UNION ZUR FÖRDERUNG VON OEL- UND PROTEINPFLANZEN E.V.

Biodiesel 2015/2016

Report on the current situation and prospects – extract from the UFOP annual report

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List of tables and Figures in the report

Table of contents

Tables

Figures

Biodiesel & Co.

The reporting period has been particularly challenging in terms of climate policy. Not in terms of increasingly common severe local weather events in Germany as well as other European countries, nor in terms of the weather phenomenon El Niño, even though some African countries such as Malawi have been particularly affected, with the government having to declare a state of emergency in light of ongoing drought and famine. In January 2016, NASA reported that the average atmospheric content of CO_2 is continuously exceeding 400 ppm, thereby signifying that this value which was first measured in 2014 has continued to persist at this level. In regards to greenhouse gas (GHG) development, the air is becoming more and more contaminated and the international community is running out of time to implement meaningful global climate-protection measures. Much time has passed since the first UN Climate Change Conference in Rio de Janeiro in 1992. The first legally binding international climate protection agreement signed by 175 States didn't come into existence until the end of the Paris climate change conference in early December 2015, with the international community taking on the goal of limiting global warming to well under 2°C in comparison to pre-industrial levels and endeavouring to restrict global warming to 1.5°C. The signatory states have until 2020 to submit binding national plans of action. The federal government is strategically driving this process forward within Germany as well as in the EU.

In October 2014, the EU Heads of State and Government set the following binding targets to be met by all Member States by 2030 and confirmed in March 2016: A reduction of greenhouse gas emissions by 40 %, the achievement of a minimum proportion of 27 % renewable energy in the total energy consumption as well as the simultaneous increase in efficiency by 27 %. With the Commission proposal's for a so-called effort-sharing ordinance, the EU is increasing the pressure to take real action in terms of climate policy. After all, in contrast to the Climate Action Plan 2020, the mandatory annual GHG reduction targets for the period 2021 to 2030 are based on the respective performance of the Member States (indicator: federal domestic product per head). For this reason, Germany must reduce the GHG emissions by at least 38 %. Due to the withdrawal of Britain from the EU, the targets must however be revised and/or redistributed accordingly. Economic sectors which do not fall under the realm of the Emissions Trading Scheme (ETS), such as agriculture, forestry, etc. are among those affected. Keyword: LULUCF (Land use, land use-change and forestry).

This proposal, which is now under examination by the Member States, means that the majority of Member States have to meet targets which are well below the total binding targets for the EU. In order to finally meet the overall target to reduce greenhouse gases, the option for Member States to carry over 'excess emission reductions' to the subsequent year or, in the case of not meeting targets, offset reductions among each other, is also being created at the same time.

As one of the largest emitters of greenhouse gases in the EU, the federal German government was a step ahead of this process of coordination, by already considering a compensation buffer in the 2013 coalition agreements. The new federal government agreed that Germany should already fulfil the predetermined GHG reduction of 40 % by 2020(!). It also declared its commitment to adopt the Paris Climate Conference's results of 'a target reduction of greenhouse gases by up to 80 – 95 % compared to 1990 levels and support these targets through measures based on a broad-based process of dialogue (Climate Action Plan 2020 and 2050)'.

As a result, the Federal Environment Ministry (BMUB) responsible for the 'Climate Action Programme 2020' within the federal government rigorously set the wheels in motion for this change with the first package of necessary measures (see Annual Report 2014/2015, p. 44). Despite repeated industry criticism, the entire bioenergy sector played no role in the package. Within this context, Helmut Lamp, the former chairman of the German Bioenergy Industry Association (BBE), lodged an urgent appeal with the members of the relevant committees in the German Bundestag in September 2015. In his statement, the BBE Chairman explained the outstanding position that bioenergy finds itself in as a source of energy as compared to other renewable energy sources such as photovoltaics and wind power. The high level of integration into different distribution systems, storage capacity and thus also its 'ability to be drawn upon' by the mains supply, but above all because of the high energy density of biofuels (transportability), make biomass from cultivated biomass and residual materials and waste stand out in terms of its level of substitutability and usability. Nevertheless, the association managed to close ranks in the final moments to implement significant changes in the amendment process of the 2016 Rnewable Energy Law (EEG) for the generation of electricity from biogas.

Climate Action Plan 2050

Simultaneous to the development of the 'Climate Action Programme 2020', the Federal Environment Ministry initiated another process of dialogue half way through 2015, incorporating the involvement of economic and agricultural associations, non-governmental organisations and representatives of the federal states and municipalities as well as the public. The UFOP also participated in this process of dialogue. The 350-page comprehensive catalogue of measures was submitted to Federal Environment Minister Barbara Hendricks in the middle of March 2016. The 'Area of focus: Agriculture/land use' (including forestry) incorporate the following measures as well as others: Climate-friendly fertiliser strategy, structure and stabilisation of humus content in agricultural soils, national grazing land strategy to increase carbon stocks in agricultural soils, reduction of sealing of land, reactivation of wetlands as carbon sinks.

In addition to aspects to develop public transport, expand cycle paths and thereby promote a modal shift, the chapter 'Area of focus: Transport' contains measurements which endeavour to ambitiously continue or reduce CO_2 limits for passenger cars and light commercial vehicles, establish efficiency standards for heavy-duty vehicles and promote electromobility. In the UFOP's view, it's disturbing that biofuels only play a minor strategic role considering their ability to act as a bridge in the field of higher CO_2 reduction goals per kilometre. As a result, the chairman of the UFOP made a written appeal to the relevant committees in the German Bundestag that sustainably certified biofuels introduced to market must be factored into an overall strategy. The greenhouse gas target reduction reached thus far as a result of efficiency competition and the quality of the implementation and documentation of sustainability requirements sets an example of how other areas can use renewable resources. The writing accompanying the UFOP position paper 'Climate Change Action Alliance 2020/2050 – Sustainable Biofuels Belong Too' [Klimaschutz-Aktionsbündnis 2020/2050 – Nachhaltige Biokraftstoffe gehören dazu!] justifies the argumentation for continued biofuel policy within the framework of the national climate strategy.

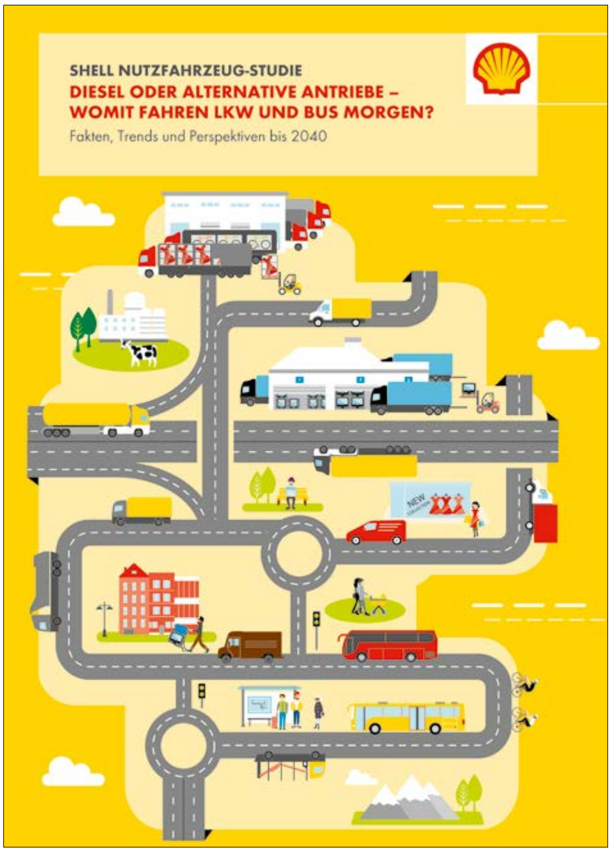
The BMUB's catalogue of measures exclusively prefers implementing electrification through so-called plug-in hybrid vehicles all the way to vehicles solely powered by batteries. Over the long run, renewable liquid fuels (including the needs of air travel) should be exclusively produced from renewable electricity from wind power and photovoltaics. Conversely, this means that individual transport must be considerably cut down, so that renewable electricity needs can be met in conjunction with increases in efficiency (see UFOP Annual Report 2014/2015, p.35). In the case of wind power, the question surrounding its potential to be expanded and thereby deliver electricity , even in relevant wind regions accepted by the public, has long since existed. While NGOs in Berlin or Brussels highly publicise against biofuels, efforts to deal with local nature and environmental issues, also in relation to necessary grid expansion, have been given considerably less attention. The German Farmers' Association used this context to successfully lobby for limiting the conversion of arable land for use as photovoltaic surfaces, for example.

The UFOP criticised that the studies conducted on behalf of the BMUB and based on its process of dialogue were not subjected to scientific evaluation procedures. Estimates, calculations and results ultimately lead to measurements being proposed that could not be fully accepted by trade associations. It didn't take long for public criticism to arise, a leading German newspaper even announced the existence of a 'climate dictatorship'. In fact, it may even be asked whether this national commitment is worth it if Germany's share of global GHG emissions accounts for only 2.5 % and China's share is 29 %. China managed to assert itself in the new global climate treaty, not having to make any contribution to CO_2 reductions until 2035. The criticism that significant quantities of CO_2 are indirectly imported from China through the import of steel, copper, etc. and even solar panels is thus justified.

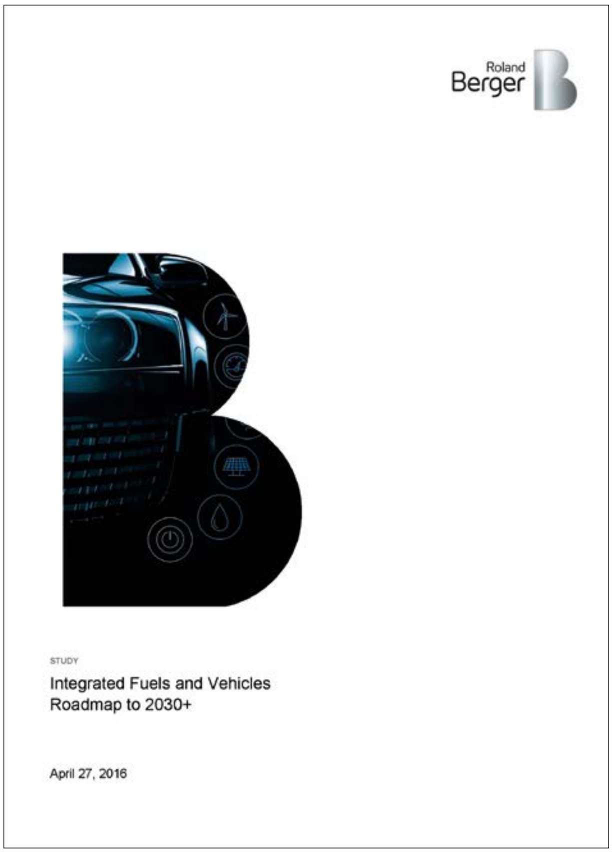
In this context, it remains to be seen whether the Federal Cabinet will pass the draft presented for a 'Climate Protection 2050' package of measurements before the deadline. The UFOP also issued its opinion in an alliance of agricultural associations. Members of the German Bundestag have also come forward in the meantime and expressed their concern about being excluded from the discussion and decision process. In the case of parliament more or less rejecting the proposal, the departments concerned will be forced to consider what measures can be taken to find an alternative way of achieving the climate protection goal agreed upon by the coalition. Essential discussions should not be rushed into even if the BMUB already intends on attending the next UN Climate Change Conference as the 'top of the climate class' in Marrakesh from 7 to 18 November 2016.

In the opinion of the UFOP, an overall strategy that would best promote the economies affected is required. There is reason to fear, however, that regulatory law shall dictate the speed at which this is done not least due to time constraints surrounding implementation. If this is so, this would eventually lead to a problem of acceptance and ultimately affect the consumer's willingness to pay and make changes. Furthermore, it does not make sense in terms of climate policy to rush forward nationally, if 'spill-over' effects are triggered elsewhere, for example, in agricultural production.

In regards to fossil fuel resources, the temporary phase-out of brown coal and black coal is already cemented. However, it should also be clear that a large part of oil must remain in the ground, which means looking into fracking options in Germany makes little sense in this context. Evidence has shown that the readiness to save energy decreases in times of low oil prices, and in terms of new registration of vehicles, for example, SUV models are preferred. Convenience and range in particular still play an important role in purchasing decisions. Whether the 3,000 EUR to 4,000 EUR incentive to buy electric vehicles, which has been available since 2 July 2016, fails cannot yet be determined as based on the recorded number of only 1,000 registrations submitted just before the deadline. It's certainly beyond question, however, that the target set by the federal government to have one million electric vehicles registered by 2020 is utopian. The new support scheme does practically nothing to promote climate policy. The electricity mix in Germany is still far from being renewable and all issues relating to life cycle assessment have still not yet been answered. This applies, in particular, to the energy-intensive and resource-intensive production of photovoltaic systems. In the face of tighter budgets, other Member States will certainly not be able to or won't want to adopt such a support scheme due to the fact that the lack of a domestic car industry makes it impossible for government funding to be returned.



'Commercial vehicle study: 'Diesel oder alternative Antriebe – womit fahren Lkw und Bus morgen?'[Diesel or alternative engines – what will power the trucks and buses of tomorrow?]



'Integrated Fuels and Vehicles Road Map to 2030+'

With that in mind, biofuels blended into fossil fuels or used as a pure fuel are and will temporarily remain the most sophisticated and cost-effective way to operate existing fleets in a climate-friendly manner. Biofuels are certainly not the only solution, but do represent part of the solution, especially until seamless certification is implemented as evidence of GHG reduction and the origin of raw materials. Studies conducted by the mineral oil industry and the automotive industry are aimed at this approach, which does not oppose electrification but which puts greater priority on feasibility that takes consumer acceptability, consumer behaviour and the service life of vehicles into mind. In addition to the study by Shell 'Commercial Vehicle Study: 'Diesel oder alternative Antriebe – womit fahren Lkw und Bus morgen?' [Diesel or alternative engines – what will power the trucks and buses of tomorrow?] created by the German Aerospace Centre (DLR – Deutscher Zentrum für Luft- und Raumfahrt), the so-called Roland Berger Study 'Integrated Fuels and Vehicles Roadmap to 2030+' also experienced a great deal of public attention. In the eyes of the UFOP, these studies are a contribution by concerned industries to the decarbonisation strategy of the transport sector in order to provide further aspects that should be considered in the design of the regulatory and/or policy framework conditions. The studies are also proof that the measures proposed for the transport sector in the Climate Action Plan 2050 are not very sustainable and must therefore be designed as an evolutionary process, taking into account relevant generations of biofuels.

[2] Source: Volker Quaschning: 'Sector Coupling by the Energy Transition', HTW Berlin

Why is that? For the greenhouse gas reduction targets to be achieved, the Climate Action Plan 2050 is based on the premise that almost all road transport must be electrified and that energy efficiency measures should also be implemented to such an extent that the electricity required for traffic amounts to 'only' 337 TWh, taking into account the best possible efficiency options[2].

In comparison: Germany's total electricity consumption (2014) is 511.4 TWh. The transport's share (including rail) accounts for 11.7 TWh. Nationwide implementation is not possible without liquid renewable fuels. Electrification, other than the tremendous need for the provision of required financing, is also limited by the law of physics. The quantities of liquid fluid required are also meant to be created through renewable energy by using 'power-to-liquid' capabilities. For this transformation to happen, however, it must be assumed that by 2030 at the latest only new vehicles with purely electric-driven engines will be allowed on the road. This integration of road transport is also referred to as 'sector coupling' which is also meant to include the areas of heating and cooling. It's here at the latest that the question of the security of the energy supply and affordability should arise. Nevertheless, no other country in the EU has pursued this question with such strategic determination as Germany.

Will other Member States or signatory states of the climate agreement, however, develop such ambitious goals? It's unlikely, because there are currently no effective sanctions against signatory states and/or EU Member States for not fulfilling climate protection targets. The evaluation of the implementation of the Renewable Energy Directive (RED) is already sobering enough. To date, neither the RED, nor the Fuel Quality Directive (FQD), have been fully enforced by all EU Member States. The possibility of effort sharing may be an appropriate option in view of acceptance being necessary. Without strict target fulfilment specifications, and monitoring processes in particular, the EU will not achieve its climate change targets. That's why, in light of the forthcoming proposals by the Commission in relation to the design of future EU biofuels policy, it must be asked whether the European Commission must also specify the details regarding the types of biomass that will be allowed or not allowed for the production of biofuels after 2020. The Member States should be able to decide this on their own based on the degree of flexibility or design freedom for the implementation of national climate change goals.

The German as well as the international biofuel industry must also deal with these complex topics themselves. With this in mind, the organisers of the international conference 'Fuels of the Future' (UFOP, BBE, FvB, BDBe and VDB) decided to name the format the 'International Conference for Renewable Mobility' for the time being. The Congress traditionally takes place during the International Green Week (IGW) in Berlin (23 to 24 January 2017). Over 500 participants are expected to attend again.

Table 1: Biofuel mandate outside the EU higher

Biofuel mandate %	2015	2016
Indonesia	15	20 20 % => Combined heat and power plants (Industry)
Malaysia	10 (7)	10 (7)
Argentina	10	10
Brazil	7	7 20/30*
Thailand	7	7
USA risk detection system programme	5.8 million t	6.3 million t (2017: 6.7 million t)

* Truck fleet test launch

EU biofuel policy – what is going to happen next?

Based on the climate agreement of Paris and the upcoming political debate on the continuation of the biofuel policy in the EU after 2020, the UFOP is calling attention to the regulations already introduced to the biofuels sector. The Renewable Energy Directive amended in 2015 includes increasing requirements on the reduction of GHG emissions. The rate is currently set at 35 % and will rise to at least 50 % in January 2018 as compared to the fossil fuel reference value. The UFOP points out that starting in 2017 all biofuel producers must provide evidence of this GHG reduction requirement in the form of certification, if the biofuels are meant for the national or EU market. The requirement on new biofuel plants to reduce greenhouse gases by 60 %, which was introduced to apply retroactively to October 2015, also represents a plant-specific challenge for investments which are carried out in non-member states for the EU market. Plant certification used as evidence of greenhouse gas reduction is thereby given character as a form of regulatory approval for the EU. With no follow-up regulation after 2020, this development desired for environmental policy would practically be stifled. At the end of May 2016, the chairman of the UFOP emphasised in writing to the members of the relevant committees of the European Parliament that this would be counterproductive, especially in view of the climate action plans to be presented in 2020 by the signatory states of the Paris climate change conference. In an accompanying position paper, the UFOP points out that Brazil already announced plans to accelerate the expansion of the biofuel industry as an important pillar of the national climate strategy in the transport sector. Countries such as Indonesia, Malaysia or the United States have also already increased the national legal obligations for the admixture of biofuels (Table 2) in order to help ease the strain on the market. Biodiesel production, however, is stagnating on a global level with supply around 24.5 million tonnes (Table 3). Significant shifts outside the EU in particular are to be expected when third countries further increase national quota requirements, and in the worst-case scenario, if the promotion

of first generation biofuels is discontinued in the EU starting as of 2020. This sudden pressure on the prices and volume will continue to increase pressure in non-member states to transfer the structural surpluses to an energy-related use in order to ease the strain on the market. Destructive competition is also happening at the same time in the food trade at the expense of agriculture. That's why the UFOP also stressed the necessity to continue biofuel policy based on a 'iLUC-free base amount' which equates to a cap limit of 7 % for biofuels derived from cultivated biomass. Furthermore, if biofuels are to be promoted to improve the acceptance of environmental policy, a greenhouse gas mitigation scheme, in line with that of the regulation in Germany, must be adopted throughout the EU by 2020 instead of an energy quota. The UFOP hereby emphasises the importance of 18 certification schemes which have already been recognised by the European Commission and implemented internationally for verifying the implementation of certain sustainability requirements. These are currently being reapproved. As a result, it's in the hands of the European Commission to examine them and, if necessary, to re-approve them with stricter conditions, for example, for the evidence of GHG reduction and raw material origin. The UFOP firmly stresses this approach because the European Court of Auditors greatly criticised the quality of some certification schemes in an examination procedure and called for subsequent improvement.

In their press release, the UFOP stressed the importance of certification systems for the public acceptance of biofuels. This also applies to the certification of waste raw materials in order to prevent fraud. From the UFOP's point of view, sustainability certification for biofuels is a fundamentally important 'training platform' in the bio-economy, because unlike voluntary schemes, such as in the food industry, misconduct or mismanagement can be sanctioned on a legal basis, such as through re-approval being denied. In terms of the quality of the evaluation of the certification schemes by the EU Commission, it remains to be seen how serious the EU Commission is about implementing the sustainability requirements adopted by the Council and the European Parliament in accordance with the RED and/ or iLUC Directive, not only against the Member States, but also against third-party states such as Brazil, Argentina, Indonesia and Malaysia. If the European Parliament and/or

Table 2: World: Biodiesel production (FAME) (1,000 tonnes)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
EU	7,245	8,409	9,021	9,027	8,730	9,408	10,147	9,584	9,681
North and Central America	2,784	1,800	1,282	3,302	3,370	4,573	4,484	4,435	4,540
South America	1,774	2,785	4,285	5,268	5,386	5,203	6,199	5,895	6,000
Asia	1,618	1,839	2,074	2,544	3,218	4,138	5,523	4,364	4,583
Oceania	47	77	77	72	47	57	59	92	92
World	13,536	14,992	16,844	20,415	20,962	23,532	26,562	24,484	24,965

Source: Licht Interactive Data / 2016: Estimate

Vol. 14, No. 17 / 11.05.2016

the European Council agrees to market-accepted biofuels no longer being promoted after 2020, the EU would inevitably surrender their former pioneering position as a driving force for shaping and implementing and/or monitoring sustainability criteria, also in non-member states. Politicians are not yet aware of the pioneering eco-political role of first generation biofuels in the bio-economy. What's been achieved already has not yet been recognised. Measured according to the sustainability efforts which are currently observed internationally, biofuels are the real 'driver' behind the enforcement of sustainability requirements in the bio-economy. Up until now the entire rapeseed industry is the only crop in Germany to be completely and sustainably certified irrespective of the end use. Acquisition and oil mills must be certified in terms of GHG efficiency and mass balance systems, even when not all quantities of rapeseed or canola oil are marketed for biofuel production. As a consequence, all possible forms of usage are sustainably certified, including the use of rapeseed meal for animal nutrition. This is significant because the public criticism also expressed by NGOs led to the European Feed Manufacturers' Federation (FEFAC) developing and publishing the 'Soy Sourcing Guidelines' for soy imports at the end of 2015.

Biofuels – the end 2020?

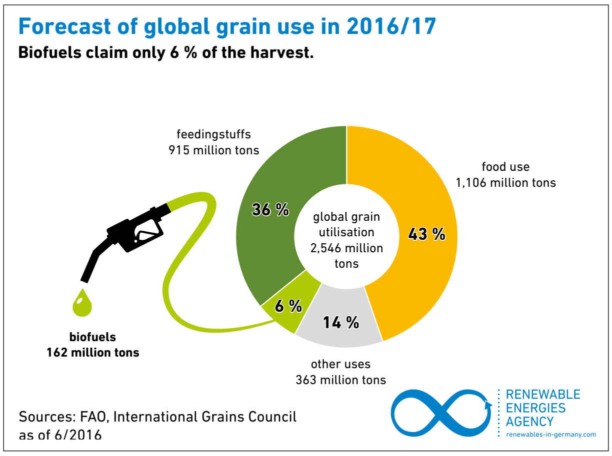
In mid-July 2016, the European Commission published the report 'A European Strategy for Low-Emission Mobility' which was long awaited by the biofuels industry. Fundamental aspects and measures as well as initial ideas for funding incentives for e-mobility, advanced (bio)fuels, etc. are explained in this report. The objective is gradual decarbonisation and the simultaneous reduction of the pollution levels in urban traffic for health protection reasons. This report's basic orientation significantly covers the measures listed in the Climate Action Plan 2050 of the German federal government. The EU Commission draws a difference between the different infrastructural requirements (urban transport, transport routes) and stresses the necessity to provide liquid renewable fuels for aviation and heavy traffic (energy density). From the UFOP's point of view, it must be recognised and/or considered that agriculture, forestry and heavy traffic are dependent on liquid renewable fuels, even if this sector is meant to contribute to the reduction of greenhouse gases through a change. Germany's agriculture uses about 1.6 million tonnes of diesel. Electrification is at best possible in sub-sectors. First concepts for the sustainable supply of energy to agricultural enterprises already exist, in terms of self-sufficiency or recycling raw materials grown (rapeseed oil fuels, biomethane), including electrification. The construction industry must also be taken into consideration accordingly. The use of renewable fuels for areas other than transport are not considered in the Commission's report.

The Commission is committed to its announcement to end the temporary promotion of biofuels made from cultivated biomass by the year 2020 as stipulated in Renewable Energy Directive. From this announcement, however, it cannot be determined if this support scheme is to really end in 2020 or if it is to be phased out gradually because the parallel development (research, projects, pilot projects) of advanced biofuels should be promoted. A production structure for advanced renewable fuels, including biomass, is virtually non-existent. It is unclear which companies should invest this biofuel processing. In the case of the future design of investment incentives, the EU Commission and policymakers must consider that the rapid development of the European and/or international biofuels industry is also based on the premise that farming businesses are structurally close knit both nationally and internationally, from raw material production to acquiring products and processing them, which will therefore result in significant synergy effects. In an initial response to the European Commission's announcement, the President of the Association of the Automotive Industry (VDA), Matthias Wissmann declared that greenhouse gas emissions from transport can only be noticeably reduced through a combination of several modules, such as clean and efficient vehicles, biofuels, new regenerative fuels, structural measurements, efficiency improvements and digitisation. As a result, the VDA calls to mind the aforementioned results of the Roland Berger study.

Biofuels – image better than expected

The demand of raw materials for the production of bioethanol derived from grains (Figure 5) or from biodiesel made out of palm oil accounts for only 3 % or 5 % of global production of these commodities. Nevertheless, environmental associations and charitable organisations criticise the use of biofuels. An objective differentiation in respect to the causes for world hunger is obviously deliberately not being made. The same can be said about the issue of land grabbing. Politicians find it difficult to recognise the fact that the biofuel market contributes to price stabilisation and thus also stabilises global agricultural earnings. Against this background, the question of public acceptance, in other words how consumers perceive the issue of biofuels, arises. UFOP, OVID and VDB initiated a representative consumer survey that turned out rather unexpected findings, with as many as 69 % of the respondents having a generally positive view of biofuels. The result that if sustainability is guaranteed, every other 'sceptic' would use biofuels to fill up their tank, is also important, as it means that for the UFOP, in the case of the very complex topic of biofuels, work with the public will remain a main focus of activities. This includes topics such as cultivation, utilisation of rapeseed oil and the 'by-product' rapeseed meal, for example, as a prerequisite for the GMO-free feeding of dairy cattle.

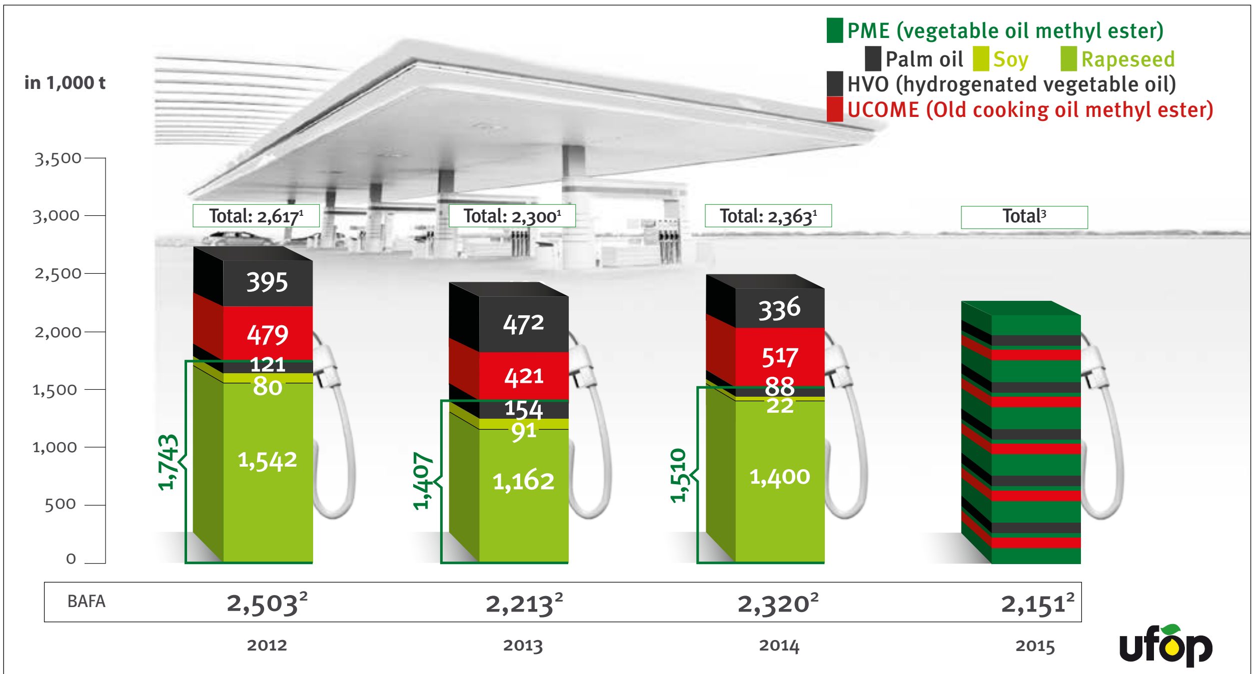
Figure 1: Forecast of global grain consumption 2016/17



Biodiesel sales – GHG efficiency and quantity effect

Despite the record consumption of about 37 million tonnes of diesel fuel in 2015, biodiesel sales fell by 0.17 million tonnes (Figure 6) compared to 2014. The admix proportion of biodiesel thus fell accordingly in the diesel market, from 6.5 % in 2014 to 5.8 % as based on findings by the Federal Office of Economics and Export Control (BAFA). For the first time since the introduction of the admixture in 2010, biodiesel fell below 6 %. If the energy quota would have also been maintained in 2015, then the anticipated admixture proportion would have resulted in higher biodiesel sales of around 0.25 million tonnes. Conversely, this means that the GHG quota could be met with a smaller quantity of biofuel than expected. The commitment to reduce greenhouse gas emissions increases from 0.5 % to 4 % in 2017, which will trigger additional demand. According to the Federal Immission Control Act, the next increase of 6 % is set to first take place starting as of 2020. The biofuel associations thus reaffirm vis-à-vis the government and parliament that this competitive gain in efficiency desired by environmental policy must be skimmed off on behalf of climate protection. A gradually increasing obligation starting in 2018 to reach 6 % by 2020 would also be appropriate since obligated oil industry companies can adjust better to the higher demand for biofuel. A limitation here, however, is that starting in 2017 it won't only be biofuels which have to meet this obligation. For one, fossil fuels can be credited with a lower emission value for a comparable value for fossil fuels (e.g. associated gas) and counted towards so-called upstream emission reduction (UER) measures.

Figure 2: Sales development in Germany/Domestic consumption 2012–2015



Sources: ¹BLE, ²BAFA, ³BLE-Evaluation Report 2015 expected October 2016

Table 3: Overview of iLUC factors (g CO_2/MJ)

Biofuel	GLOBIOM	IFPRI	CARB	iLUC Directive
Ethanol (Wheat)	34	17 – 23	.	12
Ethanol (Corn)	14	10 – 13	19.8	12
Ethanol (Sugar beets)	15	5 – 9	.	13
Ethanol (Sugar cane)	17	13 – 16	11.8	13
Biodiesel (Rapeseed)	65	53 – 56	14.5	72
Biodiesel (Sunflowers)	63	50 – 62	.	55
Biodiesel (Soy)	150	55 – 72	29.1	55
Biodiesel (Palm)	231	54 – 63	71.4	55

The UER measures are subject to rejection because they allow for the flaring of associated gas, i.e. the combustion of methane, for example. For one, the same high-quality certification requirements are not imposed for the provision of evidence as they are for biofuels, on the other hand, these mitigation measures must be credited to the country of origin in accordance with the Kyoto protocol. Enforcement must be regulated by adopting regulation as well as introducing updated GHG emission values for fossil fuels. This is expected to be carried out by autumn 2016. In terms of the other Member States, it is still not clear whether all reduction options for greenhouse gases have been enshrined in national law yet.

BLE Evaluation Report 2014

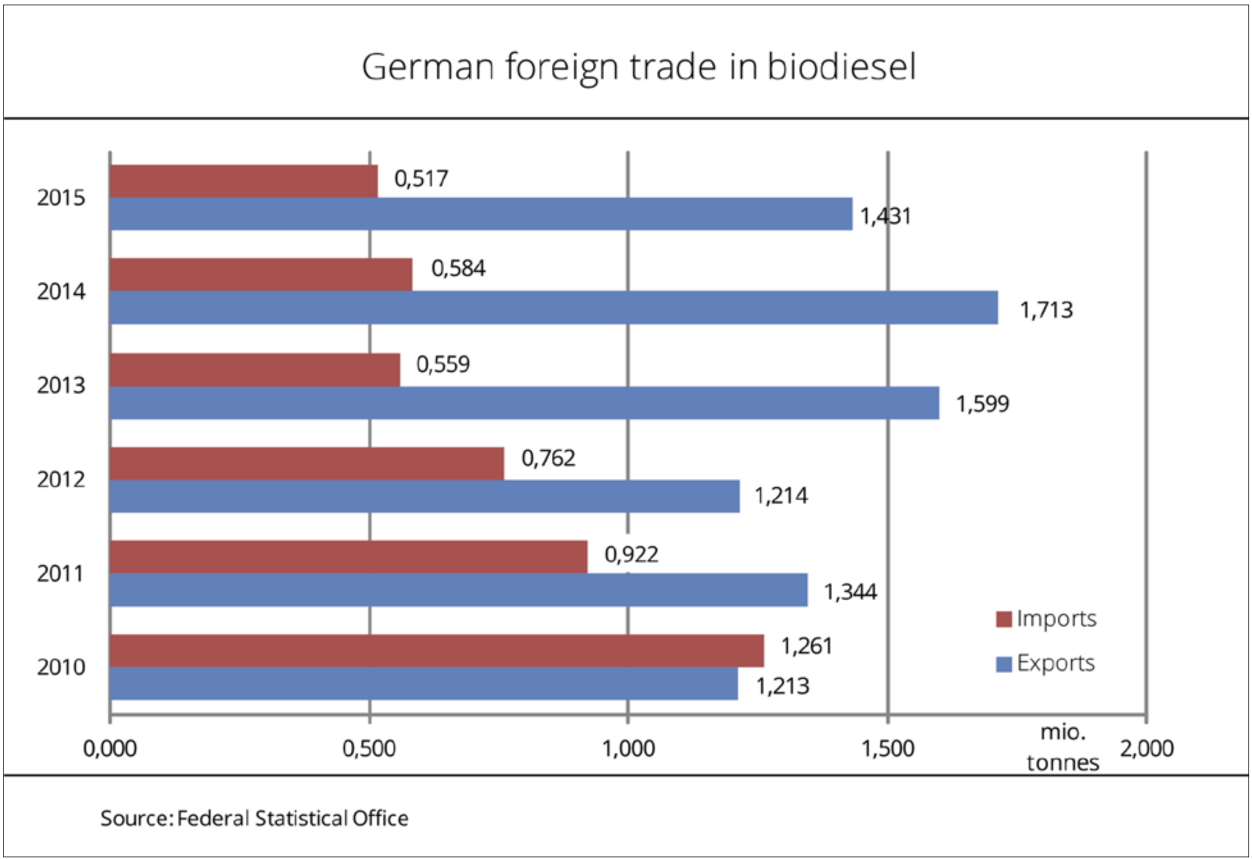
Figure 6 on page 43 shows the development of sales by the types and quantities of raw materials from 2012 to 2014 according to the Evaluation and Progress Report 2014 by the German Federal Office for Agriculture and Food (BLE). No information from the year 2015 could be included in the report because the next report will be first released in October/November 2016. It's important to note, however, that there is an increased share of biodiesel derived from used cooking oil, approximately 22 %. The use of hydrogenated vegetable oil (HVO), on the other hand, sunk to 0.336 million tonnes. Compared to 2013, the use of rapeseed oil methyl ester increased from 1.162 to 1.4 million tonnes. Arable land measuring 0.9 million hectares in size is required to meet this demand for rapeseed oil. The demand for raw materials is much higher, but cannot be quantified exactly. The composition of raw materials for the net export of biodiesel in 2015 (Figure 7) of approx. 0.9 million tonnes is unknown. With approx. 0.4 million tonnes, the German market is very important for palm oil sales, especially when the total sales of palm oil-based biofuels in the EU is only around 2 million tonnes (LMC, 2016). Environmental organisations, however, exaggerate these values for the press. Greenpeace reported this value to be 3.5 million tonnes, accordingly making allegations of deforestation, without correlating these quantities to the total global production volume of palm oil which amounts to around 61 million tonnes. This accounts for just under 6 % or 0.87 million hectares of oil palm plantations if a yield of 4 tonnes of palm oil is assumed per hectare. Since palm oil sales have been stagnating for years, the issue of land-use change is moot anyway, considering that the land would have only been cleared once according to this logic. Palm oil, no matter what it is used for, is now associated with negative connotations in the media. Manufacturers of detergent, such as the German manufacturer of well-known 'Frosch' brand products, have adjusted accordingly, praising rapeseed as a sustainable alternative as opposed to palm oil. The BLE's annual report also serves as the basis for the progress report which Germany or the Member States of the EU Commission must submit annually. The European Commission confirmed the extraordinary quality of the BLE report in a statement on the reporting of the Member States. Reports issued by other Member States, however, leave much to be desired.

iLUC – new project – no additional findings

In terms of the quality of data collected on the biofuels used in the EU, the question should be raised just how accurately indirect land use effects (ILUC) can be calculated, should these be incorporated into law as iLUC factors. The underlying IFPRI study was very heavily criticised, which led the EU Commission to incorporate the scientific evaluation as a task in the so-called iLUC Directive to amend the RED. By the end of 2013, the European Commission had already commissioned a consortium led by the Ecofys Institute based in Utrecht to carry out a new study. 'The land use change impact of biofuels consumed in the EU'. The study has been the subject of much discussion by COPA-COGECA and the European Oilseed Alliance (EOA). As was the case with the IFPRI study, the associations criticised the lack of transparency and the lack of opportunity to inspect the concrete modelling and calculation. The calculations were carried out using the so-called GLOBIOM model. The statistical data used to determine yields, price elasticities, etc. were heavily criticised. In contrast to the IFPRI study, iLUC factors for the raw materials rapeseed, soybean and palm oil were first defined (Table 4). Other studies, for example, conducted in the United States resulted in significantly lower iLUC values. Due to the methodology, it is still not possible to calculate reproducible results and thus internationally comparable and applicable iLUC factors. In the case of this study, the plausibility of the calculation system or the model (GLOBIOM) used was also not conducted based on historical data. According to the UFOP, these could be calculated based on known and accurately evaluated changes in cultivated areas for the measurement of, for example, deforestation in a given area for a past year.

The biofuel associations believe that the scientific quality of this study is not sufficient to legally enforce the designated iLUC factors. UFOP has repeatedly emphasised the prejudiced nature of this model to politicians. As a consequence, all funding policy measures that lead to a reduction of the supply of food commodities must be subject to iLUC reservations. In this case, the promotion of organic farms, whose surfaces are to be expanded by up to 20 % in Germany based on political will, would thus also be affected.

Figure 3: Foreign trade biodiesel



Expert Commission on Biofuels and Renewable Resources

Status of biofuel policy in Germany and in the EU

The members gathered information on the current status and the implementation of the decisions to amend the Renewable Energy Directive (iLUC Directive) and the Fuel Quality Directive (FQD). Their main points include the introduction of the cap limit of max. 7 % for biofuels from cultivated biomass, the introduction of a voluntary sub-quota for so-called second-generation biofuels and reporting obligations related to indirect land-use change (iLUC factors). No discussions were held on the national implementation to deduce e-mobility (consideration of the 2.5 factor on RED's energy and greenhouse gas (GHG) reduction targets) due to the fact that no government draft existed. This is expected to be released by autumn 2016. As a result of the efficiency competition expected to take place between biofuel raw materials, there will be a noticeable reduction in demand and therefore sales of biodiesel in order to meet the commitment to reduce greenhouse gases by 3.5 %. Here, the UFOP stressed the leading role of biofuels in the bio-economy. After all, when renewable raw materials are used as materials, neither the reduction of greenhouse gases nor the dated evidence of cultivated areas or any government regulated requirement for documentation (the BLE's 'Nabisy' in Germany') are stipulated as a condition to access the market. With an eye on the current political discussions in Brussels, the biofuel industry therefore eagerly looks forward to the EU Commission's 2016 announcement of recommendations for shaping the future of biofuel policy after 2020.

Based on the climate change agreements of the Paris convention and any associated national plans of action, concepts of measures were introduced and discussed as a result of the dialogue forums organised by the Federal Environment Ministry. According to the list of measures in the Climate Action Plan 2050, the decarbonisation of the transport sector is to be achieved in the long term primarily by way of a complete transition to electrification. Criticism was raised that the mobility and fuel strategy of the Federal Ministry of Transport, which was intensively discussed over a period of months, played virtually no role or only a minor role in this context. The Federal Environment Ministry has claimed power to deal with these issues, so we can look forward to the consultation process which is to take place between various departments in the summer.

The perspective of biofuels – results of the Roland Berger Study

Against this backdrop, the expert commission discussed the results of the so-called Roland Berger study 'Integrated Fuels and Vehicles Road Map to 2030+' within the context of this 'strategy of electrification'. The study, which was commissioned on behalf of a consortium from the automotive and oil industries, shows the perspective of these industries, elucidating the necessary biofuel development options linked to strategic direction of taking an evolutionarily market launch process. A noticeable contribution to the reduction of greenhouse gases is to take place by 2030 through the use of certain admixture quantities of biofuels, starting with B7 as a base blend, then by introducing E10 and E20, and finally by progressively and simultaneously introducing second-generation fuels. At the same time, however, hybrid vehicles or the hybridisation of the proportion of battery-powered engines is to increase accordingly, and thereby also increase the share of renewable electricity consumed. Based on the future purchase decisions of customers, the study states that the share of diesel cars is set to fall from 53 % in 2015 to 34 % by 2030, with petrol-powered vehicles also dropping from 44 % to 42 %. With the high share of heavier vehicles (SUVs) currently on the market standing in contradiction to this assessment, the required change in customer behaviour cannot be determined for certain without a 'certain degree of pressure'. Under current conditions, diesel engines represent the most economical alternative when higher mileage performance is a factor in determining the engine. The members found that framework conditions required for funding policy must be created to improve consumer acceptance, for example, through purchase incentives which were just adopted by the federal government to accelerate the transition to e-mobility.

Questions surrounding the support required for the necessary funding policy were the focus of subsequent discussion. As a result, discussions were held on whether the draft to amend the Energy Taxation Directive which has existed for quite some time already provides the correct approach to adopting a combined CO_2 and energy tax scheme to support energy efficiency as well as greenhouse gas reduction efficiency. This strategy would expedite the introduction of fuels and engines appropriate for greenhouse gas reduction and with the right renewable energy share (e-mobility).

Rapeseed fuels and emissions after-treatment/ health relevance of NOx

Prof. Dr. Gennadi Zikoridse, HTW Dresden and CEO of Förderkreis Abgasbehandlungstechnologien für Dieselmotoren e. V. [Research Association for Diesel Emission Control Technologies], and Prof. Dr. med. Jürgen Bünger, Institute for Prevention and Occupational Medicine of the German Social Accident Insurance, Ruhr-Universität Bochum, participated as guest speakers. Prof. Dr. Zikoridse spoke about the current and future demands on the after-treatment of emissions when rapeseed fuels are used in diesel engines and pointed out the fixed emission limits which are to be adhered to currently.

According to these, off-road machines powered by biodiesel or rapeseed fuel must comply with the Euro 5 exhaust emissions standard starting as of 2019 and thereby meet the particle concentration requirements. Professor Zikoridse stated the key here is the continual improvement of the quality of all types of fuel to prevent the formation of deposits and carbonisation effects in the injection system and engine. Prof. Dr. Bunger provided information on the health risks of nitrogen oxides and their maximum permissible values which are also currently much subject of debate in the media. But are these new maximum permissible values based on evidence? The WHO noted that despite the existence of many studies no significant cause-effect relationship could be determined between concentrations of NO_2 and adverse health effects. New experimental studies conducted in 2016 also did not confirm any acute reaction of test people when they were exposed to three hours of certain concentrations of NO_2 (0.1, 0.5 and 1.5 ppm). Prof. Dr. Bunger therefore questioned the predetermined maximum permissible limits for NO_2.

UFOP project funding

The following new UFOP-funded project proposals (see current projects) were presented to the expert commission:

- Developments to prevent injector and deposit formations when using biogenic fuels (ENIAK vegetable oil);
- Long-term studies of various biofuel blends;
- Examinations of sludge formation in engine oil when using biogenic fuels (grant extension).

Dr. Volker Wichmann, University of Rostock, provided information on the initial results of the project proposal: 'Betriebsverhalten von EU-Stufe IV, Industrie- und Landtechnikmotoren mit Abgasnachbehandlung im Biodieselbetrieb' [Operating performance of EU Stage IV, industrial and agricultural engines with after-treatment of exhaust gases in biodiesel operation']. These results concern defined engine characteristic tests on the engine test bench, which were used to determine that B100 had an expected 10 % lower performance because the control device limits the injection volume. No significant differences in B100/diesel fuel could be determined in regards to the consumption of specific fuel except for with operating point 4. Dr. Wichmann explained B100's slightly lower fuel consumption as a result of the controller's hypersensitivity with regard to fuel-related calorific value differences. In general, the results show the typical differences between diesel fuel and biodiesel. B100 has no influence on the SCR's performance since SCR is controlled by the NOx sensor and exhaust gas mass flow.

Research and development

Dr. Thomas Garbe, VW AG, explained the need for research due to the ever-increasing number of hybrid vehicles. VW expects the time fuel is stored in a vehicle's tank to increase depending on the customer and according to personal habits of use. Interactions between fuel components (fossil and bio) cannot be ruled out here. Any possible effects of the formation of deposits and changes in the quality of fuel (oxidation stability) must also be additionally considered. As a consequence, the injection system will be affected in particular. A working group of the Forschungsvereinigung Verbrennungskraftmaschinen e. V. [Research Association for Diesel Emission Control Technologies] will develop a research concept that could potentially be implemented starting at the end of 2016.

Additional guest lectures:

Daniel Then, Coburg University of Applied Sciences, presented the results of the project 'Measurement of dielectric material properties for quality detection of fuels'. The aim is to develop a remote sensor to detect the quality of the fuel which is based on near-infrared, fluorescence and dielectric relaxation spectroscopy measurement methods.

Jens Staufenbiel, Coburg University of Applied Sciences, presented the structure and operation of an optical sensor system, consisting of absorption spectroscopy and fluorescence spectroscopy. Similar to the aforementioned project, his project proposal on the subject 'The absorption and fluorescence of fuels for optical quality recognition' is likely to be used towards developing a hand-held sensor for detecting fuel quality.

Fuel quality development and especially the adaptation of the distillation properties of biodiesel to diesel is, chemically speaking, the connection to significantly improving the combustion and reduction of any possible deposits. Based on a project funded by the UFOP on the synthesis of biofuels by metathesis, Martin Kortschack from the Coburg University of Applied Sciences explained olefin cross-metathesis and the successful modifications of biodiesel using this chemical process. By using certain highly reactive catalysts, he managed to lower the cost-driven use of catalysts to 0.005 mol%. The second approach which he presented for more efficiently producing metathesis fuel is the repeated use of catalysts, for example, by immobilisation and recycling.

The commission members intensively discussed the issue of the future direction of research funding and recommended in the case of application-based projects redirecting attention to commercial vehicles and off-road vehicles in particular. In the case of agricultural machinery, the UFOP believes that it would be difficult for electrification to meet power requirements during peak times. Fuel consumption is of tertiary importance when it comes to the source of greenhouse gases in agriculture. The further development of biodiesel plants as suppliers of raw materials for material usage (perspective of biodiesel industry?) was also brought up in the discussion held by the expert commission in their last meeting. The members referred to a study on the perspective of the biodiesel industry as part of biorefinery strategy: 'Biodieselanlagen als Element einer stofflichen Nutzungskaskade' ['Biodiesel plants as an element of the cascading usage of materials'].

Current projects:

Operational behaviour of industrial and agricultural engines meeting the EU COM IV emissions standard in biodiesel operation (B100)

Project coordination:

Institute of Piston Machines and Internal Combustion Engines, University of Rostock, Albert-Einstein-Str. 2, 18059 Rostock

Duration:

January 2015 to December 2017

This project is meant to continue the very successful collaboration with DEUTZ AG and work towards having biodiesel approved as a pure fuel. The goal is to achieve a basis for pure fuel approval for the next generation of engines so that 'supply' in this regard can be ensured. The comprehensive project, which is comprised of six work packages, aims to test B100 in relation to its compatibility with a modern exhaust after-treatment system in order to ensure fault-free operation. Its position is based on the fact that this emission standard will see the introduction of on-board diagnostics (OBD), including the off-road sector as well (e.g. agricultural farming, construction machinery). The following tests were carried within the context of studying operation under load on the test bench over the course of several months:

- Measurement of emissions before and after the after-treatment of exhaust gases;
- Function check of particle filter regeneration;
- Identification of the conversion rates in the exhaust tract (SCR – use of urea in NOx reduction),
- Analysis of the OBD function;
- Rail behaviour when under pressure;
- Behaviour on cold start-up;
- Addition of biodiesel to engine oil;
- Identification of wear-and-tear metals in the engine oil, carbon particulate matter percentage, viscosity and density.

The procurement and implementation of the brake and the construction of a transformer led to the project start being delayed by several months.

Storage stability of fuel blends of biodiesel (FAME), HVO and diesel fuel

Project coordination:
TEC4FUELS GmbH, Kaiserstraße 100, 52134 Herzogenrath

Duration:
July 2016 to July 2018

Due to the fact that different biofuel blends (biodiesel, HVO, UCOME) are increasingly mixed into diesel fuel, the question of how this will interact over a longer storage period arises. The influence of different types of biodiesel (RME, SME, PME and UCOME) on the long-term stability of fuel blends, consisting of FAME, HVO and diesel fuel, should be examined. The question of the effects of interaction is important, among other things, in regards to the politically supported electrification of road traffic and the resulting increase in the market introduction of plug-in hybrid vehicles. This preferred intention for electric engines shall as a result lead to users going longer in between filling tanks.

SAVEbio – strategies for the prevention of deposits in injectors in the case of multi-fuel use of biogenic fuels

Project coordination:
Öl-Wärme-Institut GmbH (Project coordinator), Kaiserstraße 100, 52134 Herzogenrath and
Technology and Support Centre in the Competence Centre for Renewable Resources (TFZ), Schulgasse 18, 94315 Straubing

Duration:
October 2016 to March 2019

The focus of this comprehensive joint project is the question of the formation of deposits of vegetable oil fuels in modern common rail engines. Increasingly higher injection pressures, the requirement for lower fuel consumption and optimised combustion behaviour through so-called multi-injection continuously reduce the tolerance range in the injection systems, in particular with regard to the fuel injectors. The tiniest deposits can already lead to significant carbonisation effects, reduced performance and increased exhaust emissions. Dynamometer tests are performed on tractors at TFZ. The injectors are removed and evaluated after endurance testing of the injectors. These test results will be compared with test runs (ENIAK) at the OWI institute in order to evaluate the formation of deposits. Relevant test runs (injection pressures, procedures, temperatures, etc.) can be simulated on the OWI's engine test bench. However, real test runs are required for the comparison of results. The causes for the formation of deposits can be reproduced and individual influence parameters for determining the causes can be modified on the ENIAK engine test bench, making it possible to compare the actual deposits on the engine test bench and the simulation. This makes it possible pursue the goal of examining the formation of deposits under critical operating points in order develop mitigation strategies. In cooperation with the additive manufacturer ERC, the causes for the effects of deposits should be examined and additive concepts should be developed for the prevention of deposits.

Research grant on 'Examinations of sludge formation in engine oil when using biogenic fuels'

Project management:
Coburg University of Applied Sciences,
Friedrich-Streib-Straße 2, 96450 Coburg

Grant extension:
September 2016 until August 2017

Since August 2013, the UFOP has promoted this doctoral thesis at the University of Applied Sciences Coburg. Within the context of this grant, the influence of the engine oil and its composition in connection with biodiesel use and its ageing products (percentage of oxygen in biodiesel) on relevant polymerisation effects is being examined. An extensive literature review was conducted, and the interaction effects of biodiesel were investigated using so-called model substances. The reaction products obtained here could be analytically identified. For the first time ever, it was determined that not only biodiesel, but also compounds from the engine oil and/or diesel fuel components which make their way into the motor oil also lead to the formation of sludge. It is possible to determine the molecular structure of larger masses by using liquid chromatography quadrupole flight mass spectrometry coupling LC-QTOF-MS. The grant's extension is subject to the study of the substances present using this measuring instrument so that the molecular structure identified can provide insight into the composition of the polymerised molecules and their origin, such as biodiesel, engine oil or diesel fuel.

List of tables In the Appendix

Biofuels

Tables of the German Federal Office for Agriculture and Food (BLE)

Table 1: Domestic biofuel consumption 2010–2015 in 1,000 t

	2010	2011	2012	2013	2014	2015
Biodiesel blended fuel	2,236.0	2,329.0	2,347.6	2,181.4	2,310.5	2,145.2
Clean biodiesel fuel	293.1	97.2	131.0	30.1	4.9	3.5
Biodiesel total	**2,529.1**	**2,426.2**	**2,478.7**	**2,211.6**	**2,315.4**	**2,148.7**
Vegetable oil	60.9	19.6	24.7	1.2	5.5	2.0
Biodiesel & VO total	**2,590.0**	**2,445.9**	**2,503.4**	**2,212.8**	**2,320.9**	**2,150.7**
Diesel fuel	32,128.0	32,963.8	33,678.0	34,840.4	35,587.1	36,998.7
Proportion in the blend in %	7.0	7.1	7.0	6.3	6.5	5.8
Fuel total	**32,481.9**	**33,080.7**	**33,833.7**	**34,871.8**	**35,597.5**	**37,004.1**
Proportion of biodiesel & VO in %	8.0	7.4	7.4	6.4	6.5	5.8
Bioethanol ETBE	122.2	162.5	141.7	154.5	138.8	119.2
Bioethanol blended fuel	1,028.1	1,054.3	1,089.7	1,040.5	1,082.0	1,048.7
Bioethanol E85	18.1	19.7	21.3	13.6	10.2	6.7
Bioethanol total	**1,168.4**	**1,236.5**	**1,252.7**	**1,208.6**	**1,229.3**	**1,173.4**
Petrol	19,614.8	19,601.1	18,486.8	18,422.3	18,526.6	18,264.8
Petrol + bioethanol fuel	19,629.8	19,617.4	18,504.3	18,433.5	18,535.1	18,270.3
Proportion of bioethanol in %	6.0	6.3	6.8	6.6	6.6	6.4

Sources: Federal Office for Economic Affairs and Export Control, AMI

Table 2: Monthly domestic consumption of biofuels 2010–2015 in 1,000 tonnes

	2010	2011	2012	2013	2014	2015
Biodiesel blended fuel						
January	175.66	157.32	161.02	146.27	167.03	147.39
February	149.07	149.26	172.99	156.15	172.77	156.05
March	190.61	172.71	220.94	183.56	176.93	188.86
April	207.83	186.92	194.71	156.84	198.67	190.02
May	202.72	205.23	210.06	191.17	216.23	204.96
June	193.79	176.67	209.83	189.65	187.11	190.70
July	200.04	224.75	220.32	189.72	207.78	190.25
August	190.56	215.32	223.92	210.23	211.41	185.40
September	191.20	190.48	213.08	192.94	189.59	165.14
October	198.09	214.12	173.56	193.40	190.92	159.41
November	196.24	219.27	178.68	187.05	200.01	167.42
December	166.38	216.99	168.52	184.43	192.06	168.83
Average	**188.52**	**194.09**	**195.64**	**181.78**	**192.54**	**176.20**
Total volume	**2,262.18**	**2,329.03**	**2,347.62**	**2,181.41**	**2,310.48**	**2,114.44**
Biodiesel pure fuel						
January	18.79	3.59	5.26	7.19	0.17	0.00
February	10.98	4.97	4.77	3.01	0.23	0.00
March	19.04	2.22	4.93	9.24	0.15	1.66
April	22.96	3.36	19.98	1.40	0.20	0.27
May	38.84	4.69	13.79	2.37	0.25	0.21
June	39.44	7.32	5.04	0.60	0.45	0.19
July	27.75	4.77	9.10	–1.58	0.40	0.41
August	40.02	5.05	12.77	1.51	0.49	0.26
September	36.13	10.39	18.80	1.43	1.29	2.37
October	22.90	9.42	9.49	2.41	0.41	–0.11
November	10.70	8.32	8.64	2.27	–0.43	–1.73
December	5.50	33.06	18.47	0.29	1.28	–0.39
Average	**24.42**	**8.10**	**10.92**	**2.51**	**0.41**	**0.26**
Total volume	**293.05**	**97.16**	**131.03**	**30.13**	**4.89**	**3.14**
Biodiesel total						
January	194.46	160.91	166.28	153.46	167.20	147.39
February	160.05	154.23	177.76	159.16	173.00	156.05
March	209.66	174.93	225.87	192.80	177.07	190.53
April	230.79	190.28	214.69	158.24	198.88	190.29
May	241.56	209.91	223.85	193.54	216.48	205.17
June	233.22	183.99	214.86	190.25	187.56	190.89
July	227.79	229.54	229.42	188.15	208.18	190.66
August	230.58	220.37	236.69	211.74	211.90	185.66
September	227.32	200.86	231.88	194.37	190.87	167.51
October	220.99	223.54	183.06	195.81	191.33	159.30
November	206.95	227.59	187.32	189.32	199.58	165.69
December	171.88	250.05	186.99	184.71	193.33	168.44
Average	**212.94**	**202.18**	**206.55**	**184.30**	**192.95**	**176.46**
Total volume	**2,555.24**	**2,426.20**	**2,478.65**	**2,211.55**	**2,315.38**	**2,117.57**

continued on page 134

	2010	2011	2012	2013	2014	2015
Vegetable oil (VO)						
January	4.12	0.51	0.23	0.07	0.06	0.03
February	2.76	1.21	2.91	0.02	0.12	0.01
March	7.97	1.06	1.79	0.06	0.12	0.11
April	6.60	3.24	1.86	0.10	–0.18	0.11
May	5.68	2.41	1.04	0.14	0.12	0.08
June	5.83	0.97	1.09	0.08	2.04	0.06
July	6.37	0.43	7.34	0.12	0.15	0.09
August	6.33	0.57	5.44	0.13	0.19	0.13
September	3.97	2.53	1.45	0.14	2.43	1.09
October	4.99	2.27	0.74	0.17	0.20	0.03
November	3.98	2.18	0.28	0.12	0.16	0.10
December	2.32	2.26	0.55	0.07	0.11	0.02
Average	**5.08**	**1.64**	**2.06**	**0.10**	**0.46**	**0.15**
Total volume	**60.92**	**19.63**	**24.71**	**1.21**	**5.53**	**1.86**
Bioethanol						
January	84.24	87.26	95.38	92.82	94.99	78.98
February	75.44	95.57	94.63	80.65	83.84	85.05
March	86.96	85.31	107.54	99.73	86.36	90.78
April	92.54	88.36	110.89	98.98	107.83	98.76
May	103.94	107.67	112.74	108.11	114.48	108.24
June	104.77	108.30	106.79	110.36	96.42	100.65
July	118.04	111.14	107.92	111.92	110.17	107.01
August	106.03	113.14	104.14	103.73	117.60	109.16
September	102.64	112.00	100.87	101.06	99.66	99.39
October	99.22	110.15	114.03	108.73	98.00	99.15
November	96.01	106.48	105.81	97.95	98.20	94.52
December	98.66	111.13	91.99	94.54	121.75	101.68
Average	**97.37**	**103.04**	**104.39**	**100.72**	**102.44**	**97.78**
Total volume	**1,168.48**	**1,236.49**	**1,252.73**	**1,208.58**	**1,229.29**	**1,173.37**

Sources: Federal Office for Economic Affairs and Export Control, AMI

Table 3: International trade with biodiesel 2010–2015 in tonnes

	2010	2011	2012	2013	2014	2015
Imports of biodiesel						
January	67,044	35,999	28,315	24,087	17,431	43,895
February	74,784	26,463	24,575	18,576	19,251	27,362
March	88,039	48,629	37,963	26,276	31,719	32,016
April	58,430	78,277	57,865	5,057	43,874	50,178
May	150,943	82,276	98,630	62,616	49,384	54,036
June	154,608	124,658	107,837	60,835	56,013	58,882
July	136,781	114,971	83,011	78,429	81,779	57,543
August	136,321	105,697	92,707	73,280	74,013	48,774
September	128,279	86,085	73,890	49,626	58,514	38,477
October	87,527	86,125	78,031	42,602	40,080	28,194
November	104,588	62,443	34,383	42,430	52,172	35,382
December	73,386	70,318	44,437	31,740	59,741	46,227
Total	**1,260,730**	**921,941**	**761,644**	**558,553**	**583,971**	**520,966**
Exports of biodiesel						
January	68,836	61,252	74,820	116,282	150,584	139,211
February	97,385	129,323	70,809	80,558	128,300	100,679
March	95,514	101,078	89,013	134,785	143,441	89,744
April	78,214	135,813	83,518	92,598	112,717	134,214
May	103,827	131,876	92,821	116,370	105,689	122,335
June	114,460	157,211	107,396	122,474	157,471	119,437
July	89,507	116,598	102,487	152,274	145,959	136,948
August	166,430	99,556	115,681	185,278	162,281	114,961
September	85,514	144,816	131,896	159,923	169,149	134,172
October	107,993	105,822	124,902	144,817	164,607	129,624
November	78,703	85,557	93,298	158,488	163,970	119,581
December	126,207	74,957	126,943	135,310	109,276	124,998
Total	**1,212,590**	**1,343,859**	**1,213,582**	**1,599,154**	**1,713,444**	**1,465,904**

Sources: Federal Statistical Office, AMI

Table 4: EU production capacity for biodiesel 2009–2014 in 1,000 tonnes

	2009	2010	2011	2012	2013	2014
Germany	5,086	4,933	4,932	4,968	4,970	2,864[1)]
France*	2,505	2,505	2,505	2,456	2,480	2,480
Italy*	1,910	2,375	2,265	2,310	2,340	2,340*
The Netherlands*	1,036	1,328	1,452	2,517	2,250	2,495*
Belgium	705	670	710	770	959	959
Luxembourg	.	.	.	20	.	.
United Kingdom	609	609	404	574	577	577
Ireland*	80	76	76	76	76	76
Denmark	140	250	250	250	250	250
Greece	715	662	802	812	.	762
Spain	3,656	4,100	4,410	5,300	4,320	3,900
Portugal	468	468	468	483	470	470
Austria	707	560	560	535	500	500
Finland*	340	340	340	340	340	340
Sweden	212	277	277	270	270	270
Estonia	135	135	135	110	.	.
Latvia	136	156	156	156	.	.
Lithuania	147	147	147	130	.	.
Malta	8	5	5	5	.	.
Poland	580	710	864	884	900	1,184
Slovakia	247	156	156	156	156	156
Slovenia	100	105	113	113	125	125
Czech Republic	325	427	427	437	410	410
Hungary	186	158	158	158	.	.
Cyprus	20	20	20	20	.	.
Bulgaria	435	425	348	408	.	.
Rumania	307	307	277	277	.	.
EU-27	**20,795**	**21,904**	**22,257**	**24,535**	**21,393**	**20,158**

Note: The proportion of idled capacities cannot be determined for each Member State.
* = including production capacities for hydrogenated vegetable oil (HVO)/co-refining

Sources: European Biodiesel Board, national statistics, AMI [1)] without ADM

Table 5: EU production of biodiesel and HVO 2008–2015 in 1,000 tonnes

	2008	2009	2010	2011	2012	2013	2014	2015
Belgium	277	416	350	472	291	500	300	500
Denmark	98	86	76	79	109	200	200	140
Germany	2,600	2,500	2,350	2,800	2,600	2,600	3,000	2,600
United Kingdom	282	196	154	177	246	250	350	140
France	1,763	2,089	1,996	1,700	1,900	1,800	1,410	1,522
Italy	668	798	799	591	287	459	579	400
The Netherlands	83	274	382	410	382	606	770	870
Austria	250	323	337	310	264	234	269	290
Poland	170	396	371	364	592	648	692	790
Portugal	169	255	318	359	299	294	318	370
Sweden	145	110	130	239	352	223	99	50
Slovenia	8	7	21	1	6	15	0	0
Slovakia	105	103	113	127	110	105	103	125
Spain	221	727	841	649	472	581	894	900
Czech Republic	75	155	198	210	173	182	219	168
EU other	.	.	.	**548**	**660**	**712**	**713**	**719**
EU-27	**7,321**	**8,888**	**8,981**	**9,036**	**8,743**	**9,409**	**9,916**	**9,584**
HVO[1]	.	.	.	**404**	**1,201**	**1,325**	**1,620**	**1,680**
Total	.	.	.	**9,440**	**9,944**	**10,734**	**11,536**	**11,264**

Source: F.O. Licht
[1]Estimate cumulated (Sp, Fin, Fr, It)

Table 6: Germany biodiesel [FAME] trade in tonnes – imports

Imports	2010	2011	2012	2013	2014	2015
Belgium	206,884	102,112	199,491	129,453	48,847	82,405
Bulgaria	.	.	.	.	.	.
Denmark	.	1,212	1,051	699	.	25
Estonia	.	.	.	.	.	.
Finland	15	.	.	.	.	.
France	1,175	5,881	5,796	639	7,822	22,441
United Kingdom	21,379	41,439	21,372	3,470	1,840	937
Italy	13	2,713	1,720	157	20,640	15,774
Latvia	.	11,859	.	.	.	.
Lithuania	.	.	.	.	.	.
Luxembourg	.	.	.	.	.	.
The Netherlands	960,512	611,904	406,474	338,887	315,854	132,446
Austria	17,122	26,063	30,216	26,608	41,364	60,219
Poland	9,740	83,791	54,348	47,683	34,468	64,114
Portugal	.	.	.	.	.	.
Sweden	2,963	163	58	38	0	276
Slovakia	.	.	276	.	681	1,095
Slovenia	.	.	.	156	.	75
Spain	3,004	5	.	.	.	.
Czech Republic	7,701	10,451	420	2,253	5,056	5,984
Cyprus	.	.	.	.	75	.
EU	**1,230,507**	**897,592**	**721,221**	**550,044**	**476,679**	**385,830**
Malaysia	26,104	18,147	16,573	880	100,342	132,035
Indonesia	2,960	5,046	.	7,585	6,116	2,409
US	10	1	58	1	15	39
Other countries	4,114	6,206	23,792	7,628	6,935	3,062
Total	**1,230,507**	**921,946**	**761,644**	**558,553**	**583,971**	**520,966**

Sources: Federal Statistical Office, AMI

Table 7: Germany biodiesel [FAME] trade in t – exports

Exports	2010	2011	2012	2013	2014	2015
Belgium	136,304	90,826	117,539	78,995	117,923	118,891
Bulgaria	15	2	14,245	6,101	365	980
Denmark	1,512	36,453	26,341	16,120	29,141	39,949
Estonia	.	0	5	0	.	.
Finland	493	29,659	13,348	19,562	8,725	849
France	113,072	43,050	72,597	92,078	221,635	182,309
United Kingdom	74,654	115,139	24,586	92,994	68,238	29,617
Italy	58,036	32,255	69,056	63,920	77,297	44,217
Latvia	.	2,482	5	2	2	141
Lithuania	.	117	132	5,704	74	647
Luxembourg	75	59	4,027	13	.	0
The Netherlands	239,384	305,201	305,170	502,476	600,084	396,644
Austria	68,705	68,547	171,604	149,295	107,795	134,609
Poland	388,839	484,059	200,131	176,255	163,718	125,423
Portugal	35	12	26	0	0	0
Sweden	8,192	20,162	41,840	24,025	55,823	111,129
Slovakia	13,696	15,787	4,875	3,180	10,373	155
Slovenia	14,763	4,339	6,529	1,410	200	1,524
Spain	12,407	223	4,547	32,145	49,307	7,792
Czech Republic	22,607	61,187	95,526	47,018	60,405	120,087
EU	**1,160,947**	**1,325,369**	**1,205,007**	**1,384,664**	**1,615,352**	**1,323,968**
US	1,165	1,083	405	180,200	8,538	10,868
Other countries	50,484	17,411	8,170	34,290	89,554	131,068
Total	**1,212,596**	**1,343,863**	**1,213,582**	**1,599,154**	**1,713,444**	**1,465,904**

Sources: Federal Statistical Office, AMI

Table 8: 2015 biodiesel production capacities in Germany

Operator/Works	Location	Capacity (t/year)
ADM Hamburg AG -Hamburg plant-	Hamburg	not stated
ADM Mainz GmbH	Mainz	not stated
BDK Kyritz GmbH	Kyritz	80,000
BIO.Diesel Wittenberge GmbH	Wittenberge	120,000
BIOPETROL ROSTOCK GmbH	Rostock	200,000
Biowerk Sohland GmbH	Sohland	50,000
BKK Biodiesel GmbH	Rudolstadt	4,000
Cargill GmbH	Frankfurt/Main	300,000
ecoMotion GmbH	Lünen, Sternberg, Malchin	212,000
german biofuels gmbh	Falkenhagen	130,000
PROKON Pflanzenöl GmbH Magdeburg	Magdeburg	64,000
Gulf Biodiesel Halle GmbH	Halle	56,000
KFS Biodiesel GmbH	Cloppenburg	30,000
KFS Biodiesel GmbH	Niederkassel-Lülsdorf	120,000
Louis Dreyfus commodities Wittenberg GmbH	Lutherstadt Wittenberg	200,000
MBF Mannheim Biofuel GmbH	Mannheim	100,000
Vesta Biofuels Brunsbüttel GmbH	Brunsbüttel	150,000
NEW Natural Energie West GmbH	Neuss	260,000
Petrotec AG	Borken	85,000
Petrotec AG	Emden	100,000
Rapsol GmbH	Lübz	6,000
TECOSOL GmbH (formerly Campa)	Ochsenfurt	75,000
Ullrich Biodiesel GmbH/IFBI	Kaufungen	35,000
Verbio Diesel Bitterfeld GmbH & Co. KG (MUW)	Greppin	190,000
Verbio Diesel Schwedt GmbH & Co. KG (NUW)	Schwedt	250,000
Total (without ADM)		**2,817,000**

Note: = AGQM member;
Sources: UFOP, FNR, VDB, AGQM/Names sometimes shortened
The DBV and UFOP recommend the biodiesel reference from the membership of the Working Group
As at: August 2016

Table 9: Development of fuel consumption since 1990

Year	Biodiesel [1]	Vegetable oil	Bioethanol	Total renewable fuel supply
				Stated in thousand tonnes
1990	0	0	0	**0**
1995	35	5	0	**40**
2000	250	16	0	**266**
2001	350	20	0	**370**
2002	550	24	0	**574**
2003	800	28	0	**828**
2004	1,017	33	65	**1,115**
2005	1,800	196	238	**2,234**
2006	2,817	711	512	**4,040**
2007	3,318	838	460	**4,616**
2008	2,695	401	625	**3,721**
2009	2,431	100	892	**3,423**
2010	2,529	61	1,165	**3,755**
2011	2,426	20	1,233	**3,679**
2012	2,479	25	1,249	**3,753**
2013	2,213	1	1,208	**3,422**
2014	2,363	6	1,229	**3,598**
2015	2,149	2	1,173	**3,324**

Sources: BAFA, BLE

[1] from 2012 including HVO

Table 10: Source materials of biofuels in terajoules [TJ] [1]

Fuel type	Bioethanol			Biomethane			Biomethanol[2]	
Quota year	2012	2013	2014	2012	2013	2014	2012	2013
Source material								
Waste/residual material	33	677	791	1,055	1,598	1,596	95	28
Barley	1,197	1,100	1,082	.	.	.	.	.
Corn	10,591	10,761	9,576	154	152	33	.	.
Palm oil	.	.	.	.	.	.	.	.
Rapeseed	.	.	.	.	.	.	.	.
Rye	1,447	3,534	3,231	.	.	.	.	.
Soy	.	.	.	.	.	.	.	.
Sunflowers	.	.	.	.	.	.	.	.
Triticale	544	352	1,094	.	.	.	.	.
Wheat	9,330	6,911	9,012	.	.	.	.	.
Sugar cane	481	1,290	627	.	.	.	.	.
Sugar beets	10,333	8,013	6,987	.	.	.	.	.
Total	**33,955**	**32,638**	**32,400**	**1,209**	**1,750**	**1,630**	**95**	**28**

Source: BLE
[1] Differences in totals are the result of rounding
[2] No data in 2014

Table 11: Source materials of biofuels in 1,000 tonnes [kt] [1,2]

Fuel type	Bioethanol			Biomethane			Biomethanol[3]	
Quota year	2012	2013	2014	2012	2013	2014	2012	2013
Source material								
Waste/residual material	1	26	30	21	32	32	5	1
Barley	45	42	41	.	.	.	.	.
Corn	400	407	362	3	3	1	.	.
Palm oil	.	.	.	.	.	.	.	.
Rapeseed	.	.	.	.	.	.	.	.
Rye	55	134	122	.	.	.	.	.
Soy	.	.	.	.	.	.	.	.
Sunflowers	.	.	.	.	.	.	.	.
Triticale	21	13	41	.	.	.	.	.
Wheat	353	261	341	.	.	.	.	.
Sugar cane	18	49	24	.	.	.	.	.
Sugar beets	390	303	264	.	.	.	.	.
Total	**1,283**	**1,233**	**1,224**	**24**	**35**	**33**	**5**	**1**

Source: BLE
[1] Differences in totals are the result of rounding
[2] Conversion to tonnage was based on the evidence that was factored into the quota
[3] No data in 2014

FAME			HVO			Vegetable oil			UCO[2]	
2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013
17,903	15,740	19,311	7	.	.	.	.	.	568	23
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
4,535	5,757	3,276	17,224	20,559	14,646	12	1	.	.	.
57,629	43,442	52,339	.	.	7	339	367	151	.	.
.	.	.	.	.	.	.	.	.	.	.
2,941	3,392	824	.	.	.	.	0.03	.	.	.
41	.	.	1	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
83,050	**68,330**	**75,750**	**17,231**	**20,559**	**14,652**	**351**	**368**	**151**	**568**	**23**

FAME			HVO			Vegetable oil			UCO[3]	
2012	2013	2014	2012	2013	2013	2012	2013	2014	2012	2013
479	421	517	0.2	.	.	.	.	.	15	1
.	.	.	.	.	.	.	.	.	.	.
.		.	.	.	.	.	.	.	.	.
121	154	88	395	472	336	0.3	0.02	.	.	.
1,542	1,162	1,400	.	.	0.2	9	10	4	.	.
.	.	.	.	.	.	.	.	.	.	.
79	91	22	.	.	.	.	0.001	.	.	.
1	.	.	0.01	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
2,222	**1,828**	**2,027**	**395**	**472**	**336**	**9**	**10**	**4**	**15**	**1**

Table 12: Source materials of biofuels according to origin in terajoules [TJ] [1]

Region	Africa			Asia			Australia		
Quota year	2012	2013	2014	2012	2013	2013	2012	2013	2014
Source material									
Waste/residual material	158	41	75	1,381	887	2,403	192	53	16
Barley	.	.	.	.	.	.	.	.	.
Corn	.	.	.	62	45	.	.	.	.
Palm oil	.	.	.	20,987	26,316	17,916	.	.	.
Rapeseed	.	22	.	70	347	255	1,191	2,635	1,865
Rye	.	.	.	.	.	.	.	.	.
Soy	.	.	.	.	.	.	.	8	48
Sunflowers	.	.	.	.	.	.	.	.	.
Triticale	.	.	.	.	.	.	.	.	.
Wheat	.	.	.	.	.	.	.	.	.
Sugar cane	.	.	.	.	2	.	.	.	.
Sugar beets	.	.	.	.	.	.	.	.	.
Total	**158**	**62**	**75**	**22,499**	**27,598**	**20,573**	**1,383**	**2,695**	**1,929**

Source: BLE
[1] Differences in totals are the result of rounding
[2] No NN data for the years 2013 and 2014, since indicating the country of origin is now mandatory

Table 13: Source materials of biofuels in 1,000 tonnes [kt] [1,2]

Region	Africa			Asia			Australia		
Quota year	2012	2013	2014	2012	2013	2014	2012	2013	2014
Source material									
Waste/residual material	4	1	2	37	24	64	5	1	0.4
Barley	.	.	.	.	.	.	.	.	.
Corn	.	.	.	2	2	.	.	.	.
Palm oil	.	.	.	498	626	423	.	.	.
Rapeseed	.	1	.	2	9	7	32	71	50
Rye	.	.	.	.	.	.	.	.	.
Soy	.	.	.	.	.	.	.	0.2	1
Sunflowers	.	.	.	.	.	.	.	.	.
Triticale	.	.	.	.	.	.	.	.	.
Wheat	.	.	.	.	.	.	.	.	.
Sugar cane	.	.	.	.	0.1	.	.	.	.
Sugar beets	.	.	.	.	.	.	.	.	.
Total	**4**	**2**	**2**	**539**	**660**	**494**	**37**	**72**	**52**

Source: BLE
[1] Differences in totals are the result of rounding
[2] Conversion to tonnage was based on the evidence that was taken into account for the quota
[3] No NN data anymore for the years 2013 and 2014, since indicating the origin is now mandatory

Europe			Central America			NN[2]	North America			South America		
2012	2013	2014	2012	2013	2014	2012	2012	2013	2014	2012	2013	2014
9,736	15,855	17,357	.	0.4	3	7,088	1,016	1,146	1,678	89	84	167
738	1,100	1,082	.	.	.	459	.	.	.	.	.	.
6,905	9,577	8,464	.	.	.	263	3,515	1,290	1,146	.	.	.
.	.	.	.	.	.	763	.	.	.	20	.	6
36,981	40,719	50,240	.	.	.	19,728	.	.	.	.	87	136
1,447	3,534	3,231	.	.	.		.	.	.	.	.	.
208	14	24	.	.	.	584	44	3	21	2,104	3,367	730
42	.	.	.	.	.	0	.	.	.	.	.	.
288	352	1,094	.	.	.	256	.	.	.	.	.	.
7,800	6,911	9,010	.	.	2	1,321	84	.	.	125	.	.
.	.	.	127	106	229	.	.	.	.	355	1,182	398
9,475	8,013	6,987	.	.	.	857	.	.	.	.	.	.
73,620	**86,074**	**97,490**	**127**	**106**	**233**	**31,320**	**4,659**	**2,439**	**2,845**	**2,693**	**4,721**	**1,438**

Europe			Central America			NN[3]	North America			South America		
2012	2013	2014	2012	2013	2014	2012	2012	2013	2014	2012	2013	2014
258	422	463	.	0.01	0.1	188	27	30	45	2	2	4
28	42	41	.	.	.	17	.	.	.	.	.	.
259	359	319	.	.	.	10	132	48	43	.	.	.
.	.	.	.	.	.	18	.	.	.	0.5	.	0.1
990	1,090	1,344	.	.	.	528	.	.	.	.	2	4
55	134	122	.	.	.	.	.	.	.	.	.	.
6	0.4	1	.	.	.	16	1	0.1	1	56	90	20
1	.	.	.	.	.	.	.	.	.	.	.	.
11	13	41	.	.	.	10	.	.	.	.	.	.
295	261	340	.	.	0.1	50	3	.	.	5	.	.
.	.	.	5	4	9	.	.	.	.	13	45	15
358	303	264	.	.	.	32	.	.	.	.	.	.
2,260	**2,624**	**2,936**	**5**	**4**	**9**	**869**	**163**	**79**	**89**	**77**	**139**	**43**

Table 14: Total source materials of biofuels[1]

	[TJ]			[t]		
	2012	2013	2014	2012	2013	2014
Source material						
Waste/residual material	19,334	17,859	21,698	513,458	474,974	578,536
Barley	1,174	1,100	1,082	44,369	41,558	40,881
Corn	10,676	10,882	9,610	401,231	408,861	362,512
Palm oil	23,108	24,805	17,922	547,234	591,048	423,643
Rapeseed	57,219	43,559	52,496	1,531,126	1,165,585	1,404,683
Rye	1,447	3,534	3,231	54,685	133,522	122,090
Soy	2,903	3,321	824	77,684	88,849	22,044
Sunflowers	41	.	.	1,109	.	.
Triticale	546	353	1,094	20,632	13,320	41,336
Wheat	9,300	6,945	9,012	351,409	262,433	340,526
Sugar cane	479	1,290	627	18,111	48,750	23,691
Sugar beets	10,261	7,977	6,987	387,710	301,435	264,010
Total	**136,489**	**121,624**	**124,582**	**3,948,757**	**3,530,335**	**3,623,953**

Source: BLE
[1] Differences in totals are the result of rounding

Table 15: Emissions and emissions savings of biofuels[1]

	Emissions [t $CO_{2\,eq}$]			Savings [%]		
	2012	2013	2014	2012	2013	2014
Biofuel type						
Bioethanol	42.34	39.97	38.06	49.47	52.30	54.58
Biomethane	25.12	24.93	20.66	70.02	70.25	75.34
Biomethanol	26.16	26.98	.	68.78	67.81	.
FAME	46.32	42.78	41.36	44.73	48.95	50.65
HVO	42.96	39.94	45.87	48.73	52.34	45.26
Vegetable oil	37.50	36.03	36.15	55.25	57.00	56.86
UCO	14.00	.	.	83.29	.	.
Weighted average of all biofuels	**44.71**	**41.30**	**40.75**	**46.65**	**50.72**	**51.36**

Source: BLE
[1] Differences in totals are the result of rounding

Table 16: Emissions and emissions savings of biomass fuels[1]

	Emissions [t $CO_{2\ eq}$]			Savings [%]		
	2012	2013	2014	2012	2013	2014
Biofuel type						
from the pulp industry	2.29	2.23	1.87	97.49	97.55	97.94
FAME	37.83	37.56	35.44	58.43	58.72	61.06
HVO	32.00	.	.	64.84	.	.
Vegetable oil	28.48	36.26	37.19	68.70	60.16	59.13
UCO	36.00	36.00	19.31	60.44	60.44	78.78
Weighted average of all biofuels	**4.43**	**5.47**	**5.55**	**95.14**	**93.99**	**93.90**

Source: BLE
[1] Differences in totals are the result of rounding

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