.

Bioethanol Production Worldwide



Source: F.O.Licht (2011)

EU-27: Change of Greenhouse Gas Emissions (1990 – 2007)



Greenhouse gas emissions in the transport sector have increased since 1990, whereas they have decreased in all other sectors.

CONSERVING FOSSIL RESOURCES

But bioethanol means much more. It is a known fact that fossil fuels are finite. Simultaneously, the demand for energy in the world is ever-increasing at the same time that global oil sources are shrinking. Every litre of bioethanol from sustainable raw materials replacing fossil fuel helps to conserve these resources. Use of bioethanol as a substitute for petrol thus ensures that the basis of existence of future generations is maintained and that mobility as we know it today will continue to be possible in the future.

INDEPENDENCE FROM OIL IMPORTS

Fossil fuel demand for the European transport sector are predominantly met through imports. The EU obtains only approx. 15 percent from its own oil sources. Thus, dependency on oil imports has increased by 10 percent since 2000 and this dependency will increase due to a decline in North Sea oil refining. In contrast, bioethanol is produced in Europe from domestic, sustainable raw materials. Thus it does not only reduce dependency on fossil fuel sources but also simultaneously dependency on oil imports.

With its own fuel production on the basis of raw materials cultivated in the EU, the European Union becomes less dependent on strongly fluctuating oil prices and increasingly uncertain oil imports. Given the fact that there are less and less easily accessible oil reserves, the oil sources being developed today are those whose exploitation is much more technology-intensive and thus more cost-intensive and in part significantly riskier than in the past. Development of independent bioethanol production thus contributes to the independence of Europe's energy supply.

DID YOU KNOW...

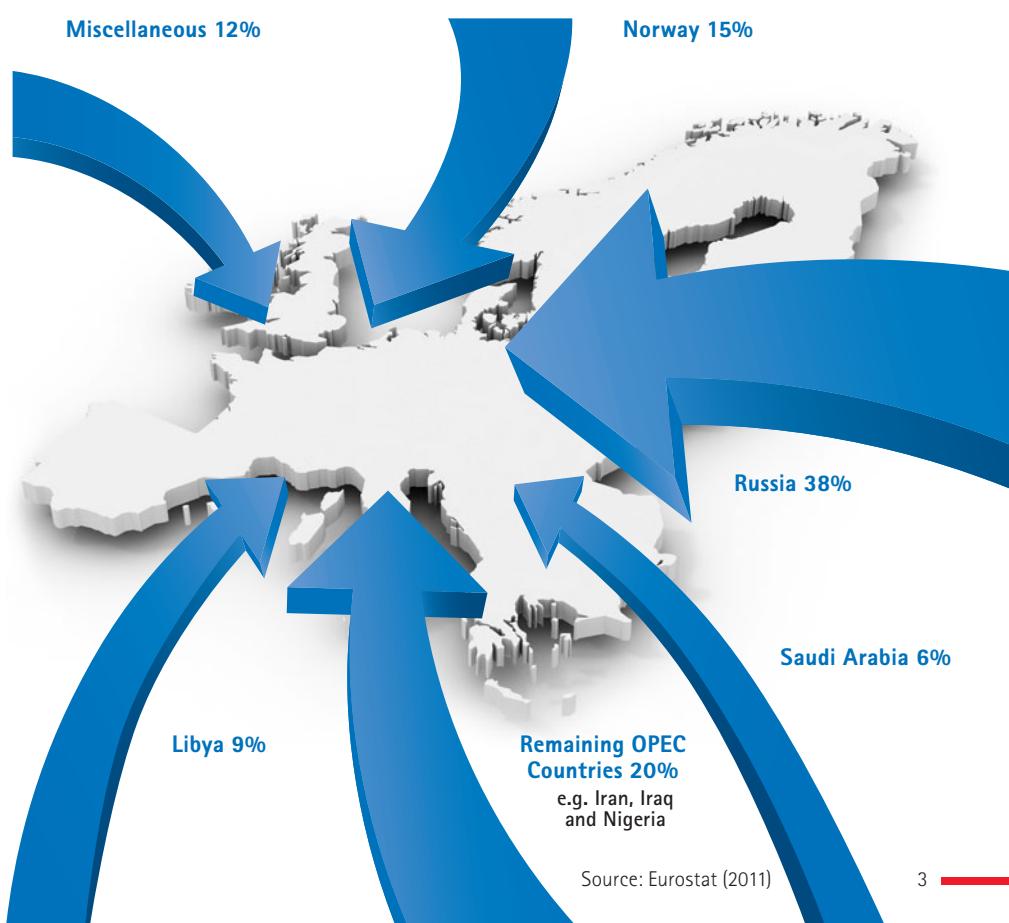
... that chemically, bioethanol is the same as ethylalcohol, known colloquially simply as "alcohol"? However, alcohol with a purity over 99 volume percent.

... that Henry Ford's and Nikolaus Otto's engines were able to run on bioethanol?

... that in 2010 almost 90 percent of the bioethanol being used for fuel is produced in the US and Brazil?

... that 1 cubic meter of bioethanol and 1 tonne of high quality dried protein animal feed can be obtained from 2.7 tonnes of grain?

Origin of the Net Imports of Petroleum and Oil Products into the EU-27 in 2009



Source: Eurostat (2011)



BIOETHANOL – FUEL FROM EUROPE FOR EUROPE

BIOETHANOL IS THE GLOBALLY MOST-USED BIOFUEL AND ITS SIGNIFICANCE CONTINUES TO INCREASE. IN THE EU, RENEWABLE ENERGY SOURCES SUCH AS BIOETHANOL ARE ALSO TO INCREASINGLY REPLACE FOSSIL FUELS IN THE TRANSPORT SECTOR IN THE FUTURE. THE OBJECTIVE IS TO REDUCE GREENHOUSE GAS EMISSIONS; FOR THIS PURPOSE, THE EU HAS PASSED THE RELEVANT DIRECTIVES WHICH HAVE THE AIM OF PROMOTING BIOETHANOL.

EU-FRAMEWORK CONDITIONS

With the "Renewable Energies Directive" which came into effect in 2009 the EU prescribed mandatory blending rates for renewable energies in the transport sector. Their proportion is required to increase to 10 percent of the energy content in the transport sector in all member states by 2020. It is up to the individual member states how to achieve this goal.

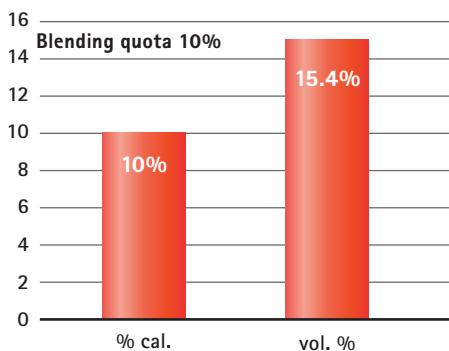
There are several approaches aimed at replacing fossil fuels with renewable energies through blending quotas or tax incentives. Use of bioethanol is one of the most important and most frequently applied methods of increasing the share of bioenergy because bioethanol is already available and can be used immediately.

NATIONAL ACTION PLANS SHOW MARKET POTENTIAL

All member states of the EU had to present by 30 June 2010 how they intended to achieve the mandatory shares of renewable energies. In order to provide an overview over the next few years and to guarantee a realistic trajectory, the member states set provisional targets along the path to 2020. If these plans are taken as the basis, the bioethanol market will grow to almost 15 million cubic

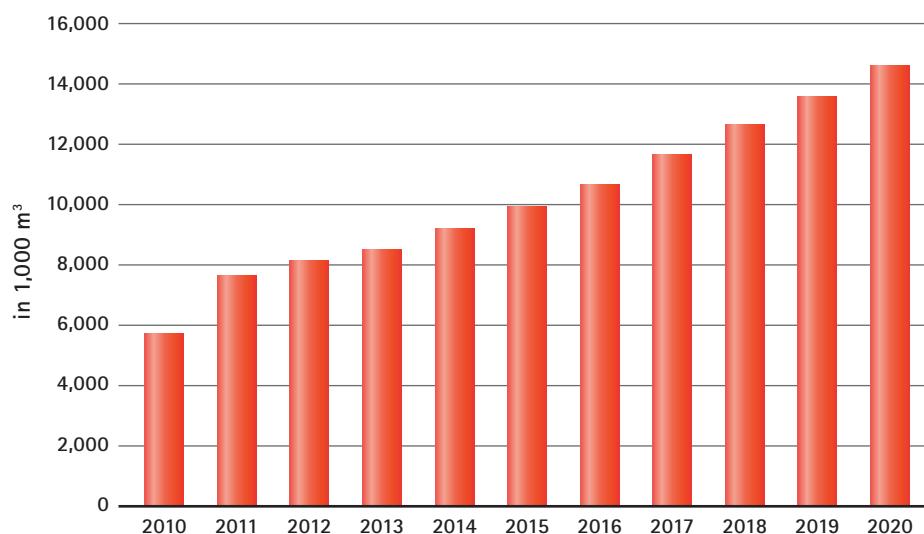
meters in the EU by 2020. This already takes the ambitious energy saving measures of the member states into account. The actual demand in 2020 is expected to be higher. If the 10 percent target is applied to the consumption of petrol currently anticipated, some 20 million cubic meters of bioethanol per year would be required in 2020.

Explanation of Energy Content (% cal.) and Volume Percent (vol. %)



A litre of bioethanol has an energy content of 21.06 megajoule, one litre of petrol an energy content of 32.48 megajoule. In order to replace the energy of one litre of petrol, 1.54 litres of bioethanol are required. In order to comply with the EU-blending target of 10 percent energy content, petrol would have to contain 15.4 volume percent of bioethanol (E15).

Development Bioethanol Use According to Action Plans



Source: Figures according to the national action plans of the EU-member states (2010)

“In the years to come, bio-fuels are the main alternative to petrol and diesel used in transport, which produces more than 20% pf the greenhouse gas emissions in the European Union.”

Günther Oettinger,
EU Commissioner for Energy

10 June 2010

AVAILABLE PETROL SUBSTITUTE

Bioethanol plays an important part in the plans of the member states for various reasons. In addition to the great potential for cutting greenhouse gas emissions, its availability is one of its key benefits. Technology for large-scale production has been developed to the stage that an efficient, economical supply is possible. Bioethanol from European production was at times already cheaper than petrol. As a reliable existing substitute, bioethanol can contribute towards balancing the strong fluctuations on the petrol market and act as a price dampener.

IMMEDIATE USE POSSIBLE

From the technical aspect, use of bioethanol in petrol engines is not a problem. Bioethanol is a widespread substitute for petrol in many countries of the world and has been used there for years. Automotive technology for use in all petrol engines is available. Whereas the prerequisites for the introduction of E10, i.e. petrol with 10 volume percent bioethanol were created in the EU in 2009, E15 is already being introduced in the US. There, E10 has already been available at petrol stations since 1972. In Brazil, standard petrol contains 20–25 volume percent bioethanol, depending on the market situation. The major

part of the newly registered vehicles there is even flexible with regard to the type of fuel and can run on petrol, pure bioethanol, or any type of blend thereof.

EXISTING INFRASTRUCTURE

In contrast to other alternative energy sources, such as electricity and gas, the existing petrol station and transport structure can be used for bioethanol. As liquid fuel it can be transported in the same way as petrol and served at regular petrol stations. In contrast to conventional petrol however, bioethanol reduces greenhouse gas emissions and is produced from renewable resources.

FRAMEWORK CONDITIONS FOR BIOETHANOL IN GERMANY

■ Biofuel quotas

The petroleum industry is obligated to add 6.25 percent of biofuels, with regard to energy content. In addition, specific quotas for petrol and diesel fuel of 2.8 or 4.4 percent of energy content are applied. Starting in 2015, the systems will be adapted to greenhouse gas emission targets. Through use of biofuels the petroleum industry must achieve reduction of greenhouse gas emissions of 3 percent of the fuels on the market, 4.5 percent as from 2017 and 7 percent as from 2020.

■ Taxation of bioethanol

Bioethanol used to meet bioethanol quotas is subject to energy tax to the full extent. Bioethanol used for the production of E85 and not to fulfil the quota will in contrast be tax-privileged until 2015.

■ Implementation of the 10 percent target of the EU in 2020

Germany plans on reaching the EU targets with the existing provisions. The German government anticipates a demand of approx. 1.7 million cubic meters of bioethanol in 2020.

DID YOU KNOW...

... that in 2010, bioethanol replaced more than 20 million barrels of oil in the EU?

... that E10 is the standard petrol in the US?

... that in Brazil over 85 percent of the newly registered vehicles are flexible for any type of fuel and are able to run on up to 100 volume percent bioethanol?

BIOETHANOL – CERTIFIED SUSTAINABLE



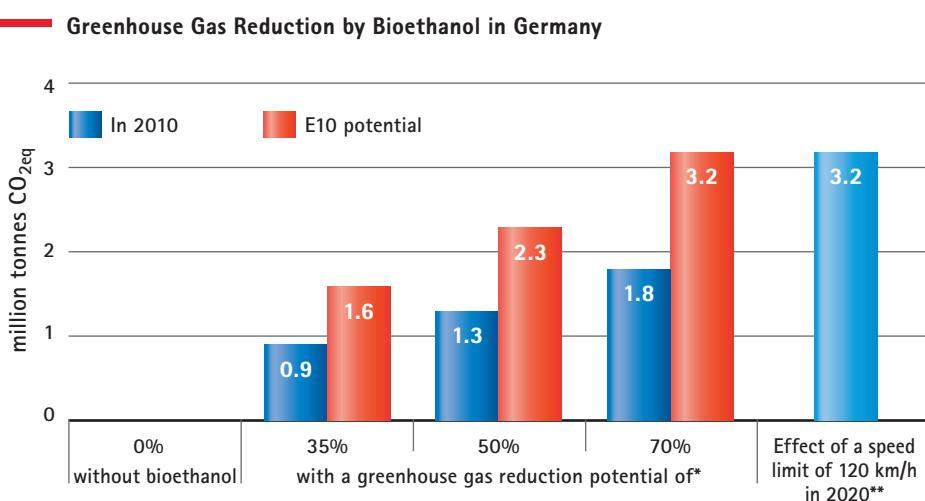
BIOETHANOL SAVES LARGE AMOUNTS OF GREENHOUSE GAS EMISSIONS IN THE TRANSPORT SECTOR IF THE RAW MATERIALS ARE CULTIVATED AND PROCESSED SUSTAINABLY. THE ACHIEVABLE REDUCTIONS IN GREENHOUSE GAS EMISSIONS ARE AMONG OTHER THINGS DEPENDENT ON THE RAW MATERIALS BEING USED, THE TECHNOLOGY BEING APPLIED, AS WELL AS THE ENERGY AND CO-PRODUCT CONCEPT. THE GERMAN BIOETHANOL INDUSTRY ASSOCIATION ESTIMATES THAT GERMAN-PRODUCED BIOETHANOL IS ALREADY REDUCING GREENHOUSE GAS EMISSIONS BY MORE THAN 50 PERCENT IN COMPARISON WITH PETROL.

LEGAL REQUIREMENTS

In order to ensure that biofuels such as bioethanol adequately reduce greenhouse gas emissions, the EU issued the relevant provisions in the "Renewable Energies Directive". These sustainability criteria prescribe that biofuels used in the EU reduce greenhouse gas emissions by at least 35 percent in comparison with the reference value for fossil fuels. Starting in 2017, the emissions must be cut by 50 percent, starting in 2018, by 60 percent in new plants.

For the calculation of the greenhouse gas balance, the EU has stipulated strict regulations which ensure that damage to the environment in the transport sector is significantly decreased. Calculation is per megajoule, comprising potential differences in energy content of different fuels. The principle is simple: At every stage of biofuel production the amount of greenhouse gas emissions is calculated, from the harvest and fertilizing of the energy plants through transport of the raw materials and their processing in modern bioethanol plants down to use of the finished fuel in the engine. The total emissions calculated are then compared with the reference value for petrol.

In addition to the regulations for the CO₂-reduction, further social and environmental standards must be complied with in the cultivation of the raw materials for production of the fuel. Cultivation of raw materials in areas with high biodiversity value such as forests, grassland and peatland is prohibited. The requirements for bioethanol thus exceed those mandatory in the EU for food and animal feed.



In the case of nation-wide distribution of E10, bioethanol, which cuts 70 percent of greenhouse gas emissions, reduces CO₂-emissions by 3.2 million tonnes per year.

* Own calculations on the basis of petrol consumption (domestic) 2010

** Source: Federal Environmental Agency (2010)

CERTIFICATION

Bioethanol producers must prove since 2011 that they comply with EU-regulations. This is done via a relevant certification by an independent expert in accordance with a licensed certification system. In regular, independent audits, the experts inspect the origin of the raw materials and the processing thereof in the respective bioethanol plants. Calculation of the greenhouse gas emissions reduction is examined. The farmers are required to

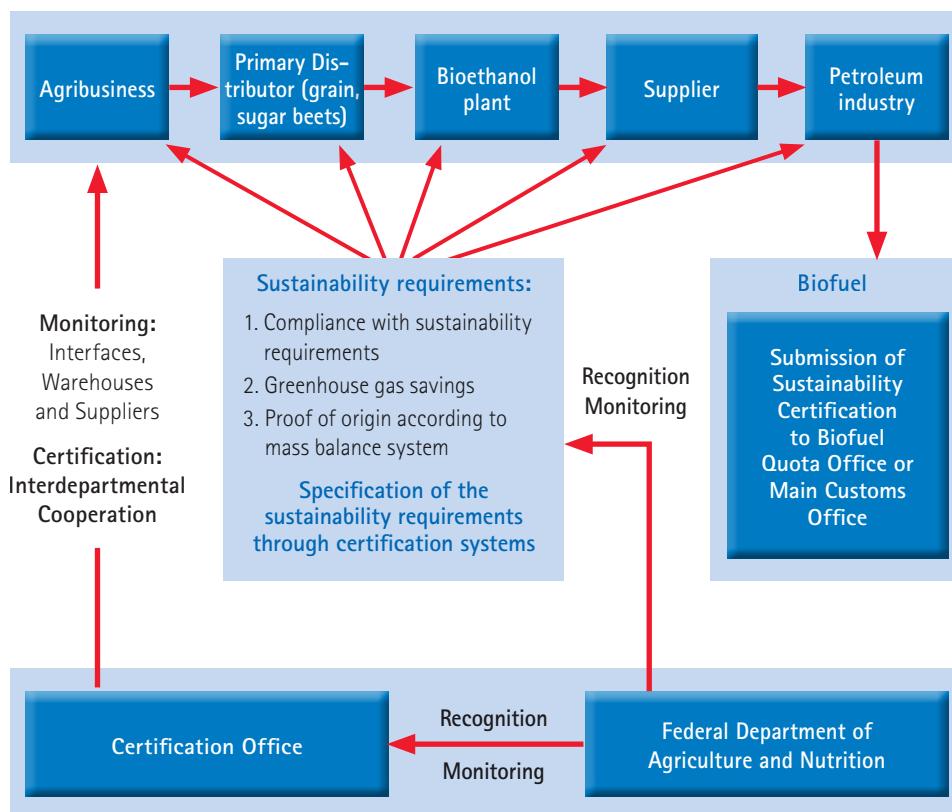
document the sustainability of their cultivation. Only biomass cultivated sustainably can be processed to certified bioethanol.

The respective regulations include among other things regulations regarding the admissible amount of fertilizer and pesticides per hectare and the protection of grasslands.

SUSTAINABILITY FOR REACHING THE QUOTA

In order to reach 10 percent of renewable energies required in the transport sector by the EU, only biofuels from production that is proven to be sustainable may be included. This applies to fuels regardless of their origin. In this way it is ensured that biofuels actually reduce the emission of greenhouse gases and make a significant contribution towards climate protection.

What does Certification Comprise?



On the basis of the Federal Institute for Agriculture and Nutrition.

“Biofuel can be an important building block for climate-friendly transformation of the transport sector, provided that the fuel is produced sustainably. E10 is the first step toward this. In order to prevent a negative impact on climate and species protection, however, not only biofuels but all agricultural raw materials will soon have to comply with sustainability criteria.”

**Martina Fleckenstein,
Head of Agriculture, WWF Germany**

7 March 2011

DID YOU KNOW...

... that grain for bioethanol and animal feed requires less fertilizer than grain for flour for the baking industry?

... that the sustainability regulations apply to all bioethanol volumes used as fuel in the EU, i.e. also to imported goods?





BIOETHANOL – ECONOMICAL CLIMATE PROTECTION

BIOETHANOL IS AN EFFECTIVE TOOL FOR REDUCING GREENHOUSE GAS EMISSIONS IN ROAD TRAFFIC. ALREADY TODAY, BIOETHANOL IS AVAILABLE AT A SIMILAR PRICE AS THAT OF PETROL. WITH EVERY LITRE OF BIOETHANOL, THE CONSUMER IS GETTING MORE CLIMATE PROTECTION AT A COMPARABLE PRICE. AT THE SAME TIME, ITS USE AS A SUBSTITUTE FOR PETROL CREATES JOBS AND INCREASES LOCAL VALUE ADDED, AS THE BIOETHANOL USED IN THE EU IS PREDOMINANTLY PRODUCED FROM LOCAL SOURCES IN EUROPEAN PLANTS.

“The introduction of biofuel is expedient, in order to make mobility sustainable too. In times of high oil prices, biofuels can replace at least a part of the oil imports, thus reducing dependency on unpopular supplying countries.**”**

Prof. Dr. Claudia Kemfert, Head of Energy Department at German Institute for Economic Research (DIW Berlin)
March 14, 2011

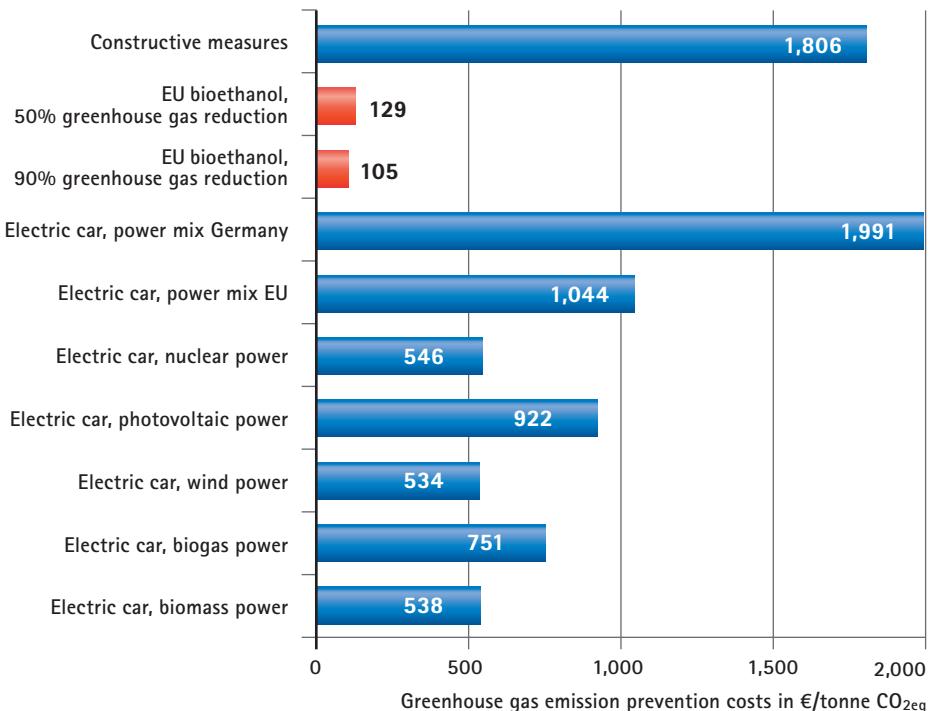
LOW GREENHOUSE GAS EMISSION ABATEMENT COSTS

For reduction of greenhouse gas emissions in road traffic there is currently no alternative for biofuels such as bioethanol. In comparison with other mobility concepts such as electrical mobility or constructive measures in vehicle construction, bioethanol as a petrol substitute has the great advantage of the reduction of greenhouse gases in a short period of time without significant financial burdens. In Germany alone, use of E10 can improve the climate balance of 28 million vehicles. In the case of nation-wide distribution, use of E10 cuts at least 1.6 million tonnes of CO₂ per year. The costs for greenhouse gas emission reduction using bioethanol are relatively low due to a great savings potential and the price competitiveness in comparison with petrol. With rising petrol prices and the development of efficient bioethanol plants this advantage will continue to increase.

INEXPENSIVE CLIMATE PROTECTION

With every litre of bioethanol the consumer fills up on verifiably more climate protection, increasingly with no extra charge. Bioethanol has become a competitive alternative and was in part cheaper than petrol in the past. For the consumer, in addition to the price, consumption is also a decisive factor. Bench tests made upon the launching of E10 have shown that this fuel in comparison with petrol with 5 volume percent bioethanol does not necessarily lead to a higher consumption. The reason for this is among other things the good combustibility of bioethanol.

Greenhouse Gas Abatement Costs on Short Distances



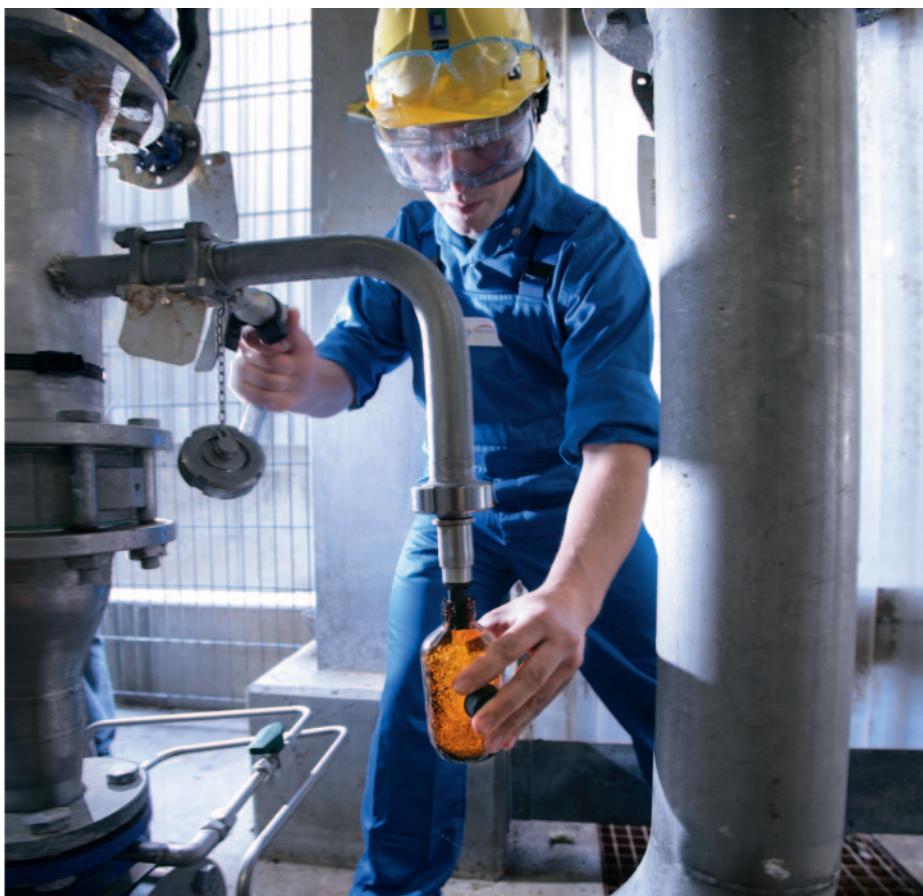
Source: Klenk, I. / Kunz, M. (2008): European bioethanol from grain and sugarbeet from an economic and ecological viewpoint, in: Sugar Industry, Vol. 133.

With bioethanol produced in the EU prevention of one tonne of CO₂ costs least compared to other measures.

Results: Bench Test

VW Golf VI, 90 kW, BJ 11/2009	Premium 98	Premium (E5)	Premium (E10)
RON	98.3	95.8	97.3
Efficiency	101.2 kW	100.8 kW	103.4 kW
Consumption per 100 km	5.60 l	5.44 l	5.48 l

Source: Exhaust emission and fuel consumption according to EU Directive 715/2007-692/2008 (Euro 5)-NEDC, New European Driving Cycle, performed in March 2011



MORE INCOME AND JOBS

The development of domestic bioethanol production not only reduces dependency on oil imports, but at the same time creates more jobs and added value. The European Producers Union of Renewable Ethanol (ePURE) estimates that some 1,500 jobs are created through the production of 100 million litres of bioethanol. The European bioethanol industry currently employs some 75,000 people. With the 10 percent target of the EU, an increase of employment to over 250,000 people is anticipated.

In addition, there are numerous indirect employment opportunities along the entire value-added chain. The use of E10 fuel in Germany alone offers a market potential of approx. 2.4 million cubic meters of bioethanol. In this way 35,000 jobs are created, predominantly in rural areas and thus frequently areas with a weak infrastructure. According to calculations by the ifo-Institute in Munich, domestic value-added increases by more than 2 billion Euro per year in the form of wages and salaries.

With the production and use of bioethanol in Europe not only employment and income increase, but the high import costs of crude oil for the production of fossil fuels are reduced as well. Using 2.4 million cubic meters of bioethanol is equivalent to a crude oil volume of some 9 million barrels, which at an oil price of 120 US-\$ per barrel, would have to be imported for 1 billion US-\$.

DID YOU KNOW...

... that fuel ethanol cost less than petrol on the Rotterdam market in April 2010?



BIOETHANOL PRODUCTION – FOR FOOD, FUEL, AND FEED

EUROPEAN BIOETHANOL MANUFACTURERS PRODUCE FOOD, FUEL, AND FEED. IN ADDITION TO THE PETROL SUBSTITUTE BIOETHANOL, VALUABLE PROTEIN FOOD AND ANIMAL FEED IS OBTAINED FROM THE RAW MATERIALS AS WELL AS FURTHER USEABLE CO-PRODUCTS. IN THIS WAY, BIOETHANOL PRODUCED IN EUROPE NOT ONLY CONTRIBUTES TOWARD FILLING AN ENERGY GAP IN THE EU BUT ALSO TOWARD IMPROVEMENT OF THE SUPPLY OF VEGETABLE PROTEIN.

PROTEIN DEFICIT IN THE EU

In 2010, 275 million tonnes of grain were harvested in the EU. Only 9 million tonnes were used for the production of bioethanol. The major part was used as animal feed. However, farm animals have an increased demand for protein which cannot be met e.g. by grain alone. Here, animal feed with a high share of high-quality protein is used. Whereas the EU traditionally produces more carbohydrate-based agricultural products such as grain and sugar than it needs, it is dependent on the import of vegetable protein. In 2009, for example 42 million tonnes

or 70 percent of the required amount of protein-rich raw material had to be imported. Domestic bioethanol production can reduce this dependency and improve the supply situation. For obtaining bioethanol only the starch and sugar components of the raw materials are needed; the rest – proteins, fibres, and fats – can be refined into food or animal feed and returned to the food chain. In bioethanol production, the raw materials are fully utilized for food, fuel, and feed.

DDGS

(Dried Distillers' Grains with Solubles)

Dried, pelleted stillage from grain distillation. Contains a large amount of protein and fat: tasty food for cattle, pigs, and poultry.

Sugar beet vinasse

Liquid feed from protein of fermented sugar syrup remaining after fermentation. Easy to digest feed for dairy cows and beef cattle.



RELEASE OF CULTIVATION SPACE

From a total of 1 hectare of wheat 2.6 tonnes of vegetable protein are obtained in addition to 2.8 cubic meters of bioethanol. In order to produce the same amount from soy, 1.3 hectares would have to be cultivated. Also in the case of processing of sugar beets into bioethanol the residue is further processed into valuable animal feed, thus contributing to the nutrition of Europe. In contrast to what critics of biofuels often claim, bioethanol production does not decrease the area available for food production, on the contrary, areas in other countries are released for the cultivation of additional raw materials.

Calculation of Area Released		
	Grain	Soy
Yield per year and hectare (in tonnes)	7.5	2.7
Yield DDGS (as co-product of bioethanol production)/ Soy meal (in tonnes)	2.639	2.192
Useable raw protein per tonne DDGS/Soy meal (in kilogram)	269	253
Useable raw protein per hectare (in kilogram)	709.86	554.58

Source: Klenk/Kunz (2008): Sugar industry

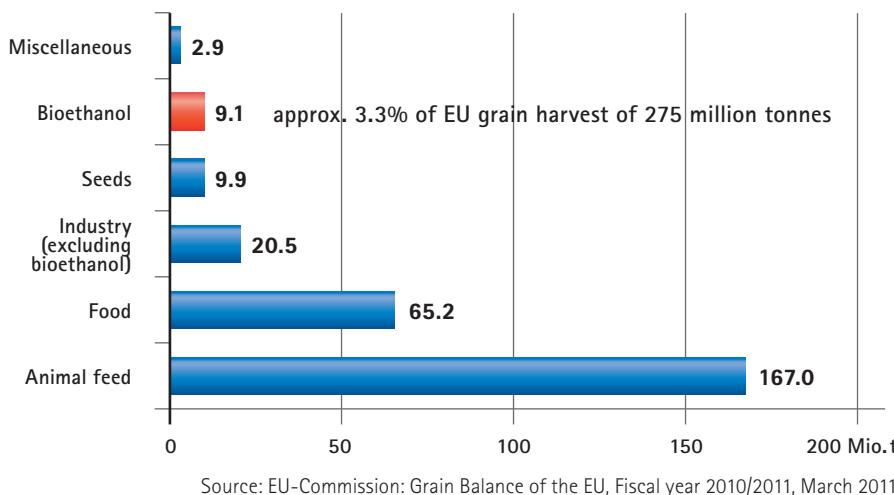
In order to obtain 710 kilograms of useable raw protein from soy meal, 1.3 hectares of soy would have to be cultivated.

DID YOU KNOW...

... that the EU-Commission expects that the EU will remain a net exporter of grain even when the 10-percent target is met?

... that wages and energy costs make up a significantly greater part of the price of bread than the actual grain costs?

Use of EU Grain Harvest 2010/11e



Source: EU-Commission: Grain Balance of the EU, Fiscal year 2010/2011, March 2011

“ In bioethanol production, large quantities of animal feed are produced at the same time. Domestic bioethanol production reduces the European import of protein animal feed for example such as from South America. **”**

Gerd Sonnleitner,
President of the German Farmers Association

31 March 2011

Broad Range of Food and Animal Feed from Bioethanol Production

CDS (Condensed Distillers' Solubles)

Liquid animal feed from protein residue and other components of fermented grain of wheat after distillation. Is used as protein supplier for cattle and pigs.

Gluten

Processed protein, part from endosperm of grain of wheat. Used as protein source in the baking industry or in aquaculture.

Wheat bran

Hull of the wheat grains separated during grinding. Contains protein, carbohydrates, fibres, minerals, and vitamins. Animal feed for all farm animals and fibre source for humans.

Sugar beet pulp

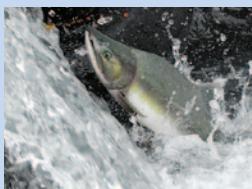
Produced when manufacturing bioethanol from sugar beets. High-energy feed for cattle, pigs, sheep, and horses.

Yeast

Fermentation aid in bioethanol production. Superfluous yeast cells are expelled and sold as food or for food processing.

Carbon dioxide

Carbon dioxide produced in fermentation is used in purified liquid form in food and beverage production.





GREATER SELECTION OF RAW MATERIALS

Large bioethanol plants today process agricultural raw materials such as grains or sugar. Some of the plants are already designed in such a way that they can run on various raw material combinations. In order to make more biomass useable for the production of ethanol, research and development deals with production of bioethanol from lignocellulose i.e. wood or straw. There are currently different technologies in the trial stage, being tested in pilot and demonstration plants. In future, these technologies are to be applied on a large-scale production.

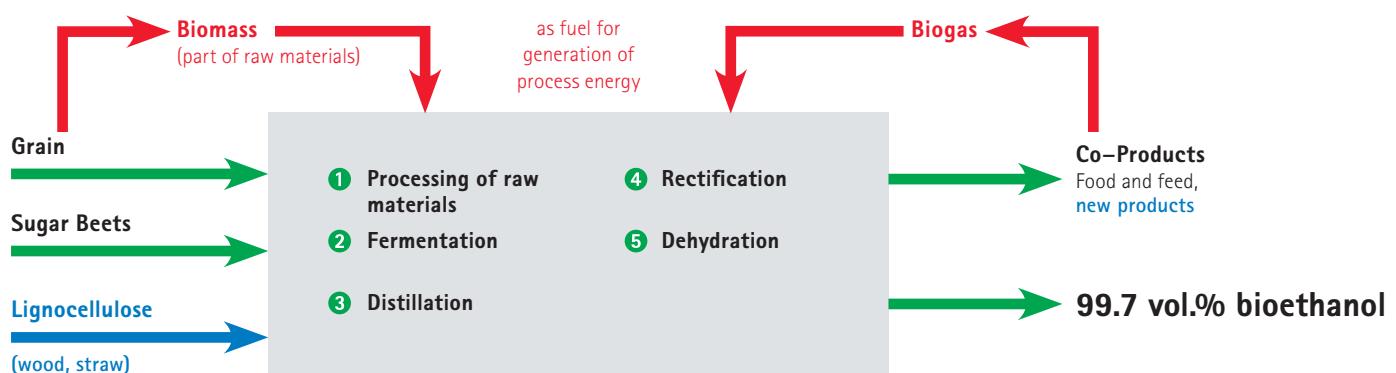
GREATER GREENHOUSE GAS REDUCTIONS

The plants require energy for the production of bioethanol. This energy in the form of heat and power comes predominantly from fossil fuels such as coal and gas. Increasingly, biomass-based concepts are being applied. For example, parts of the raw materials, such as the wheat bran not used for bioethanol production directly substitutes coal and gas as fuel for energy generation. Other production plants use the co-products from bioethanol production energetically, generating biogas. Both approaches further improve the greenhouse gas balance of bioethanol and save fossil fuels. Other developments have the target of further diminishing the amount of energy used in the production process such as through the improved use of waste heat.

BIOETHANOL – ENERGY SOURCE WITH PERSPECTIVE

BIOETHANOL TODAY IS MANUFACTURED PRIMARILY FROM AGRICULTURAL RAW MATERIALS AND USED AS A PETROL SUBSTITUTE. THE GLOBALLY USED TECHNOLOGY FOR THE PRODUCTION OF BIOETHANOL IS FULLY DEVELOPED AND HIGHLY EFFICIENT. BOTH IN PRODUCTION AND IN USE OF BIOETHANOL, THE DEVELOPMENTS CONTINUE IN ORDER TO OPTIMISE THE PRODUCTION AND USE OF BIOETHANOL.

Optimisation Possibilities in Bioethanol Production



GREATER EFFICIENCY IN THE AUTOMOBILE SECTOR

Bioethanol is characterised by a high octane number of at least 109 ROZ, favourable combustibility as well as a high degree of vaporized heat in combustion. These characteristics allow a better exploitation of the

energy in the fuel, in particular in highly charged spark ignition engines. Greater shares of bioethanol in the fuel enable the automotive industry to achieve the same engine power with smaller engines with lower consumption.

But bioethanol fuel also plays a part in electro mobility. For example, Opel uses E85 in its electric car as fuel for a combustion engine that charges the storage battery, expanding the range.



“The combination of a large amount of vaporization heat and a high octane number makes bioethanol an efficient fuel for high-performance engines – not only for the racing track.”

**Patrick Brenndörfer,
Champion of the 24h race at the
Nürburgring 2010 in a bioethanol car.**

15 April 2011

DID YOU KNOW...

... that more than 60 billion litres of bioethanol from lignocellulose are to be blended in the US in 2022?

... that bioethanol is highly suited for use in fuel cells due to its high energy density?

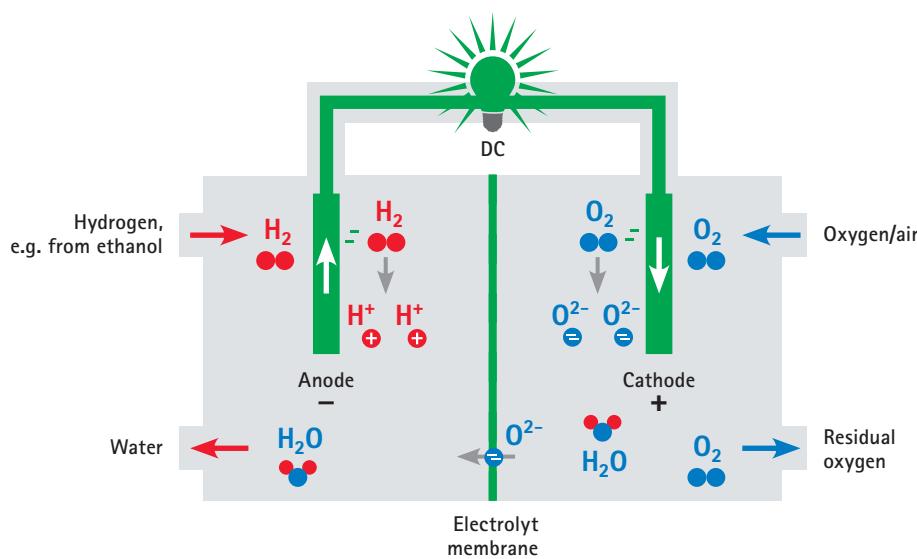
ELECTRICITY FROM BIOETHANOL

The significance of bioethanol as a renewable energy source will continue to increase in other areas of energy supply. Research is being carried out today into new areas of application. Bioethanol could for instance be used in fuel cells which directly transform it into electricity without noise or odour emissions. This type of low-maintenance fuel cells is particularly suitable for supplying electricity to electrical appliances in remote

and sensitive areas that are away from the power grid. The opportunities for use of this type of technology cover power supply of remote telecommunications plants or construction sites as well as outdoor leisure activities such as camping. The durable bioethanol fuel cells are a reasonable, low-maintenance alternative to battery systems or diesel engines.



Diagram of Fuel Cell Using the Example of Hydrogen



In a fuel cell, transformation of hydrogen and oxygen into water takes place in two chambers separated by a membrane (anode and cathode). Ethanol may also be used instead of hydrogen. Then carbon dioxide is produced additionally. The membrane not only separates the two chambers spatially, but also makes an electrical connection between them. "Ions" (such as oxygen ions) flow through the membrane.

An electrical consumption device connected to the fuel cell (electric motor) is able to use the electrical energy released in the reaction directly. For the user, the functioning of the fuel cell is like that of a battery which is not discharged but is continuously supplied with a fuel (hydrogen or ethanol).

CROPENERGIES – INNOVATIVE, SUSTAINABLE, AND PROFITABLE



CROPENERGIES AG IS ONE OF THE LARGEST BIOETHANOL PRODUCERS IN EUROPE, SETTING BENCHMARKS WITH REGARD TO TECHNOLOGY, EFFICIENCY, FLEXIBILITY, AND GREENHOUSE GAS REDUCTION IN ITS PLANTS IN BELGIUM, GERMANY, AND FRANCE. SINCE THE INITIAL PUBLIC OFFERING IN SEPTEMBER 2006, CROPENERGIES HAS CREATED A UNIQUE PRODUCTION AND LOGISTICS NETWORK IN EUROPE, TAKING A LEADING POSITION AMONG THE EUROPEAN BIOETHANOL PRODUCERS AND HAS PRODUCTION CAPACITIES TODAY OF OVER 700,000 CUBIC METERS OF BIOETHANOL AND OVER 500,000 TONNES OF FOOD AND ANIMAL FEED PER YEAR.



Bioethanol as fuel



Bioethanol for traditional and technical applications



ProtiGrain®



ProtiWanze®



Gluten



Liquefied carbon dioxide

ATTRACTIVE PRODUCT PORTFOLIO

In addition to bioethanol as a petrol substitute, CropEnergies also produces bioethanol for traditional and technical applications, i.e. for the beverage industry, but also for the cosmetics and chemical industry. The non-fermentable components of the raw materials

are refined by CropEnergies into high-quality food and animal feed. ProtiGrain®, pelleted animal feed for cattle, pigs, and poultry, ProtiWanze®, liquid animal feed for cattle and pigs as well as gluten, which is used both in the baking industry and as animal feed, e.g. in aquaculture.

Since 2010 CropEnergies has been purifying and liquefying CO₂ from the bioethanol plant in Zeitz and has been marketing it e.g. for carbonic acid in the beverage industry.

Südzucker pilot plant for bioethanol production in Ochsenfurt

Production start of the plant in Zeitz

First-time supply with E85 (CropPower85)

Formation of CropEnergies AG and IPO in September

■ 1983



■ 2005



■ 2006



LEADING TECHNOLOGY POSITION THROUGH SITE-OPTIMIZED PRODUCTION PLANTS

CropEnergies sets benchmarks in the areas of technology and innovative power. The production plants are characterised by a high degree of efficiency, reduction of greenhouse gas emissions, flexibility in raw material processing as well as innovative co-product concepts. The production and co-product concepts are adapted exactly for each site. The selection and availability of the raw materials being used, the type and marketing of the co-products refined into food and animal feed products, logistical organization and development of markets, in all these areas CropEnergies has not chosen a standard one-fits-all solution but implemented the corporate philosophy of adapting every production plant to its site. CropEnergies has created a unique production and logistics network in Europe and takes a leading position among bioethanol producers with regard to profitability and sustainable economy.

PROFITABLE GROWTH THROUGH SUSTAINABLE BUSINESS

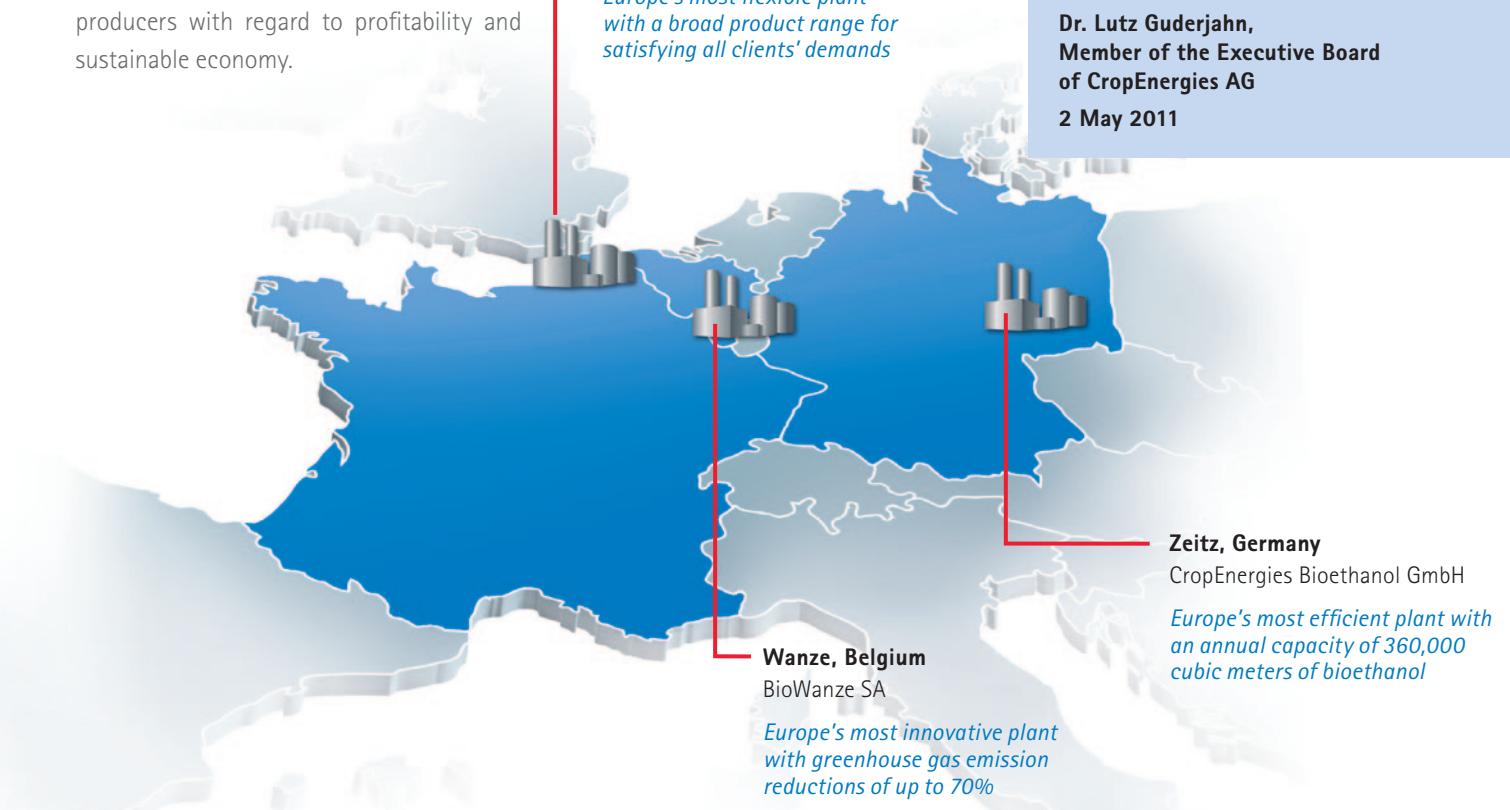
Sustainable business is a key element of the business model of CropEnergies and the basic prerequisite for profitable growth. As a company in the area of renewable energies, CropEnergies is already working today towards solutions for the social and corporate challenges of tomorrow. CropEnergies has the goal of creating sustainable values and of further strengthening its leading position on the growing European bioethanol market.

- ... that the bioethanol plants in Zeitz and Wanze are certified as sustainable?
- ... that the required production energy in Wanze in a biomass boiler is made from a part of the supplied biomass?
- ... that CropEnergies is the German market leader with the E85-fuel CropPower85 introduced in 2006?
- ... that with 71% Südzucker AG is the majority shareholder of CropEnergies?
- ... that Südzucker AG already started operation of a pilot plant for the production of bioethanol in 1983?
- ... that CropEnergies is listed on the Prime Standard of the Frankfurt Stock Exchange?

“CropEnergies is a good example for how values and growth can be created through responsible and sustainable business.”

**Dr. Lutz Guderjahn,
Member of the Executive Board
of CropEnergies AG**

2 May 2011



Completion of expansion of the plant in Zeitz

Acquisition of Ryssen Alcools SAS in Loon-Plage, France

Production start in Wanze, Belgium

Start of construction and completion of the CO₂ liquefaction plant in Zeitz

■ 2008



■ 2010

CROPENERGIES AG MANNHEIM (GERMANY)

AN OVERVIEW OF THE COMPANY:

Founded in 2006

Headquarters in Mannheim, Germany

Product Portfolio

Bioethanol:

for fuel applications
for technical applications
for traditional applications

Food and animal feed:

ProtiGrain® (DDGS)
ProtiWanze® (CDS)
Gluten
Liquefied carbon dioxide

Production Sites

Zeitz, Germany
Wanze, Belgium
Loon-Plage, France

Production Capacities (per annum)

> 700,000 m³ bioethanol
for fuel application
80,000 m³ bioethanol
for technical and traditional applications
260,000 t ProtiGrain®
> 200,000 m³ ProtiWanze®
> 55,000 t gluten
100,000 t liquefied CO₂

Stock Exchange Listing Prime Standard



Zeitz, Germany



Wanze, Belgium



Loon-Plage, France

CropEnergies – a member of the Südzucker group – is a leading European producer of sustainably produced bioethanol for the fuel sector. "Crop" stands for "creative regeneration of power": energy in the form of bioethanol is obtained from sustainable raw materials – grain and sugar beets. In addition, CropEnergies refines the co-products from the bioethanol production into high-quality food and animal feed products.

CropEnergies is a pioneer on the German bioethanol market and is strengthening its position throughout Europe. With three modern production sites, CropEnergies has established an efficient production and distribution network in the European growing market of renewable energies. The shares in CropEnergies AG (ISIN DE000A0LAUP1) are listed in the regulated market on the Frankfurt Stock Exchange (Prime Standard).

