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

Biodiesel 2016/2017

Report on Progress and Future Prospects – Excerpt from the UFOP Annual Report

WWW.UFOP.DE

Publisher:
UNION ZUR FÖRDERUNG VON
OEL- UND PROTEINPFLANZEN E. V. (UFOP)

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November 2017

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International and National Climate Protection Policy

After many years of negotiations, representatives of 196 governments (including the USA) signed the Paris Climate Agreement, which is legally binding under international law, at the end of 2015. In 2016 ratification by national parliaments began, in order to enshrine the Paris Agreement's objectives in national measures. On 1st June 2017, US President Donald Trump described the agreement as "a bad deal for the US economy" and announced the USA's withdrawal from the Paris Agreement. This signifies that the country that makes the largest contribution to global warming is evading its international commitments. In contrast, the German Bundestag ratified the Paris Agreement on 22nd September 2016; the European Parliament followed suit on 4th October 2016. From the outset, Germany has assumed a pioneering role as one of the world's leading industrialized nations. UFOP's press release on the topic underscored that Germany, and all other industrialised nations, recognise their responsibility for the development of global greenhouse gas (GHG) emissions and must make a greater contribution to climate protection to achieve what is termed the 2-degree Celsius objective, or better still the 1.5-degree Celsius objective, by 2050. In numerical terms this signifies that global emissions must be limited to at most 700 gigatons GHG equivalent (CO_2, nitrous oxide, methane) by 2050. Emissions should be kept as far below this "budget allowance" as possible. The Federal Government's ambitious Climate Action Plan 2050 must be viewed against this backdrop (c.f. 2015/2016 Annual Report p. 37). Associations including DBV, DRV, VLK, UFOP issued a joint statement on this topic. The Climate Action Plan 2050, which has been criticised by many industry and environmental associations, was adopted so promptly by the Federal Government that Federal Environment Minister Dr. Barbara Hendricks was able to present it as a yardstick environment policy measure at the follow-up conference to Paris in November 2016 in Marrakech (COP22). Signatory states to the Paris Agreement must present their national action plans by 2019/2020. This "timely" presentation of the German National Climate Action Plan was at the same time also a signal directed to the other EU Member States, urging them to likewise respond immediately on the basis of the October 2014 decision. Heads of State and Government had agreed to achieve GHG reductions of at least 40 % (against the 1990 baseline) by 2030 and to increase the share of renewable energies to 27 %. While welcoming the introduction of these objectives in principle, particularly as agriculture is directly affected by climate change, UFOP however also pointed out that the requisite measures must be adopted in unison across Europe. National measures must not give rise to competitive disadvantages, particularly vis-à-vis third countries. The next climate conference, organised by the Federal Government on behalf of conference host, Fiji, is being held in November 2017 in Bonn.

Table 1: Overview of Decisions in the "EU Winter Package"*

Binding goals for reductions in GHG emissions
At least 40 % by 2030 (compared with 1990 baseline), broken down as follows:
43 % for sectors in the Emissions Trading System (ETS, baseline 2005)
30 % for sectors outside ETS (baseline 2005)
Caveat: Reform of the ETS system
Binding renewable energies goal
27 % of final energy consumption in 2030
Non-binding energy efficiency goal
27 % for energy efficiency in 2030
Guidelines: effort-sharing principle – cost-effective
No discrimination against energy-intensive industries
Effort-sharing based on pro-capita GDP of Member States (MS)
10 % of emissions trading certificates to "poorer" MS
Scope of obligations for MS: 0 % – 40 % GHG reduction by 2030
Transport sector
No goal stipulated! Integration into the European Emissions Trading System (ETS) authorised
Agriculture/Forestry
No goal stipulated! Integration into the European Emissions Trading System (ETS) authorised
European Commission tasked with submitting instruments for sustainable intensification and GHG reduction (Implementation by 2020)

*Status July 2017

The European Commission's "Winter Package"

In late November 2016 the European Commission submitted a comprehensive package of draft legislation on these issues, which has since been discussed in the European Parliament. Known as the "Winter Package", it comprises more than 1,000 pages. It is made up of the following eight (!) draft Directives and Regulations:

Table 2: The European Commission's "Winter Package"

Recast of the **Renewable Energy Directive**
New: Regulation on **Energy Union Governance**
Recast of the **Internal Electricity Market Directive**
Regulation on the Electricity Market (Recast of the Regulation on Conditions for Access to the Network (Electricity)
Regulation on Risk-preparedness in the Electricity Sector
Recast of the **Regulation Establishing a European Agency for the Cooperation of Energy Regulators (ACER)**
Revision of the **Energy Efficiency Directive**
Revision of the Energy Performance of Buildings Directive

* COM (2016) 860 "Clean Energy for All Europeans", 30.11.2016

Even before the 2014 Resolution adopted by EU Heads of State and Government, it was questionable whether the climate protection objective could be achieved in the transport sector by 2030 without biofuels. This question is above all relevant for Germany, because the Federal Government has established sector-specific climate protection objectives in the National Climate Action Plan 2050, (c.f. Table 3). The transport sector is lagging furthest behind, having made practically no contribution to GHG reductions since 1990. On the contrary: Efficiency gains through developments in engine technology have been offset by the emergence of larger and heavier vehicles such as SUVs, in part due to consumer preferences. In 2016 SUVs made up the fourth largest segment in new passenger car registrations at around 25 % of the total.

All EU Member States are called upon to fulfil the 2050 climate protection objective. Environmental organisations and climate scientists have supported calls for efforts to meet the 1.5 degree Celsius goal and insist that climate protection measures must be devised in this spirit. It remains to be seen how EU Member States will design their national strategies. The capacity of EU Member States and/or their national budgets to attain the goals stipulated varies as a result of differing economic structures. The package of proposed legislative measures therefore took account of this by introducing the "effort-sharing principle" adopted in October 2014, which enables greater flexibility in stipulating national goals and measures. Those EU Member States obliged to fulfil a comparatively low GHG reduction objective by 2030 are thus partly relieved of responsibility. This "balancing act" is intentional. The European Commission has opted for a balanced and flexible approach to avert potential "resistance". National ability to meet the goals is determined on the basis of economic potential. Crises in southern Europe make clear that there is limited scope in the countries in question to fund such measures. The European Commission's Communication of July 2016 announcing the "Winter Package" therefore affirmed that fairness is to be the guiding principle. In Germany the EEG (Renewable Energy Sources Act) reallocation charge is over 20 billion EUR per annum. There are good reasons why the new concept of "energy poverty", which also figures in the European Commission proposals, was coined here. It would therefore be logical to move from a fixed feed-in tariff to a tendering model to exploit technical progress to the full. Competition is nothing new for the biofuels sector, for biofuels also faced global competition prior to introduction of the energy quota obligation and mandatory GHG reduction, in force since 2015. Global transportation of biofuels and their feedstocks is economically viable – particularly for vegetable-oil-based fuels – as their energy density is comparable to that of diesel fuel. If biofuel companies, as the final interface, meet the sustainability requirements stipulated by the EU, biofuels may be imported into the EU, where they can be counted towards quota fulfilment or be eligible for tax relief. UFOP position papers and press releases in Berlin and Brussels have repeatedly drawn attention to this context; rather than abandoning sustainability requirements stipulated by the EU, UFOP

Table 3: National Climate Action Plan 2050: Goal for Greenhouse Gas Reductions in Action Areas Included in the Goal Definition

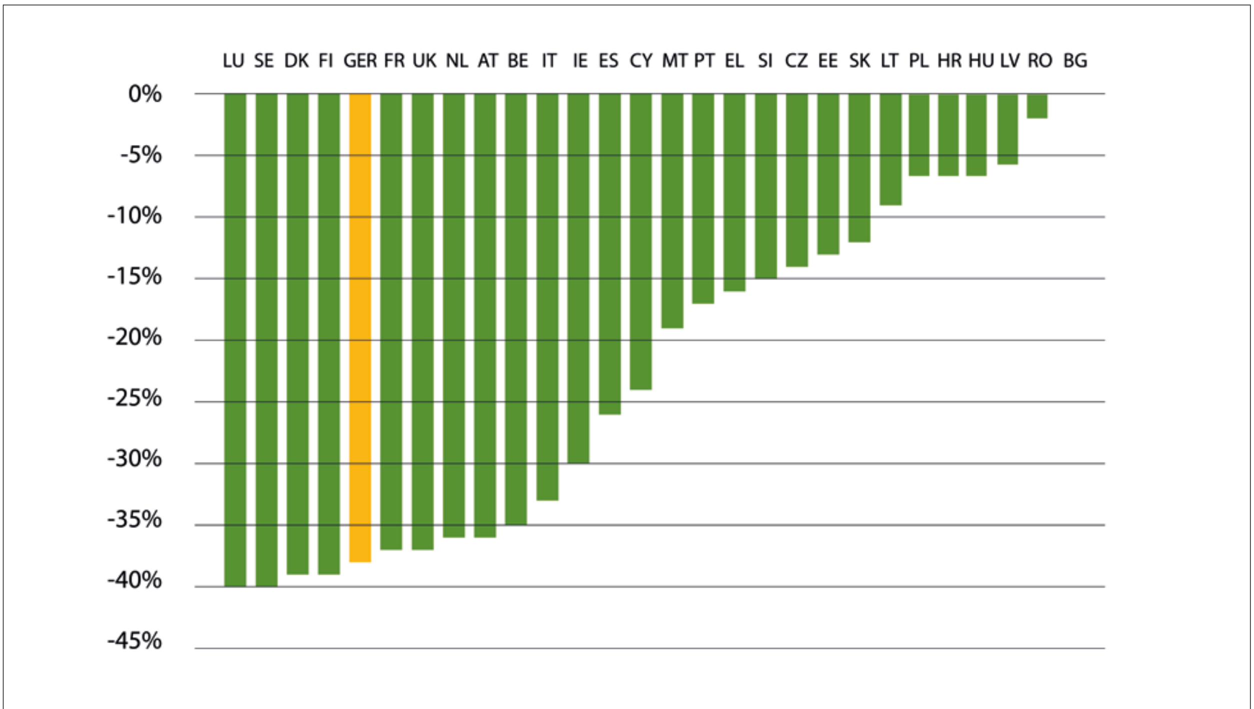
Action area	1990*	2014*	2030*	2030**
Energy sector	466	358	175–183	62–61 %
Buildings	209	119	70–72	67–66 %
Transport	163	160	95–98	42–40 %
Industry	283	181	140–143	51–49 %
Agriculture	88	72	58–61	34–31 %
Sub-total	1.209	890	538–557	56–54 %
Other	39	12	5	87 %
Total	**1.248**	**902**	**543–562**	**56–55 %**

*emissions in million t CO_2-equivalent
**reduction goal as % compared with 1990
Source: National Climate Action Plan 2050 (14.11.2016)

has called for this competition to be viewed as an opportunity to further develop global feedstock competition on the basis of these standards. The requirements enshrined in legislation ("level playing field") present an opportunity to introduce sustainability requirements globally for all biomass cultivation. As UFOP has emphasised, EU agriculture is confronted with world-market conditions in all biomass production areas due to liberalisation of EU agricultural policy. In contrast, competitive disadvantages, arising from varying degrees of adoption of technical progress (genetic engineering, authorisation of plant protection products etc.), still persist, as do distortions of competition due to lower social and environmental standards in certain countries.

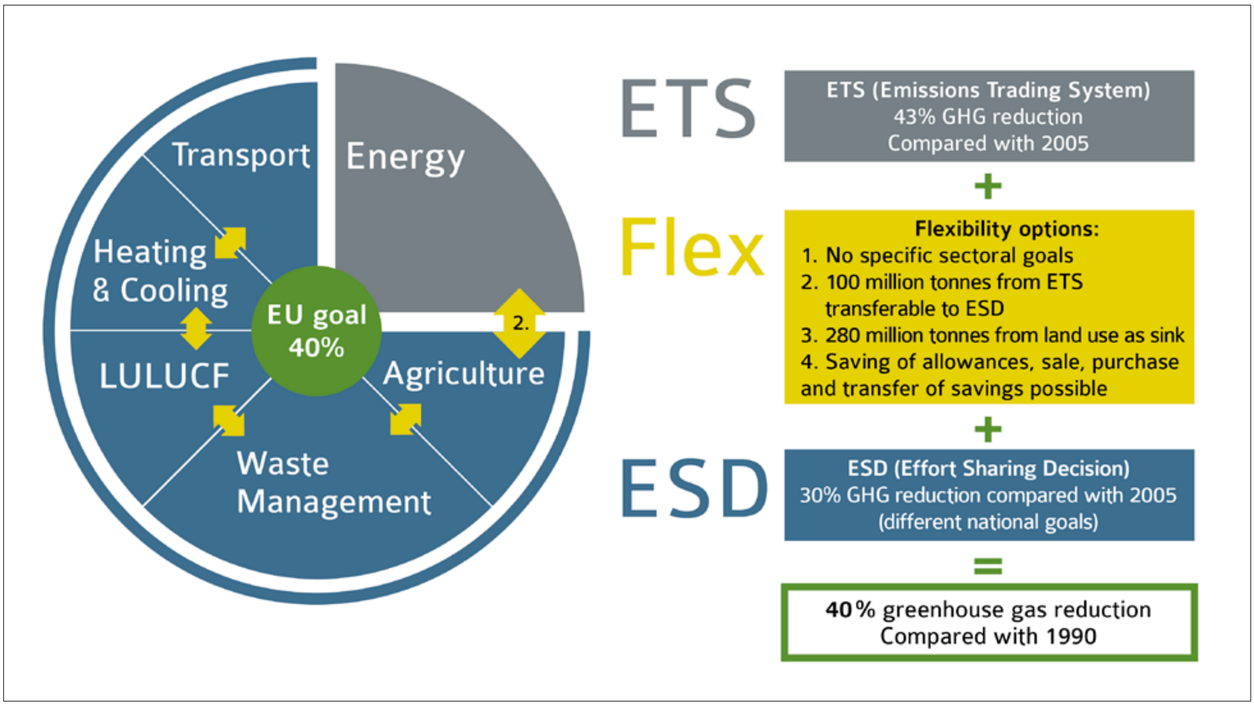
The European Commission's July 2016 Communication addressed implementation of the October 2014 Council decisions and presented details on arrangements for the mechanism known as effort-sharing. Pro-capita gross domestic product (GDP) forms the basis for the European Commission's calculations on effort-sharing between EU Member States, and thus for the respective minimum GHG reduction to be attained by 2030 (Fig. 1). This constitutes the European Commission's response to the 2014 Council Decision stating that stipulation of national objectives must be fair in view of EU Member States' economic performance. The European goal of 40 % greenhouse gas reduction is to be achieved by a 43 % reduction of GHG emissions (against the 2005 baseline) in the energy and industry sectors (covered by the Emissions Trading System – ETS) and a 30 % reduction in economic areas not covered by the ETS (baseline also 2005: transport, buildings, land use, agriculture and waste management, see Fig. 2). EU Member States are empowered to devise individual climate protection measures for these sectors and also to stipulate higher target values. Germany has already made use of this provision (c.f. table 3: Breakdown by sector). Flexibility options in terms of transferability are however limited (100 million t CO_2 from ETS). Scope to count CO_2 savings from sinks in the agriculture and forestry sector towards the goals is restricted to 280 million t CO_2. There should be an option for EU Member States to trade CO_2 credits, as well a mechanism for establishing "reserves" that may be factored into calculations for subsequent target values. This is relevant above all for the forestry sector, by affording scope to form sinks and inventorize carbon stock. The European Commission proposes that EU Member States essentially establish measures to attain the goals of their own accord, e.g. emission reduction in transport management, transition to GHG-neutral means of transport (e-mobility), tax law provisions, promotion of public transport, utilization of biofuels, improving the energy efficiency of buildings. The European Commission focuses in particular on transport, in the light of growing GHG emissions from this sector since 1990, triggered above all by increased heavy haulage. The Fachvereinigung Güterkraftverkehr und Entsorgung (Freight and Waste Management Professional Association) estimates that freight transport by road will increase by around 17 % to 20 % by 2030.

Figure 1: National Goals for Greenhouse Gas Reductions in the EU to 2030*



*compared with 2005, calculation basis is pro-capita GDP
Source: European Commission 2016

Figure 2: EU Emissions Trading System (EU ETS) and Effort Sharing Decision (EU ESD) from 2020



Source: VDB

The European Commission Communication on a European Strategy for Low-emission Mobility presented the elements needed for decarbonisation of the transport sector:

- Increasing the efficiency of the transport system (traffic flow etc.)
- Rapid introduction of low-emission alternative energy sources in the transport sector (inter alia advanced biofuels, renewable electricity, synthetic fuels from non-biogenic renewable sources)
- Transition to emission-free vehicles (all-electric operation)

Associations in the agriculture and biofuels sector observe with concern the European Commission's announcements on phasing-out of commercially available biofuels from cultivated biomass already on the market.

Reform of the Renewable Energy Directive (RED II) – Associations Take Action

The European Oilseed Alliance EOA, whose members include inter alia: UFOP (Germany), FOP (France), KPZPR (Poland), APPO (Belgium), NFU (United Kingdom), the French National Federation of Agricultural Holders' Unions (FNSEA) and the Deutscher Bauernverband (German Farmers' Association/DBV), urged the European Commission to maintain the existing upper limit for biofuels from cultivated biomass at 7 % until 2030 even before the European Commission submitted its proposals in November 2016. At the initiative of the EOA, EOA President Xavier Beulin, who is also FNSEA President, and DBV President Joachim Rukwied urged European Commission President Jean-Claude Juncker, and Agriculture Commissioner Phil Hogan to act. They underlined the importance of the biodiesel market for European rapeseed cultivation, for crop rotation and in reducing the EU protein shortfall as the most significant EU-based source of protein. Their central demand to maintain the 7 % upper limit was rooted in the 2015 compromise agreed for the iLUC Directives. The European umbrella organization COPA-COGECA (Committee of Professional Agricultural Organisations - General Confederation of Agricultural Cooperatives) also endorsed this line of argument vis-à-vis the European Commission. UFOP reiterated this demand at the end of November 2016 in response to the European Commission's proposal. It backed up its comments by pointing out that EU Member States are already authorised to introduce lower national caps.

iLUC and a Never-ending Debate – Palm Oil, the Problematic Feedstock

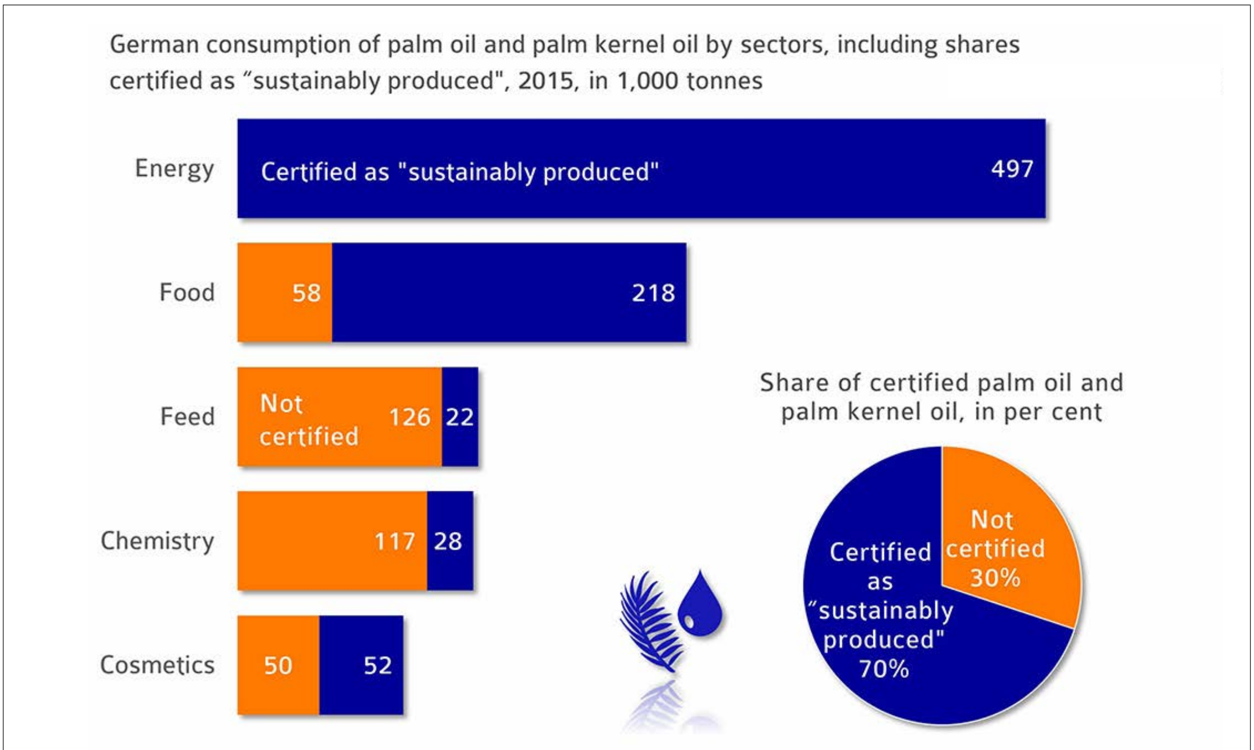
UFOP has urged the European Commission to take account of growing criticism in the face of constantly rising imports of palm oil for biofuel production (biodiesel or hydrated vegetable oil (HVO) and thus to respond to rainforest deforestation (c.f. Fig. 3). EU rapeseed producers must not be held responsible for the failings of environmental policy in respect of rain forest protection. Introducing iLUC factors does not save a single hectare of rain forest. Instead, all utilization areas (foodstuffs, material use in oleochemistry) in the expanding global vegetable oil market must, like biofuels, comply with binding statutory sustainability requirements. Whereas biofuels are certified as 100 % sustainable, this is far from being the case for other uses.

Existing certification instruments (e.g. satellite monitoring, process-related certification – GRAS tool) are already one step ahead of rhetoric and reality. UFOP therefore highly commends the critical European Parliament Resolution on "Palm Oil and Deforestation of Rainforests", which was adopted by an overwhelming majority. It calls on the European Commission to phase out use as biofuels of palm oil and other vegetable oils (also soya oil) that drive deforestation from 2020. Instead sustainable feedstock options such as rapeseed and sunflowers from European cultivation should be promoted. Furthermore, the Resolution also calls for the introduction of ambitious sustainability criteria for palm oil from 2020 irrespective of its end use. In addition, the criticism expressed in the EU Court of Auditors Special Report 18/2106: "The EU System for Certification of Sustainable Biofuels" concerning insufficient supervision of voluntary certification systems and their obligations is also cited. Non-governmental organisations (NGOs), such as Deutsche Umwelthilfe (Environmental Action Germany/DUH), have made high-profile calls for all vegetable oils (including rapeseed oil) to be excluded from schemes promoting biofuels from 2020. UFOP finds this initiative surprising, as DUH has created a communication platform to foster dialogue between NGOs, industry associations (including UFOP) and political representatives on topics such as sustainability certification, biomass potential etc. UFOP would consequently have expected this NGO to adopt a sound fact-based stance and a differentiated approach. Ongoing high-profile campaigns by environmental organisations continue to fuel critical discussion. At the same time, the most important producer countries, Indonesia and Malaysia, have undertaken almost no steps to counteract palm oil's poor image. In contrast, the Brazilian Association of the Sugar and Bioethanol Industry, UNICA, has lobbied in Brussels for iLUC factors, introduced by the European Commission to date solely for reporting purposes, to be factored into calculations of GHG balance. It is well-established that inclusion of iLUC factors in such calculations would signify the immediate demise of all biofuels based on vegetable oil, as the stipulated GHG reduction (50 %) compared with fossil fuel could thus no longer be attained by 2018. This example unfortunately demonstrates that the biofuels sector does not present a united and harmonised front when dealing with the European Commission and European Parliament. UFOP has repeatedly pointed out that biodiesel sales are a crucial prerequisite for continued cultivation in Germany (1.3 to 1.4 million ha) and throughout the European Union (roughly 6.2 million ha) of rapeseed, an important component of crop rotation and the most important source of non-genetically-modified protein in the EU.

Proposals Concerning the Recast of RED II

The aforementioned initiatives by professional associations have had an impact: Initial fears concerning reduction to 0.0 % proved unfounded. From 2021, the upper limit for biofuels from cultivated biomass is to be gradually reduced from 7.0 %, reaching 3.8 % in 2030. Analogously to the approach adopted for the iLUC Directives (see above), EU Member States shall remain empowered to reduce the upper limit to 0 %, which would signify immediate abolition of biofuels from cultivated biomass. On the other hand, the EU Member States have introduced obligations for the mineral oil industry to introduce a minimum share of biofuels from residues onto the market, along with the share of renewable electricity in energy supplies for transport (see. Fig. 4). Another option to meet the goals entails

Figure 3: Shares of Palm Oil from Sustainable Production by Sector

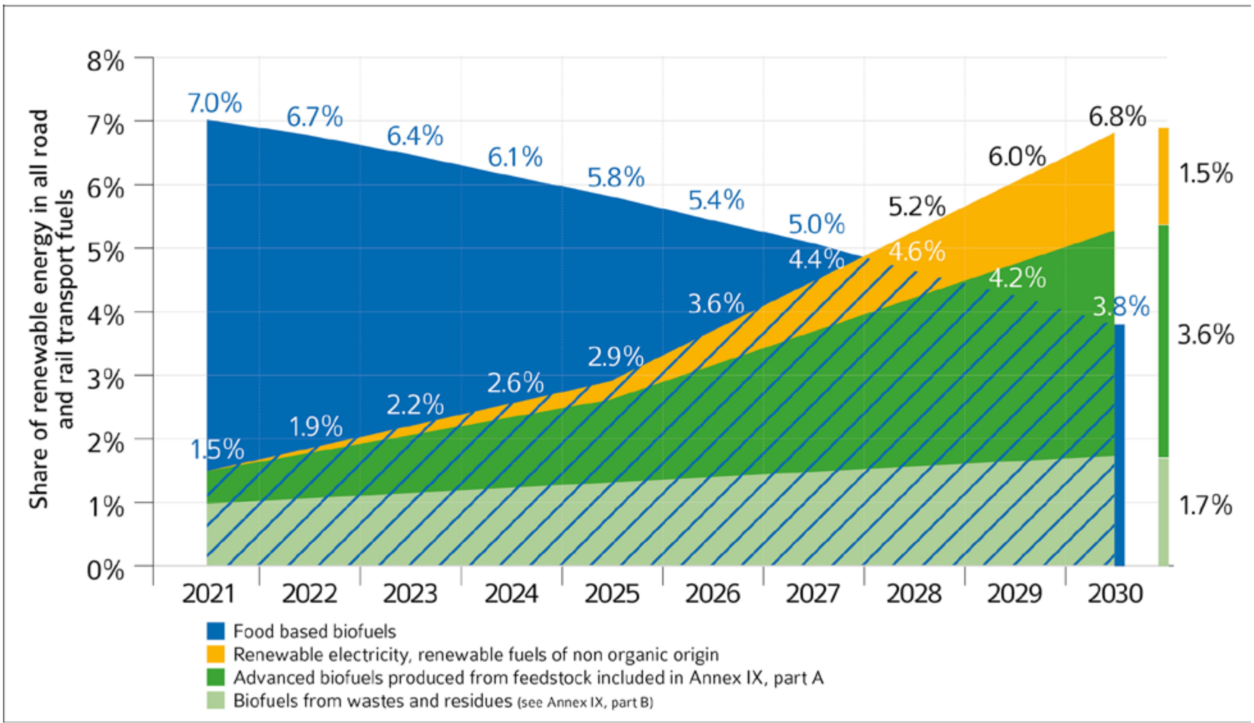


Energy: Data for 2014
Source: UFOP supply report 2016/2017, AMI

using renewable fuels from renewable electricity (e-fuels, power-to-X). The automotive and mineral oil industry focuses on these fuels also in large part to shore up prospects for the combustion engine's future and to secure the existing re-fuelling infrastructure. In particular, critical discussion has addressed the residue potential available. UFOP finds it astonishing that scant attention is paid to the agricultural sector's highly critical stance on these production alternatives. It is instead assumed that this potential "simply exists". FNR has called for a study to assess the biomass potential of biofuels from residues. In particular in the case of residues such as straw (from cultivated biomass!), the potential that is actually available must be taken into account by means of a risk assessment spread for investments (low bulk/transport density, dependency on feedstock supply (price setting/supply contracts) as well as competition with other sources of demand (coarse fodder, litter, heat generation) and the introduction of sustainability requirements (humus content etc.). In the case of straw, harvesting and/or recovery and storage risk (losses) must be factored in, as harvesting cereals will take precedence for farmers, as this is a weather-dependent activity. The Deutsche Biomasseforschungszentrum (German Biomass Research Centre/DBFZ) indicates the available volume of sustainable straw to be 8 to 13 million t in Germany. With a corn-straw ratio of 1:1 and cereal yield of 7 t/ha, this quantity correlates to around 1.15 to 1.86 million ha cultivated area equivalent (area under sowing cereals, without grain maize 2016: c. 6.4 million ha). In addition, developments in process engineering are directed primarily to production of bioethanol and hence also to global competition (bioethanol from bagasse, South America). The collapse of CHOREN in Saxony, with losses in the millions, illustrates the difficulties involved in implementing pyrolysis procedures and fuel production. UFOP has therefore called repeatedly for investments, above all in those third countries with the highest biomass potential and lowest production costs, in order to promote these procedures, which are expensive compared with technologies already on the market.

The decomposition and synthesis processes currently under discussion serve to produce bioethanol, meaning that current over-supply of petrol-engine fuels would be further augmented, assuming current market evolution for diesel and petrol vehicles. However, action is required above all to address GHG-neutral substitution of diesel (increase in heavy-load traffic). The European Commission's proposal to abolish the option of multiple-entry in calculations of biofuels from residues and waste is therefore welcome. This measure should reduce the distortions of competition that have been identified, in particular in the biodiesel market. Biodiesel from waste oils or waste animal fats in Category 1 and 2 (the latter option is excluded in Germany) reduce actual demand for biodiesel in other EU Member States due to multiple-entry in calculations on energy policy goal compliance (10 % to 2020). The European Commission intends to incentivise investments in this comparatively expensive and under-developed technology, alongside additional funding from EU Member States. Since 2015, public-sector investment to promote commercially available biofuels has no longer been possible. The European Commission wants to kick-start investment in production of what are known as "advanced" biofuels through increases in

Figure 4: RED II – Share of Renewable Energy in the Transport Sector 2021-2030



Source: COM 2016/0382 – 23.02.2017

minimum quantities, beginning with 0.5 % in 2021 and rising by 2030 to 3.8 % (c.f. Fig. 4). This is a mandatory provision for oil companies, with fines for non-compliance. A 1.7 % cap is proposed for biofuels from waste oils and animal fats. In 2030 that would correspond to c. 3.6 million t, measured in terms of EU fuel consumption of 280 million t. Reporting and data reconciliation requirements are to be made more stringent for residues and waste, with a view to avoiding fraud. In this respect the European Commission has apparently learnt from past experience.

The RED II draft also envisages more rigorous requirements for GHG reductions, with certification required if measures are to count towards the goal of 27 % renewable energy from 2021. These requirements are in addition extended to include electricity generation, heating and cooling (see table):

Table 4: GHG Minimum Reductions from 2021 for Biofuels, Electricity and Heating/ Cooling*

Biofuel installations:	
in operation on 15.10.2015:	at least 50 %
in operation since 15.10.2015:	at least 60 %
in operation after 01.01.2021:	at least 70 %
Electricity, heating/cooling:	
in operation after 01.01.2021:	at least 80 %
in operation after 01.01.2026:	at least 85 %

*for biomass-based mobility, heating/cooling and electricity generation (including forest biomass)

As a consequence, a biogas installation that stores biogas for use as fuel while simultaneously generating electricity would be required to fulfil different GHG reduction requirements and/or to provide certified evidence of compliance. This would lead to a corresponding increase in bureaucratic effort for installation operators and has given rise to criticism. Installation manufacturers must also comply with ambitious GHG reduction targets included in tendering specifications for new installations in the EU, as well as in third countries if the biofuel produced in the installation in question is intended for use in the EU. The requirement applies when the installation becomes operational and must be confirmed by means of annual certification. The European Court of Auditors has rightly criticised insufficient oversight by the European Commission, which leads to frequent shortcomings in the qualifications of experts involved in the certification systems. Audit quality is also a competition-relevant factor for installation operators, and in appraising eligibility for the energy produced to count towards sustainability certificates for quota obligations. Witness audits such as those conducted by the Bundesanstalt für Landwirtschaft und Ernährung (Federal Office of Agriculture and Food/BLE) both in Germany and in third countries should therefore also be made mandatory for feedstock use in the food sector and for material use.

The basis for GHG calculation is the updated calculation methodology in RED II and the emission factors, which still need to be updated. In this context, UFOP maintains its insistence that by-products such as rapeseed meal must be taken into account appropriately in the calculation (substitution of soya imports). Equally, calculation of nitrous oxide emissions must reflect the results of the project funded by the BMEL and UFOP: "Reduction of GHG emissions in rapeseed cultivation with nitrogen-based fertilization". The emission factor used in GHG accounting today is much too high at 1 % of the N quantity used as fertiliser (IPCC). This does not reflect the soil/climatic conditions of rapeseed cultivation in the EU. This is also confirmed by multi-annual studies in France and Great Britain. At UFOP's initiative, results from these projects were presented to a broad-based audience at a workshop organized by FNR in Brussels.

Table 5: Demand Potential for Areas under Rapeseed Cultivation for Biodiesel, on the Basis of the European Commission's RED II proposal, with caps of 7 % / 5.4 % and 3.8 %

	2020	2026	2030
Target (cap)*	7 %	5.4 %	3.8 %
Diesel consumption (in million t)	210.0	210.0	210.0
FAME/HVO demand (in million t)	14.7	11.34	8
Area required (in million ha)	9.9/8.6	8.1/7.1	5.7/5.0

Biodiesel yield/ha in the EU: 1.4 t EU; in Germany 1.6 t. The area under rapeseed cultivation in the EU is 6.5 million ha with a yield of c. 9 million t rapeseed oil. Climate protection potential is boosted if the GHG quota is introduced across the EU.

*Share of energy from renewable sources in the transport sector for all means of transport
Source: D. Bockey, UFOP

Impact of Current Debates on Rapeseed Cultivation

For the pre-2020 period, the higher percentage for mandatory GHG reductions stipulated in the German provisions is to be welcomed, with an increase from 2017 from 3.5 % to 4.0 %, rising from 2020 to 6 %. There is currently no indication that other EU Member States intend to alter the quota obligation to the detriment of biofuels. This will determine demand for biofuel up to and beyond 2020. As well as using biofuels, EU Member States may also deploy a raft of other measures to attain the stipulated goals. A crucial role will therefore be played by transport decarbonisation measures included in National Action Plans, which are to be submitted by 2019 pursuant to the Climate Protection Agreement. The European Commission has indicated the general thrust of policy through its proposals. It is however important to recall that the upper limit of 7 % was already a compromise. The Czech Republic, Slovakia, France, Spain, Hungary, Poland and Romania have made their consent to the proposal conditional on there being no reduction in the upper limit. There is however reason to fear that implementing the European Commission proposals would trigger falling demand for rapeseed oil for biofuel production. For this reason, new applications and market options should be opened up, for example for high-quality rapeseed cooking oil under the aegis of the BMEL export initiative. Stepping up exports of seed for rapeseed is also conceivable. This would however lead to domestic oil mills operating under capacity, and would run counter to production of rapeseed meal that has not been genetically engineered, as well as hampering efforts to secure market supply from domestic protein sources.

There is a tangible upsurge in pressure on volumes on international biodiesel markets, as can be seen in more stringent standards concerning third countries' blending provisions (c.f. UFOP 2015/2016 Annual Report, p. 10) and export policy. Imports from Argentina and Indonesia in particular are increasingly penetrating the EU Single Market. Although EU consumption has scarcely altered, at approximately 11 million t biodiesel and HVO, there is a shift in feedstock origin. Imports of subsidised soya methyl ester (SME) from the USA, which receives US tax breaks to the tune of 1 USD/gal., were blocked by successful anti-dumping proceedings in 2008/09. In the USA, SME sales rose in subsequent years in line with national blending provisions and exclusion of palm oil-biodiesel. This led to stabilisation of the soya price and thus also of the rapeseed price. However, after losing anti-dumping proceedings against the EU in 2013, Argentina stepped up biodiesel exports to the USA, which retaliated with import duty proceedings. Argentina therefore attempted to resolve its dilemma by appealing against customs measures introduced by the EU, hoping to expand biodiesel exports to the EU as promptly as possible. Indonesia also became a party to this case, which is currently pending before the WTO. A WTO ruling in their favour would be likely to unleash a flood of imports, particularly from Argentina.

The consequences for the scale of cultivation from 2021 are illustrated in Table 5, p. 13. It is based on the best-case scenario of feedstock demand being met almost entirely from rapeseed. In recent years rapeseed oil constituted around two-thirds of market share for biodiesel production in the EU. Against this backdrop it becomes clear why UFOP vigorously advocates exclusion of palm oil, as described above, and calls for more rigorous international certification.

Major Challenges for the Automotive and Mineral Oil Industry

The mineral oil industry must comply with sub-quotas for what are known as "advanced" biofuels from 2021. There is a general assumption that ever-expanding quantities of biofuels will to be available, but these de facto are not currently available, due to a lack of production facilities to meet EU demand. The quantity of biofuel (biodiesel/HVO) produced from waste oils is also inherently limited. The iLUC Directives established an obligation for EU Member States to impose significant fines (in Germany: 470 EUR/t CO_2). In this context debate centres on the future of the combustion engine, with controversy fanned by Dieselgate and breaches of statutory threshold values in many urban centres. This is now also reflected in falling numbers of new registrations for diesel engine cars. It remains to be seen whether this trend will continue. Vehicle owners and purchasers are unsettled, fearing their vehicles will lose value and be barred from urban centres. This holds true both for Germany and for other EU Member States such as France and Great Britain. In addition, from 2021 manufacturers must comply with more stringent requirements for CO_2 reduction. The fleet average for authorised new vehicles must be below 95 g CO_2/km in 2021 (currently: 130 g CO_2/km). Table 6 depicts approaches adopted to comply with the more stringent targets: greater engine efficiency, which is however constrained by physical limits, phased decarbonisation of fuels in conjunction with hybridisation of power trains and switching to all-electric operation, provided that the electricity comes exclusively from renewable sources. Given the tight deadline and current CO_2 values for newly registered cars, there is enormous pressure on the automotive industry to take action to avoid fines to the tune of billions after 2021. For each excess gram and vehicle, a fine of 95 EUR will be payable directly to the European Commission. In 2016 the figures fell against the previous year by only 1.4 g/km, to 127 g/km (source: KBA). If this average value of 127 g/km persists after 2021, fines of over 3,000 EUR per vehicle would be incurred! A proposal from Energy Commissioner Miguel Arias Canete on CO_2 goals after 2021 is expected before the end of the year. It has not yet been determined whether there will be a mid-term goal in 2030, as the European Parliament has urged. The German automotive industry faces enormous pressure to avoid fines by promoting electrification and/or hybrid power trains system, as well as by rapidly increasing sales of vehicles with this technology. On average, competitors in neighbouring countries offer smaller vehicles and would therefore be less affected by fines. Another option is to increase sales of vehicles powered by natural gas. This could in turn promote feed-in of biogas into the natural gas network.

Table 6: Evolutionary Combination of Fuels/Power Trains for Transport Sector Decarbonisation

Fuel consumption in the light of CO_2 legislation (in litres/100 km)

Fuel type	130 g CO_2/km*	95g CO_2/km*	75g CO_2/km	30g CO_2/km
Petrol	5.50	3.99	3.15	1,26
Diesel	4.90	3.60	2.83	1,13
Liquefied petroleum gas	7.30	5.34	4,21	1,69

Decarbonisation options:

- Biofuels from cultivated biomass, residues and waste
- Non-biogenic renewable fuels (e-fuels)
- Hybridisation (diesel/petrol engines) with increasing proportion of battery use
- Pure battery operation
- Natural gas, LNG, CNG

Sources: Prof. Dr. Zikorde (Lecture at FAD Conference, Dresden 2016) * UBA data

Decarbonisation policy for the transport sector distinguishes between the automotive industry, which must meet the stipulated CO_2 fleet targets per km by altering power trains and improving their efficiency, and mineral oil industry companies subject to quotas, which must ensure decarbonisation of fuel to comply with the 6 % GHG reduction stipulated from 2020. Renewable fuels or electricity are not (yet) eligible to count towards fulfilment of the automotive industry's obligation to cut CO_2 emissions. However, the automotive industry and the mineral oil industry are in the same boat, because the "chicken and egg problem" must be solved in respect of the switch to lower-CO_2 fossil fuels (natural gas, LNG) and renewable electricity. The funding programme described (c.f. Table 7, next page) can therefore get the ball rolling, although further measures will also be needed to establish the requisite infrastructure in the light of the deadlines stipulated. Largely for this reason, UFOP, together with other biofuel associations, has urged the European Parliament to introduce a mandatory increase to 15 % for the share of renewable energy in the transport sector by 2030. This must be achieved through competition between all biofuels, e-fuels and e-mobility systems, with caps of 7 % and 1.7 % respectively maintained for commercially available biofuels and for biofuels from waste oils and fats. The associations call explicitly for the goal of 10 % renewable energy by 2020 to be maintained for all EU Member States. This allows existing infrastructure to be used for fuels with a higher proportion of biogenic shares, thus gaining time to develop new structures. If this strategy were not adopted, it would be tantamount to focus policy on technologies that may not yet be well-established in ten or twenty years.

Drawing on the expertise of the UFOP Expert Commission "Biofuels and renewable feedstocks", UFOP is actively involved inter alia in the Fachausschuss Brennstoffe (Expert Committee on Fuels) of the Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle e. V. (German Society for Petroleum, Gas and Coal Science and Technology/DGMK), the Fachausschuss Mobilität (Expert Committee on Mobility) of the Bundesverband Erneuerbare Energien (German Renewable Energy Federation/BEE), and in the DECHEMA Temporärer Arbeitskreis Alternative Brenn- und Kraftstoffe (DECHEMA Temporary Working Group on Alternative Fuels). This working group drew up a comprehensive strategy paper in Spring 2016 on future orientations for research on advanced biofuels. Limited range and a lack of infrastructure (charging stations) explain why to date only 27,000 funding applications have been received for all-electric or part-electric vehicles (plug-in hybrid, source: BAFA). Originally it was envisaged that a million such vehicles would be in use by 2020. The Federal Government has long abandoned this vision. In the light of the challenges described above, progress must be made on infrastructure development for alternative fuels. EU Member States were obliged to implement the relevant Directive by 18th November 2016. The EU Commission's first implementation report is scheduled for 18th November 2019. There are huge differences in EU Member States' economic structures and economic capacity to fund additional infrastructure. The effort-sharing principle will also impact implementation in this realm. Germany is forging ahead in this sphere too. The Federation, the federal states, and above all the relevant business sectors are playing their part through co-financing of charging infrastructure or in projects such as industrial-scale testing of procedures to manufacture electricity-based fuels, known as e-fuels (power-to-gas/power-to-liquid). Table 7 presents an overview of support measures from which commercially available biofuels are explicitly excluded. The measures, funded to the tune of c. 1 billion EUR from fiscal resources, are supplemented by funding from the automotive and oil industry. The goal is not only to construct a sufficient number of rapid-charging points at least on motorways, but also to ensure introduction of renewable fuels of non-biogenic origin. Constructing charging points does not however suffice to resolve the issue. Rapid-charging points need their own

Table 7: National Strategic Framework for Expanding Infrastructure for Alternative Fuels (NSR), based on EU Directive 2014/94/EC
Measures and Goals for the Infrastructure Offensive in the Power Train Revolution

Strategy:
infrastructure development for the alternative fuels electricity, hydrogen and natural gas (biomethane)
No need for investment or support for "established biofuels" (biodiesel, bioethanol)

Funding: c. 1 billion EUR!
300 million EUR for funding programme "E-Mobility Charging Infrastructure"
140 million EUR for funding programme "Local E-Mobility"
247 million EUR for further development and market establishment of National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP)
268 million EUR from Mobility and Fuels Strategy of the German Government (MFS)

For the following measures:
Electromobility/charging columns:
All motorway service stations with rapid-charging points
Full-coverage network with 5,000 rapid- and 10,000 standard charging columns by 2020
Funding programme "Local E-Mobility": Support for local authorities, inter alia for procurement of electric vehicles and charging
infrastructure fuel cell/hydrogen fuelling stations:
Further development of "basic network" of 21 hydrogen fuelling stations
Extension by 2020: 100 fuelling stations
Extension by 2025: 400 fuelling stations
Support for demonstration projects:
Purchase of LNG lorry fleets
LNG power packs for land-based electricity supply to container ships during layovers

supply line to ensure that sufficient electricity is available for rapid simultaneous charging at several charging points. Introducing e-fuels aims to decarbonise the existing range of fuels on offer and ensure that fuelling station infrastructure can be maintained (supplemented by rapid-charging stations); this will help secure the future of the combustion engine. These challenges are reflected in the topics to be addressed at the 15th International Renewable Mobility Congress on 22nd/23rd January 2018 in Berlin, with UFOP involved in content design. As in previous years, 550 participants from Germany and abroad are expected to attend.

Germany is setting the pace and defining the scope of measures through its budgetary framework, forging ahead at a rate that "poorer" EU Member States can scarcely keep up with. Nonetheless it is vital to get to grips with this challenge, as otherwise the EU will run out of time to meet not only the 2030 goals, but also the 2050 objectives. The EU Member States must transpose the recast RED II at the latest by 30th June 2021. There is enormous time pressure to adopt the comprehensive legislative package against the backdrop of pending concertation procedures between the European Parliament, European Council and European Commission (trilogue procedure).

European Parliament – Diverging Positions Offer Hope

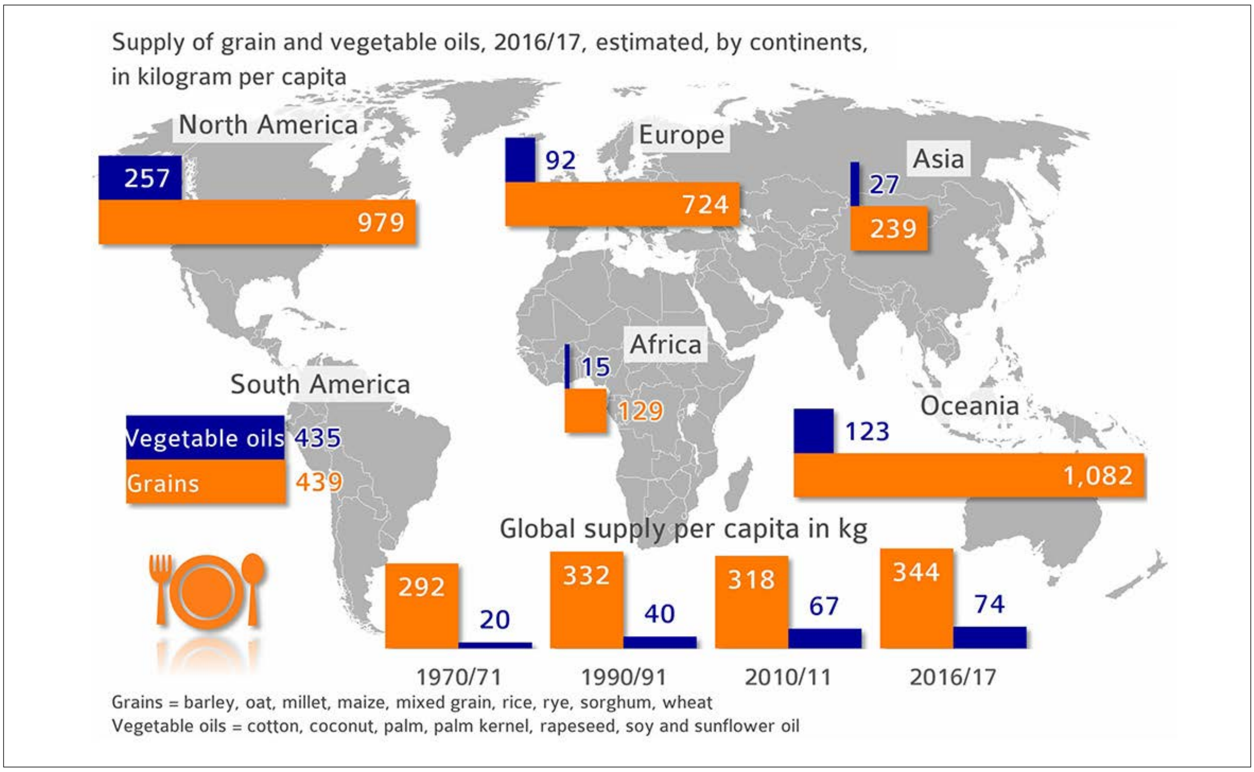
Prior to discussion of the draft Directives, in Spring 2017 the Chairs of the EP's Environment Committee (ENVI) and Industry Committee (ITRE) first established an agreement on the respective committees' responsibilities in deliberations on the legislation. It remains to be seen how this division of competences will be put into practice, particularly in concertation efforts with the Council and European Commission. The rapporteurs for the aforementioned committees and for the other committees involved, namely the Agriculture (AGRI) and the Transport Committee (TRAN), have submitted draft amendments, which will be examined in the committees in September/October 2017. The draft amendments reject the 27 % renewable energy goal established by the Council and incorporated into the European Commission's RED II draft, viewing this as completely insufficient. The committees have stated that this goal must be increased to 35 % (ITRE) or 45 % (ENVI, TRAN) and fulfilled by the individual EU Member States (instead of an EU-wide goal). They have also criticised the "penalties" envisaged in the draft for likely non-compliance with the goals, stating that such penalties are inadequate. Whereas ENVI's draft amendments support reducting the figure for commercially available biofuels from 7 % in 2021 to 3.8 % in 2030, this proposal is rejected in the AGRI draft amendments, which instead propose retaining the upper limit of 7 %. This limit should however apply only to biofuels that contribute to EU protein supply. In contrast, biofuels from palm oil are to be excluded. In contrast, draft amendments from the ENVI Committee envisage inclusion of iLUC factors in calculating the GHG balance. The ensuing GHG values would mean the immediate demise of biofuels from vegetable oil and would give preferential treatment to biofuels from cereals, sugar etc. Furthermore, e-mobility, or rather pro-rata inclusion of renewable electricity, should be eligible to count towards attaining the goals, with a factor of 5 applied. There are pronounced differences in the draft amendments from the various committees. In this respect, forthcoming deliberations in EP committees offer further scope for the biofuel product chain's concerns to be taken on board. COPA-COGECA and the European Oil Seed Alliance (EOA) have submitted proposals for amendments. As the draft amendments are in some cases very different from the European Commission proposal, a comprehensive discussion process is expected in order to reach an agreement. It is obviously crucial to enter into dialogue with the European Council too, as certain draft amendments would affect EU Member States directly in terms of implementation and enforcement of penalties. It is therefore likely that deliberations on the "Winter Package" will continue until 2018.

UFOP supply report 2016/2017

The Food or Fuel DiscussionA Never-ending Story? UFOP Presents Supply Report

The "food or fuel" debate continues to play a role in political debates on prospects for biofuels from cultivated biomass. Too little attention is often paid in this context to the actual supply situation on international agricultural markets. For years, producer prices for cereals and oil seeds have been too low to allow companies to form a sound equity capital basis. This point is often brushed aside in the biofuel discussion, as NGOs repeatedly succeed in turning the spotlight on high-profile issues such as problems related to palm oil. Against this backdrop, UFOP has commissioned Agrarmarkt Informations-Gesellschaft mbH (AMI) to produce the "Supply report 2016/2017". The report presents charts that provide concise explanations of the global supply situation for the most important agricultural feedstocks, which are at the same time also the basis for biofuel production. Questions of cause and effect are explained for production of bioethanol and biodiesel. In the case of rapeseed, for example, rapeseed protein production is highlighted as a by-product. The report notes that the driving force for biodiesel production from soya oil is not European biofuel policy, but rather, the expansion of cultivated areas for this crop to meet global demand for feed protein, driven by soya meal prices. Structural over-supply on agricultural markets is the underlying cause and driving force in use of this feedstock inter alia for fuel production. The report also elucidates the most important reasons for hunger and malnutrition. The report points out that production of cereals and vegetable oil more than suffices to secure food supplies, particularly if the enormous losses during harvesting, storage and procession are minimised and respect for foodstuffs in general is improved in industrialised countries (Fig. 5). The report, published in English and German was transmitted to members of the aforementioned European Parliament committees.

Figure 5: Growing Population Has More to Eat



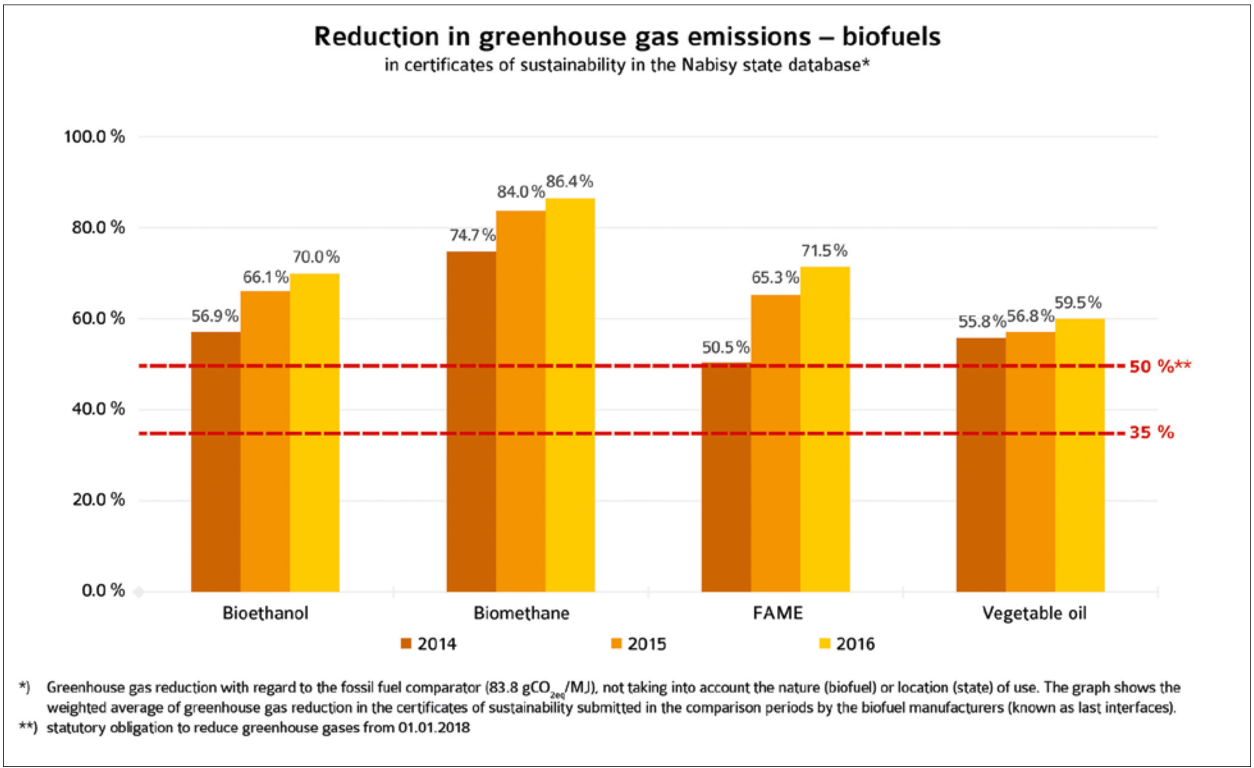
Source: UFOP supply report 2016/2017, AMI

Changes in National Biofuel Policy

EU Directive 2015/652 (20th April 2015) introduced an obligation for Member States to transpose the calculation methods and reporting stipulated in the Fuel Quality Directive 98/70/EC into national law by 21st April 2017. This Directive envisages target greenhouse gas reduction of 6 % by 2020. In Germany, implementation of this Directive gives rise to new approaches to fulfil the GHG reduction obligation: authorisation for the first time for co-processing of vegetable oils and waste oils in oil refineries, factoring in of electromobility to calculations, the GHG-emission value for non-biogenic renewable fuels (PtG) as well as factoring in of GHG reduction measures from oil production (upstream emissions reductions (UER)) when calculating achievement of goals. On this point the BMUB (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety) has submitted three draft Regulations: the 37th and 38th Federal Emissions Protection Regulation (BImSchV) and the Upstream Emissions Reductions Regulation (UERV). These drafts emphasise competition in the context of these GHG quota compliance regulations, which are open to all technologies. UFOP advocates competition between technologies, but also between feedstocks. However, developments have confirmed the anticipated fall in demand for biomass and increased market price pressure for biodiesel and vegetable oil. At the same time, the full potential to cut GHG is not utilised, as the Federal Government does not have the courage to undertake the phased increase in mandatory GHG reduction that UFOP and other associations in the biofuel chain have demanded. In a nutshell, this approach does not make sense in environment policy terms if decarbonisation of the transport sector and attainment of goals by 2030 are jeopardized. The 37th BImSchV was adopted in March 2017 by the German Bundestag. The 38th BImSchV and the UERV do not require a Bundestag vote and are currently being examined in interministry concertation. One reason for the delay lies in the BMUB's intention to reduce the upper limit for commercially available biofuels from cultivated biomass from 7 % to 5 %, which has been vehemently criticised by the biofuel industry. On this point the BMEL has successfully insisted on a revised draft. An overview of the points addressed in this legislation:

1. Introduction of co-processing of vegetable oils in a refinery process at the hydrogenation phase, limited to 2020;
2. Factoring into calculations of renewable fuels of non-biogenic origin, introduction of a GHG-emission factor for power-to-gas (PtG) of 3.3 g CO_2/MJ;
3. More concrete details and/or extension of the feedstock definition for first-generation biofuels, so that cultivated biomass for biogas production (inter alia maize) is included in the upper limit of 7 %;

Figure 6: GHG Reduction Risen Again



Source: BLE

4. Baseline value for calculation of GHG-reduction obligation of companies subject to quota increased from 83.8 g CO_2/MJ to 94.1 g CO_2/MJ;
5. Eligibility of e-mobility to count towards goal of 10 % renewable energy in 2020; provisions stipulate requirements concerning the identity of origin of renewable electricity;
6. Introduction of an upper limit for biofuels from cultivated biomass of max. 5 %; provision not time-limited and therefore also applies after 2020; increase addressed in ongoing inter-ministry concertation between BMUB (lead ministry), BMEL and BMWi (Federal Ministry for Economic Affairs and Energy);
7. Introduction of a sub-quota for advanced biofuels. Compliance obligations are graduated as a factor of the quantity of fossil fuel in transport of the company responsible for compliance;
8. Penalty for non-compliance with GHG reduction obligation unchanged at 470 EUR/t CO_2.
9. The UERV provides that from 2020 1.75 % GHG reduction from certified UER can count towards mandatory GHG reduction (which will be 6 % in 2020).

The UERV has triggered a highly critical discussion. UFOP underlined in the position paper it submitted to BMUB that for example highly cost-efficient compliance with the GHG reduction obligation is possible through combustion of associated gas (methane to CO_2), thus leading to considerable disruption on the biofuel market. Inclusion of this measure is anyway worrying, because oil production should be conducted in a manner that minimises GHG as much as possible. Conversely this would signify that inefficiency in oil production is subsequently even rewarded. At present there is discussion in particular of the maximum eligible share (1.75 %) that may be included in calculations. UFOP is calling for this figure to be reduced (max. 1 %); otherwise this would almost entirely cancel out the increase in the mandatory reduction from 4% to 6 % in 2020. Growth in volume of commercially available biofuels would be excluded. It becomes clear here that the actual problem for the sector lies in the Federal Government's unambitious (bio-)fuel strategy. UFOP draws attention to the Biofuels Roadmap, agreed upon with professional associations as well as the BMU and BMEL in 2007 with a view to implementation of the Meseberger Decisions. This included both the introduction of processing of vegetable oil in oil refineries (Hydrogenation Regulation) as well as grant of approvals for petrol (E10) and diesel (B7). UFOP has above all advocated that the amended Fuel Quality Regulation be implemented as expeditiously as possible and called for introduction of B7 across the country. In UFOP's view it is worth looking back to the situation ten years ago before beginning to design future plans.

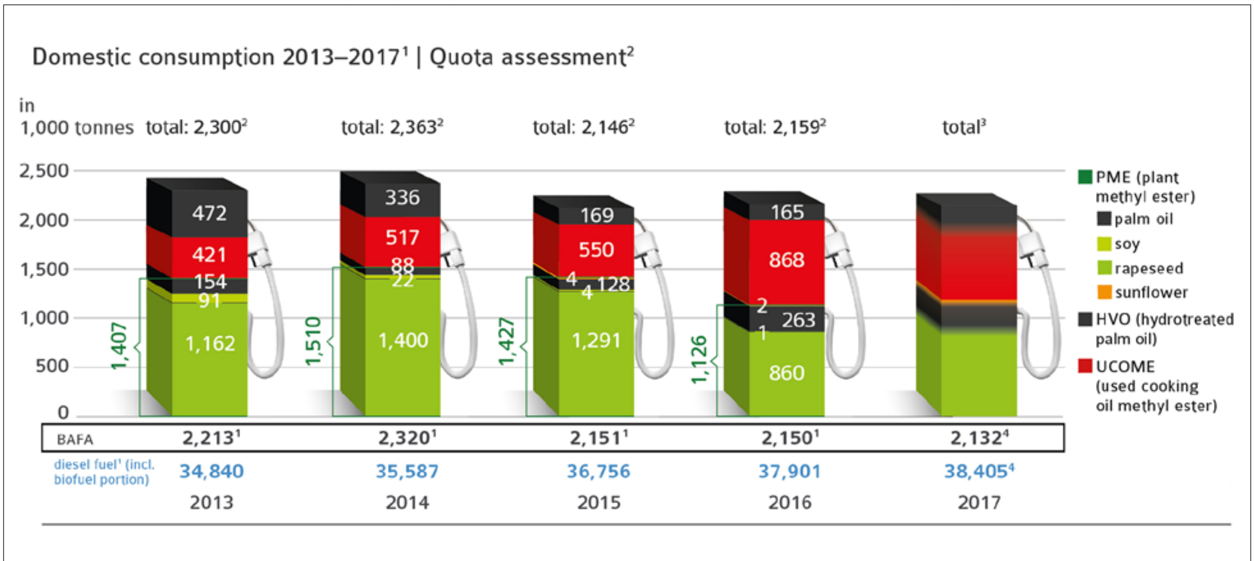
GHG Efficiency Hampers Sales Development

GHG-efficiency competition triggered by the GHG reduction obligation introduced in Germany in 2015, which is in principle viewed as positive in environmental terms, is reflected not only in the evolution of sales volumes but also in feedstock composition. According to the results of BLE's "2015 Evaluation and Experience Report" the average GHG reduction compared with fossil fuels has risen to 73 % (Previous year: 70 %). All biofuel types have improved in comparison with the 2015 figures (Fig. 7). Closer examination is however required in the case of FAME (biodiesel). FAME encompasses hydrogenated vegetable oil (HVO), biodiesel from rapeseed, soya and palm oil as well as biodiesel from waste oils. In Germany there is a statutory ban on counting biodiesel from waste fats of animal origin towards fulfilment of the targets. Evaluation of the sustainability certificates enables the data to be depicted with a breakdown of data on volume sold and feedstocks, as well as origins. Fig. 7 shows sales development from 2013 to 2017 taking account of feedstock composition. The main point revealed is the constantly growing share of UCOME, which in 2016 was higher than biodiesel from rapeseed. This was caused by the GHG reduction obligation introduced in 2015 and ensuing GHG-efficiency competition. Feedstock composition for the 2017 quota year was not available at the time of going to press, as concertation on the 2017 report with BMEL and BMUB will not be concluded until October 2018. Rapeseed oil methyl ester (RME) has stabilised at about 1.3 million t. This RME volume can be assumed for 2016 too. This corresponds to around 0.82 million ha. By way of comparison: the volume of RME included in overall consumption in the EU is roughly 6 to 6.2 million t, which corresponds to around 5 million ha (Total area under cultivation in 2016: 6.3). That underlines the great significance of this market outlet for the future of rapeseed cultivations. For that reason, UFOP calls for biofuel policy to be continued after 2020 and for the upper limit of 7 % to be maintained.

UFOP regrets that biofuels' potential for decarbonisation of the transport sector is not fully exploited. Demand for biodiesel is stagnating compared with 2015 figures and remained at around 2.15 million t in 2016, although diesel consumption had risen to 35.75 million t (previous year 34.6 million t). The incorporation rate of biodiesel in diesel therefore dropped from 5.84 % in 2015 to 5.68 % in 2016.

UFOP criticised the GHG quota established for 2015 and 2016, which set a 3.5 % cap for RME from domestic production. At the same time, increasing GHG efficiency diminishes the volumes needed. There are grounds to fear this trend will continue, particularly to the detriment of biodiesel, as confirmed by the growing share of biodiesel from waste oil. It is however striking that the share of biofuels from palm oil fell in 2015 to 0.3 million t (2014: 0.42 million t). UFOP has called repeatedly for the climate protection potential of GHG-optimized biofuels to be exploited to the full by gradually raising the mandatory reduction to be achieved in the run-up to 2020. Germany's decision to adopt an independent policy approach also leads to more imports of biodiesel from used vegetable oils to Germany. UFOP therefore rejected any extension of the scope of feedstocks from animal fats and advocated EU-wide introduction of the GHG reduction obligation with a view to counteracting these displacement effects. Concentrating deliveries to Germany as a profit-maximisation approach for "disposal" of these waste-based feedstocks is not at all beneficial for global climate protection. UFOP draws attention to the fact that the potential of waste feedstocks is also very limited and leads to substitution effects, which are in turn relevant for GHG accounting. In 2013 the Deutsche Biomasseforschungszentrum (German Biomass Research Centre/DBFZ) drew up an expert report for UFOP: "Biodiesel on the basis of animal and plant waste oils and fats – devising a proposal on revision of the GHG standard value".

Figure 7: Development of Sales of Biodiesel in Germany / Raw Material Composition / Diesel Consumption



Sources: [1]BAFA, [2]BLE, [3]BLE Evaluation Report 2017 expected for October 2018, [4]projection according to BAFA monthly inputs

Although mandatory GHG reduction has been increased in 2017 from 3.5 to 4.0 % (applicable until 2019), stagnating demand for biodiesel at around 2 million t is expected in 2017, although diesel consumption is likely to reach a record c. 38 million t (!). This signifies a further drop in incorporation rate from 5.7 % to 5.5 %. Disaster is looming for RME sales, and also on another front: The very low share of soya methyl ester (SME) in the statistics is striking. Imports from the USA and Argentina have not played a role in recent years due to the antidumping duties introduced by the EU. This could however change from 2017 if Argentina were to win the aforementioned World Trade Organization (WTO) proceedings.

Biofuels study "Implications of political decisions on biofuels and raw materials markets" commisioned by VDB, OVID and UFOP

Association Study on GHG Quota Policy in Germany

Against this backdrop, the professional associations VDB, OVID and UFOP commissioned the Institut für Landwirtschaftliche Betriebslehre (Institute of Farm Management) at Hohenheim University to draw up a study: "Implications of political decisions on biofuels and raw materials markets". The study identified the value-added effects associated with the GHG quota policy in agriculture and on the macroeconomic level. These are determined by use of rapeseed oil for biodiesel production, substitution of soya imports by rapeseed meal, as well as by glycerine production for manufacture of high-value products. The study depicts substitution effects for fossil fuels, but also the fact that the existing GHG quote does not make full use of GHG reduction potential. The calculations confirm the fundamental significance of the biodiesel market for future prospects for rapeseed cultivation in the light of its valuable crop-rotation qualities.

Biofuels Branch Platform for the Agricultural and Forestry Sector

Both meetings of the branch platform in the reporting period focused on an exchange of experience concerning utilization of biofuels in the agricultural and forestry sector. Particular attention was addressed to a presentation on in-house fuel production from rapeseed, upgrading of rapeseed oils to comply with the fuel norms, use of by-products as feed, as well as technical experience with a wide range of aggregate equipment (tractors, harvesting machinery, farm trucks). There was intensive discussion on the draft revision of the Energy Taxation Bill, submitted in early 2017, which in § 57 envisages abolition of tax relief for biofuels used in the agriculture and forestry sector. Extensive lobbying by UFOP and DBV convinced politicians that deleting this provision would send entirely the wrong signal. Firms producing agricultural machinery would turn away from engine development as a prerequisite for receiving approvals. At the same time, biofuels are the only option to make a contribution to decarbonisation with non-road-based vehicles too, provided that the aggregate equipment is approved for operation with biofuels. In the framework of a project funded by FNR and UFOP, which was concluded in mid-2017, a Deutz AG diesel engine was successfully tested for utilization of biodiesel as pure fuel (B100). This engine could be approved for exhaust-gas categories IV and V (with a modification). The fleet of existing equipment means there must be scope for free choice of fuels, which is an important factor to ensure acceptance in the agricultural sector. This fleet requires around 1.6 million t diesel per annum and is therefore called upon in the National Climate Action Plan 2050 to make a substantial contribution to GHG reduction. This can be partly ensured by biofuels from agriculture for the agricultural sector, as UFOP and DBV underscored. Both associations expressed great relief when the Bundestag decided at the end of May 2017 to maintain the existing provisions.

Expert Commission on Biofuels and Renewable Resources

At the Expert Committee meeting on 13th July 2017, Chairman Prof. Dr. Jürgen Krahl welcomed a new member, Prof. Dr.-Ing. Bert Buchholz, Professor for Piston Engines and Combustion Engines, Rostock University.

Status of Biofuel Policy in Germany and the EU

Members were informed about the status of national legislation in the wake of transposition of EU Directive 2015/652/EC on establishing the calculation method and reporting obligations pursuant to the amended Fuel Quality Directive (98/70/EC). The Federal Government transposed these Directives with the 37th and 38th Federal Emissions Protection Regulation (BImSchV) and the Upstream Emissions Reductions Regulation (UERV) on counting such reductions towards the mandatory greenhouse gas (GHG) reduction. The provisions relate to the new option, which is however to continue only until 2020, of co-processing of vegetable oil and waste oils in oil refineries, the requirements for inclusion in calculations of electromobility and non-biogenic renewable fuels, such as power-to-gas (PtG) and power-to-liquid (PtL), which are currently in the development pipeline. The 38th BImSchV also envisages a more comprehensive feedstock definition for biofuels from cultivated biomass. Alongside cereals, sugar beet, sugar cane, rapeseed, soya and palm oil, all principal crops grown on agricultural land primarily for energy production, are to be included. The growing period as a principal crop is therefore the decisive factor determining whether the biofuels produced from these feedstocks are covered by the upper limit (7 %). As a result, this also affects new crops such as the flowering plant Silphium perfoliatum, the cup plant, which is to be cultivated as an alternative to maize for production of biogas. The issue is therefore the fundamental question of competition for cropland. Criticism of the biofuel associations was addressed concerning the renewed attempt by the BMUB to reduce the upper limit for biofuels from cultivated biomass from 7 % to 5 % through these draft regulations. As a result of this criticism, BMEL has demanded that an amended draft of the 38th BImSchV be submitted. There is also criticism of the provision envisaged in the UER Regulation of pro-rata inclusion in the calculations (up to 1.75 % of the GHG reduction achieved with UER) related to the GHG reduction obligation of 6 % from 2020. This signifies an upper limit of 4 % for all other biofuel alternatives. Increase in volume would hence be excluded. There is a risk of considerable disruption on the biofuel market, because UER measures can be implemented comparatively cheaply. The Umweltbundesamt (Federal Environment Agency) is responsible for monitoring of UER measures, PtG and arrangements for inclusion of e-mobility in the calculations.

The European Commission's proposed recast of the Renewable Energy Directive (REDII) was also discussed, along with UFOP's opposition to reducing the upper limit for biofuels from cultivated biomass from 7 % in 2021 to 3.8 % in 2030. UFOP in particular criticised plans to abolish of the 10 % sub-goal for the transport sector, which is binding on all EU Member States, in 2020 and called instead for extension of this provision, along with an increase of the target to 15 %, arguing that setting the goal at this level would generate the requisite pressure for action to ensure that market access for all technologies is secured or enabled, on the basis of a level playing field (e-mobility) (c.f. also Chapter 3. "Biodiesel and Co.").

Challenges Linked to Emissions Legislation – What Lies Ahead for the Automotive Industry?

Dr. Jakob Seiler from the Verband der Deutschen Automobilindustrie (German Association of the Automotive Industry/VDA) offered an overview of the discussions currently underway relating to emissions legislation provisions on requirements for approval and presented the relevant test cycles and test criteria. Against the backdrop of the climate protection discussion and fleet goal for automobiles of 95 g CO_2/km to be attained by 2021, he emphasised the diesel engine's energy conversion efficiency compared with the internal combustion engine. He stressed that the diesel engine is essential in higher performance categories in order to achieve this goal. However, considerably more stringent requirements enshrined in emissions legislation also trigger higher costs for exhaust gas purification and ultimately lead to higher vehicle prices. Dr. Seiler conceded that if CO_2 emissions from heavy commercial vehicles remain constant, emissions from automobiles would need to fall even more, by 72 %. In tackling this challenge, the efficiency of new vehicles cannot be the yardstick or sole focus of climate protection policy; instead all options for CO_2 reduction in the transport sector should be taken into account. These include in particular decarbonisation of fuels, the switch to e-mobility by means of hybridisation, extending to all-electric operation. Dr. Seiler also addressed the problem of discrepancies between nitrogen oxide (NOx) emission values measured on the chassis dynamometer and in real operation (RDE). Diesel has also been subject to criticism because engines have not been developed or optimised in the light of the RDE cycle, but rather in terms of statutory stipulations on test cycles for type approval. Questions concerning future measurement of CO_2 emissions in RDE were also discussed, together with the question of establishing a representative driving cycle. For conformity testing in the context of what is known as the first RDE level, the appropriate technology is available to comply with emission caps.

The CO_2 balance of electric power trains was also examined. It was noted that the CO_2 target could not be attained as long as the German electricity mix remains in force. Dr. Seiler concluded by underlining that a more comprehensive approach, also taking account of fuel decarbonisation, is needed for the post-2020 period.

UFOP Project Funding

Members of the expert committee were informed about current progress in the following UFOP-funded research projects:

- Development of On-board Sensor Systems for Early Identification of Deposit Formation in Fuels Containing Biodiesel, TAC University of Applied Sciences Coburg;
- Operating Behaviour of EU Category IV Industry and Agricultural Engines with Exhaust Gas After-Treatment in Biodiesel Operation (B100), Rostock University; Presentation of Final Report and Final Results from Research Project "Studies on Sludge Formation in Engine Oil Under Operation with Biogenic Fuels – Results and Action Required", TAC University of Applied Sciences Coburg;
- Storage Stability of Fuels with FAME, HVO and Diesel, TEC4FUELS, Aachen;
- Fuels for PHEV vehicles, TAC University of Applied Sciences Coburg, OWI Oel-Waerme-Institut, Herzogenrath.

The meeting concluded with a debate between members, in the context of discussion on prospects for the future, on the future thrust and priorities of the requisite research and development in fuels research. a strategy paper to be published in Autumn 2017 will be developed on the basis of statements from the experts.

On-going Projects

Fuels for Plug-in-Hybrid Electric Vehicles

Project supervision:
OWI Oel-Waerme-Institut GmbH, Kaiserstrasse 100, 52134 Herzogenrath

and

TAC Technologiezentrum Automotive der Hochschule Coburg (TAC), Friedrich-Streib-Strasse 2, 96450 Coburg

Duration:
May 2017 to December 2018

As a result of the need for the transport sector to comply with an ever-increasing number of climate protection obligations in the context of decarbonisation strategy, power train technology will also evolve. Legislation on CO_2-reduction per kilometre forces automotive manufacturers to move towards growing electrification in combination with the combustion engine, to ensure that the total range achieved to date can be secured insofar as this is possible. The combustion engine will therefore remain essential for the foreseeable future. The ambitious provisions on CO_2 reduction of 95 g CO_2/km, with mandatory implementation from 2020, will however accelerate the market launch process of hybrid vehicles and will to some extent change owners' behaviour when using these vehicles, specifically with reference to preferences for use of the electric or fuel-fired engine power train. As a result, behavioural differences in terms of re-fuelling will also arise, leading to varying residence times of the fuel in the vehicle tank. The fuel is however not a homogenous blend, but is made up of various different fossil components as a function of the crude oil's origin and bio-components such as biodiesel and/or hydrogenated vegetable oil (HVO). Hybridisation and the associated increases in electrical range, and consequently also longer fuel residence times in the tank. lead to interactions or ageing processes that can be influenced by biodiesel as an oxidant. This is the question addressed in this project. In the framework of a Germany-wide or EU-wide EU fuel matrix, the project aims to study aging behaviour and its correlation to probable “refuelling behaviour.” The study looks not only at chemical aging processes but also at interactions with fuel-carrying components.

The project is complemented by a further fuel matrix, based on only rapeseed oil methyl ester (RME) as a blend component.

Operating Behaviour of Industrial and Agricultural Engines of Exhaust Gas Category EU COM IV in Biodiesel Operation (B100)

Project supervision:
Institut für Kolbenmaschinen und Verbrennungsmotoren, Universität Rostock, Albert-Einstein-Str. 2, 18059 Rostock

Duration:
January 2015 to June 2017

This project continues the overall very successful cooperation with DEUTZ AG on issuing of approvals for biodiesel as a pure fuel. It aims to establish a basis for pure fuel approval for the next engine generation, with a view to ensuring “joined-up development” on this front. The project, comprising six work packages, envisages tests of B100’s compatibility with a modern exhaust gas after-treatment system to ensure failure-free operation. The background is the introduction of on-board-diagnosis (OBD) for this exhaust gas category in the off-road segment (for example agriculture, construction equipment).

The following studies were conducted in operation under load over several months on a test stand:
- Measurement of emissions before and after exhaust gas after-treatment
- Performance check of particle filter regeneration Ermittlung
- Determination of conversion rates in the exhaust gas system (SCR – deployment of urea for NOx-reduction)
- Analysis of OBD function
- Rail pressure behaviour
- Cold start behaviour
- Biodiesel incorporation into engine oil
- Determination of metallic particles (wear metals) in engine oil, soot content, viscosity and density

Brake procurement and activation as well as set-up of a transformer led to a delay of several months in initiation of the project.

Storage Stability of Fuel Blends with FAME, HVO and Diesel

Project supervision:
TEC4FUELS GmbH, Kaiserstrasse 100, 52134 Herzogenrath

Duration:
July 2016 to July 2018

As diesel is increasingly incorporated into various biofuel mixtures (biodiesel, HVO, UCOME) the question of interactions over a longer storage period arises. In particular studies should be conducted on the influence of various types of biodiesel (RME, SME, PME and UCOME) on long-term stability in fuel mixtures made up of FAME, HVO and diesel. The question of interactions is significant inter alia in connection with electrification of road traffic, which is also a policy goal, and the associated market penetration of plug-in hybrid-vehicles. The preferential focus of driving behaviour on e-power power trains leads to corresponding user-dependent extensions of periods between re-fuelling.

SAVEbio – Strategies for Avoidance of Deposit Formation on Injection Nozzles During Multi-fuel Operation with Biogenic Fuels

Project supervision:

OWI Oel-Waerme-Institut GmbH (project coordinator), Kaiserstrasse 100, 52134 Herzogenrath

and

Technologie- und Förderzentrum im Kompetenzzentrum für Erneuerbare Rohstoffe (TFZ), Schulgasse 18, 94315 Straubing

Duration:

October 2016 to March 2019

The question of deposit formation arising from vegetable-oil-based fuels in modern common-rail engines is at the heart of this extensive joint project. Rising injection pressures, the demand for lower fuel consumption and optimised combustion behaviour thanks to multiple injection increasingly reduce the tolerance areas in injection systems, particularly for injectors. Even minimal deposits can lead to considerable coking effects, reductions in performance and higher exhaust gas emissions. Dynamometer tests are conducted with tractors at TFZ. After endurance tests, the injectors are removed from the injection nozzles and are evaluated. The results are compared with test runs (ENIAK) to evaluate deposit formation. The test bench made it possible to simulate the relevant test runs (injection pressures, courses, temperatures etc.). However, real test runs are necessary to ensure comparability of results. The study offers scope to understand the causes of deposit formation, and individual parameters that may influence the result can be altered in the ENIAK test stand to determine causality. As a result, actual deposits in the test stand can be compared with values obtained in the simulation. This also enables study of certain critical operating points for deposit formation and offers scope to develop reduction strategies. In addition, in cooperation with additive manufacturer ERC, causes of deposition effects can be studied and additive concepts developed to avoid such deposits.

Research Grant: "Studies on Sludge Formation in Engine Oil Under Operation with Biogenic Fuels"

Project supervision:

Hochschule für Angewandte Wissenschaften Coburg, Friedrich-Streib-Strasse 2, 96450 Coburg

Extension of Grant:

September 2016 to August 2017

UFOP has been supporting this doctoral thesis at the Hochschule für Angewandte Wissenschaften Coburg (University of Applied Sciences Coburg) since August 2013. Within the framework of the research grant, studies are conducted on the influence on polymerisation effects of engine oil and its composition in combination with biodiesel incorporation and its aging products (oxygen proportion in biodiesel). An extensive study of the literature has been conducted and biodiesel's mechanisms of action studied on the basis of what are known as model substances. The ensuing reaction products can be identified analytically; it was possible for the first time to determine that oil sludge formation can be triggered not only by use of biodiesel, but also due to compounds from the engine oil or diesel components that enter the engine. The molecular structure of larger masses can be determined using liquid chromatography quadrupole flow time mass spectrometry coupling LC-QTEFMS. The extended scholarship will now investigate the substances in question with this measuring instrument; the molecular structure identified will therefore provide insight into the composition of polymerised molecules and their "origin": biodiesel, engine oil or diesel.

List of Tables in the Appendix

Biofuels

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

Key/Explanation of Symbols in Tables:

- – none or less than one unit
- . no information available by copy deadline for this publication
- 0 less than half the final digit shown but greater than nil
- / not specified due to lack of sufficiently sound numerical data
- () numerical value statististically relatively uncertain

Table 1: Domestic biofuel consumption 2011–2016 in 1.000 t

	2011	2012	2013	2014	2015	2016
Biodiesel blended fuel	2,329.0	2,347.6	2,181.4	2,310.5	2,144.9	2,150.3
Clean biodiesel fuel	97.2	131.0	30.1	4.9	3.5	0.4
Biodiesel total	**2,426.2**	**2,478.7**	**2,211.6**	**2,315.4**	**2,148.4**	**2,150.7**
Vegetable oil	19,6	24.7	1.2	5.5	2.0	3.6
Biodiesel & VO total	**2,445.9**	**2,503.4**	**2,212.8**	**2,320.9**	**2,150.7**	**2,154.3**
Diesel fuel	32,963.8	33,678.0	34,840.4	35,587.1	36,756.4	37,901.3
Proportion in the blend in %	7.1	7.0	6.3	6.5	5.8	5.7
Fuel total	**33,080.7**	**33,833.7**	**34,871.8**	**35,597.5**	**36,761.8**	**37,905.3**
Proportion of biodiesel & VO in %	7,4	7,4	6,4	6.5	5.8	5.7
Bioethanol ETBE	162.5	141.7	154.5	138.8	119.2	128.8
Bioethanol blended fuel	1,054.3	1,089.7	1,040.5	1,082.0	1.054.2	1,046.7
Bioethanol E85	19.7	21,3	13.6	10.2	6.7	0.0
Bioethanol total	**1,236.5**	**1,252.7**	**1,208.6**	**1,229.3**	**1,173.4**	**1,175.5**
Petrol	18,380.9	17,251.5	17,225.0	17,305.8	17,057.0	17,062.3
Petrol + bioethanol fuel	19,617.4	18,504.3	18,433.5	18,535.1	18,230.4	18,237.8
Proportion of bioethanol in %	6.3	6.8	6.6	6.6	6.4	6.4

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

Table 2: Monthly domestic consumption of biofuels 2011–2016 in 1.000 t

	2011	2012	2013	2014	2015	2016
Biodiesel blended fuel						
January	157.32	161.02	146.27	167.03	159.92	174.56
February	149.26	172.99	156.15	172.77	173.73	167.74
March	172.71	220.94	183.56	176.93	188.86	194.59
April	186.92	194.71	156.84	198.67	190.02	191.14
May	205.23	210.06	191.17	216.23	204.96	184.26
June	176.67	209.83	189.65	187.11	191.21	203.36
July	224.75	220.32	189.72	207.78	190.25	194.50
August	215.32	223.92	210.23	211.41	185.33	186.81
September	190.48	213.08	192.94	189.59	165.14	172.73
October	214.12	173.56	193.40	190.92	159.41	159.06
November	219.27	178.68	187.05	200.01	167.24	160.88
December	216.99	168.52	184.43	192.06	168.83	160.68
Average	**194.09**	**195.64**	**181.78**	**192.54**	**178.74**	**179.19**
Total volume	**2,329.03**	**2,347.62**	**2,181.41**	**2,310.48**	**2,144.90**	**2,150.29**
Biodiesel pure fuel						
January	3.59	5.26	7.19	0.17	0.00	0.00
February	4.97	4.77	3.01	0.23	0.00	0.00
March	2.22	4.93	9.24	0.15	0.00	0.00
April	3.36	19.98	1.40	0.20	0.00	0.00
May	4.69	13.79	2.37	0.25	0.00	0.00
June	7.32	5.04	0.60	0.45	0.00	0.00
July	4.77	9.10	-1.58	0.40	0.00	0.00
August	5.05	12.77	1.51	0.49	0.00	0.22
September	10.39	18.80	1.43	1.29	2.37	0.15
October	9.42	9.49	2.41	0.41	0.00	0.00
November	8.32	8.64	2.27	-0.43	0.00	0.00
December	33.06	18.47	0.29	1.28	-0.39	0.00
Average	**8.10**	**10.92**	**2.51**	**0.41**	**0.16**	**0.03**
Total volume	**97.16**	**131.03**	**30.13**	**4.89**	**1.98**	**0.37**
Biodiesel total						
Januar	160.91	166.28	153.46	167.20	159.92	174.56
February	154.23	177.76	159.16	173.00	173.73	167.74
March	174.93	225.87	192.80	177.07	188.86	194.59
April	190.28	214.69	158.24	198.88	190.02	191.14
May	209.91	223.85	193.54	216.48	204.96	184.26
June	183.99	214.86	190.25	187.56	191.21	203.36
July	229.54	229.42	188.15	208.18	190.25	194.50
August	220.37	236.69	211.74	211,90	185.33	187.03
September	200.86	231.88	194.37	190.87	165.14	172.88
October	223.54	183.06	195.81	191.33	159.41	159.06
November	227.59	187.32	189.32	199.58	167.24	160.88
December	250.05	186.99	184.71	193.33	168.83	160.68
Average	**202.18**	**206.55**	**184.30**	**192.95**	**178.74**	**179.22**
Total volume	**2,426.20**	**2,478.65**	**2,211.55**	**2,315.38**	**2,144.90**	**2,150.67**

continued on page 30

	2011	2012	2013	2014	2015	2016
Vegetable oil (VO)						
January	0.51	0.23	0.07	0.06	0.03	0.09
February	1.21	2.91	0.02	0.12	0.01	0.00
March	1.06	1.79	0.06	0.12	0.11	2.55
April	3.24	1.86	0.10	-0.18	0.11	0.00
May	2.41	1.04	0.14	0.12	0.08	0.84
June	0.97	1.09	0.08	2.04	0.06	0.10
July	0.43	7.34	0.12	0.15	0.09	0.09
August	0.57	5.44	0.13	0.19	0.13	0.13
September	2.53	1.45	0.14	2.43	1.09	0.10
October	2,27	0.74	0.17	0.20	0.15	0.00
November	2.18	0.28	0.12	0.16	0.10	0.04
December	2,26	0.55	0.07	0.11	0.02	0.00
Average	**1.64**	**2.06**	**0.10**	**0.46**	**0.16**	**0.33**
Total volume	**19.63**	**24.71**	**1.21**	**5.53**	**1.97**	**3.94**
Bioethanol						
January	87.26	95.38	92.82	94.99	78.98	93.375
February	95.57	94.63	80.65	83.84	85.04	80.021
March	85.31	107.54	99.73	86.36	90.78	89.75
April	88.36	110.89	98.98	107.83	98.76	90.295
May	107.67	112.74	108.11	114.48	108.24	98.41
June	108.30	106.79	110.36	96.42	100.65	107.851
July	111.14	107.92	111.92	110.17	107.01	112.062
August	113.14	104.14	103.73	117.60	109.16	103.163
September	112.00	100.87	101.06	99.66	99.39	96.376
October	110.15	114.03	108.73	98.00	99.15	101.297
November	106.48	105.81	97.95	98.20	94.53	99.653
December	111.13	91.99	94.54	121.75	101.78	103.201
Average	**103.04**	**104.39**	**100.72**	**102.44**	**97.79**	**97.95**
Total volume	**1,236.49**	**1,252.73**	**1,208.58**	**1,229.29**	**1,173,48**	**1,175.45**

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

Table 3: International trade with biodiesel 2011–2016 in t

	2011	2012	2013	2014	2015	2016
Imports of biodiesel						
January	35,999	28,314	24,087	17,431	43,895	42,014
February	26,463	24,575	18,575	19,251	27,362	53,819
May	48,629	37,962	26,276	31,719	32,016	71,161
April	78,277	57,864	50,057	43,874	50,178	99,509
Mai	82,276	98,630	62,615	49,384	54,036	62,848
June	124,658	107,837	60,834	56,013	58,882	62,877
July	114,971	83,011	78,428	81,779	57,543	74,976
August	105,697	92,707	73,279	74,013	48,774	60,430
September	86,085	73,889	49,625	58,514	38,477	74,432
October	86,125	78,031	40,602	40,080	28,194	50,255
November	62,443	34,383	42,430	52,172	35,382	39,655
December	70,318	44,436	31,739	59,741	46,227	34,432
Total	**921,941**	**761,639**	**558,547**	**583,971**	**520,966**	**726,408**

Exports of biodiesel						
January	61,252	74,819	116,281	150,584	139,211	86,117
February	129,323	70,808	80,558	128,300	100,652	124,512
March	101,078	89,012	134,784	143,441	89,716	103,756
April	135,813	83,517	92,598	112,717	134,857	102,930
May	131,876	92,820	116,369	105,689	127,422	138,811
June	157,211	107,396	122,473	157,471	120,061	121,659
July	116,598	102,486	152,273	145,959	137,746	137,484
August	99,556	115,680	185,278	162,281	116,957	130,780
September	144,816	131,896	159,922	169,149	134,234	118,485
October	105,822	124,902	144,816	164,607	141,909	178,806
November	85,557	93,297	158,488	163,970	124,179	180,360
December	74,957	126,942	135.309	109,276	124,995	139,180
Total	**1,343,859**	**1,213,575**	**1,599,149**	**1,713,444**	**1,491,939**	**1,562,880**

Sources: Federal Statistical Office, AMI

Table 4: EU production capacity for biodiesel 2009–2014 in 1.000 t

	2009	2010	2011	2012	2013	2014
Germany	5,086	4,933	4,932	4,968	4,970	3,038[1)2)]
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	.	.
Romania	307	307	277	277	.	.
EU-27	**20,795**	**21,904**	**22,257**	**24,535**	**21,393**	**20,332**

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

Source: European Biodiesel Board (statistics have been discontinued since 2014), national statistics
1) without ADM
2) Status July 2017, no statistics available for other countries

Table. 5: EU production of biodiesel and HVO 2008–2016 in 1.000 t

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Belgium	277	416	350	472	291	500	446	248	445
Denmark	98	86	76	79	109	200	200	140	140
Germany	2,600	2,500	2,350	2,800	2,600	2,600	3,000	3,100	3,200
United Kingdom	282	196	154	177	249	267	143	149	350
France	1,763	2,089	1,996	1,700	2,271	2,035	1,946	1,965	1,350
Italy	668	798	799	591	287	459	580	577	350
The Netherlands	83	274	382	410	382	606	734	679	650
Austria	250	323	337	310	265	217	269	340	340
Poland	170	396	371	364	592	648	692	759	871
Portugal	169	255	318	359	304	299	324	342	290
Sweden	145	110	130	239	111	125	126	92	82
Slovenia	8	7	21	1	6	15	0	0	0
Slovakia	105	103	113	127	110	105	103	125	110
Spain	221	727	841	649	472	581	894	971	1,160
Czech Republic	75	155	198	210	173	182	219	168	170
EU other	.	.	.	**548**	**663**	**717**	**714**	**756**	**785**
EU-27	**7,321**	**8,888**	**8,981**	**9,036**	**8,885**	**9,556**	**10,390**	**10,411**	**10,293**
HVO[1]	.	.	.	**404**	**1,233**	**1,461**	**2,153**	**2,434**	**2,494**
Total	.	.	.	**9,440**	**10,118**	**11,017**	**12,543**	**12,845**	**12,787**

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

Table 6: Germany biodiesel [FAME] trade in t – exports (2011–2016)

	2011	2012	2013	2014	2015	2016
Belgium	90,826	110,880	60,938	109,465	106,681	80,219
Bulgaria	2	12,811	6,101	339	980	-
Denmark	36,453	26,322	15,429	28,333	39,911	43,271
Estonia	0	5	0	-	-	-
Finland	29,659	8,496	688	8,729	855	7,603
France	43,050	35,392	86,369	221,605	182,278	84,972
Griechenland	35	1	387	806	22	-
United Kingdom	115,139	24,311	92,994	68,233	29,543	12,553
Ireland	2	3,001	18	14	2,225	1,555
Italy	32,255	63,362	58,271	77,291	32,165	9,488
Croatia	5	0	0	0	0	-
Lithuania	2,482	131	5,704	50	762	403
Luxembourg	117	4,026	12	-	-	-
Malta	59	1,240	-	-	-	-
The Netherlands	305,201	269,114	453,694	545,156	372,586	538,882
Austria	68,547	170,308	144,675	107,063	132,774	71,763
Poland	484,059	197,625	172,576	137,243	125,443	229,507
Portugal	12	-	-	-	-	-
Romania	10,760	13,577	3,954	1,925	-	11,911
Sweden	20,162	26,056	6,964	55,829	111,094	60,133
Slovakia	15,787	4,871	3,180	10,376	155	939
Slovenia	4,339	6,456	1,410	174	1,530	164
Spain	223	274	15,146	49,312	7,799	30,865
Czech Republic	61,187	93,886	34,649	60,411	119,323	98,430
Hungary	62	6	55,466	25,627	7,654	31
Cyprus	4,949	14,899	13,540	15,796	81	-
EU-28	**1,325,369**	**1,087,049**	**1,232,164**	**1,523,776**	**1,273,862**	**1,282,690**
USA	1.083	405	180,200	8,485	10,857	84,933
Other Countries	17.411	3,274	34,207	89,009	130,396	111,528
Total	**1,343,863**	**1,090,728**	**1,446,571**	**1,621,270**	**1,415,115**	**1,479,151**

Sources: Federal Statistical Office, AMI

Table 7: Germany biodiesel [FAME] trade in tonnes – imports (2011–2016)

	2011	2012	2013	2014	2015	2016
France	5,881	5,669	574	7,741	22,401	8,733
The Netherlands	611,904	385,439	321,278	257,853	127,116	252,896
Italy	2,713	727	2	20,643	15,776	-
United Kingdom	41,439	20,446	3,470	1,845	862	877
Denmark	1,212	1,051	1	-	29	7
Spain	5	-	-	-	-	10
Sweden	163	58	38	0	277	168
Austria	26,063	30,194	25,751	38,336	51,133	84,959
Belgium	102,112	191,117	127,403	46,651	80,366	101,252
Latvia	11,859	-	-	-	-	-
Poland	83,791	54,337	47,683	34,471	63,715	87,420
Czech Republic	10,451	173	2,253	4,978	3,742	12,184
Slovakia	276	-	682	123	8,203	-
Hungary	-	-	-	-	50	-
Bulgaria	-	-	-	-	3,664	-
Slovenia	-	156	-	76	1,190	-
Cyprus	-	-	75	-	-	-
EU-28	**897,592**	**689,485**	**528,608**	**413,276**	**365,614**	**561,613**
Malaysia	18,147	16,572	880	100,348	132,041	129,042
Indonesien	5,046	-	7,585	6,121	2,412	5,822
USA	1	2	1	16	38	31
Other Countries	1.160	23,710	43	808	620	2,382
Total	**921,946**	**729,769**	**537,117**	**520,569**	**500,725**	**698,890**

Sources: Federal Statistical Office, AMI

Table 8: 2016 biodiesel production capacities in Germany

Operator/Works	Location	Capacity (t/year)
ADM Hamburg AG -Werk Hamburg-	Hamburg	not stated
ADM Mainz GmbH	Mainz	not stated
Bioeton Kyritz GmbH	Kyritz	80,000
BIO-Diesel Wittenberge GmbH	Wittenberge	120,000
BIOPETROL ROSTOCK GmbH	Rostock	200,000
Biowerk Sohland GmbH	Sohland	80,000
Bunge Deutschland GmbH	Mannheim	100,000
Cargill GmbH	Frankfurt/Main	300,000
ecoMotion GmbH	Sternberg	100,000
ecoMotion GmbH	Lünen	162,000
ecoMotion GmbH	Malchin	10,000
german biofuels gmbh	Falkenhagen	130,000
Glencore Magdeburg GmbH	Magdeburg	64,000
Gulf Biodiesel Halle GmbH	Halle	56,000
KFS Biodiesel GmbH	Cloppenburg	50,000
KFS Biodiesel GmbH	Niederkassel -Lülsdorf	120,000
KFS Biodiesel GmbH	Kassel/Kaufungen	50,000
Louis Dreyfus commodities Wittenberg GmbH	Lutherstadt Wittenberg	200,000
Mercuria Biofuels Brunsbüttel GmbH	Brunsbüttel	250,000
NEW Natural Energie West GmbH	Neuss	260,000
Rapsol GmbH	Lübz	6,000
REG Germany AG	Borken	85,000
REG Germany AG	Emden	100,000
TECOSOL GmbH	Ochsenfurt	75,000
Verbio Diesel Bitterfeld GmbH & Co. KG (MUW)	Greppin	190,000
Verbio Diesel Schwedt GmbH & Co. KG (NUW)	Schwedt	250,000
Total (without ADM)		**3,038,000**

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
Status July 2017

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**
2016	2,154	3	1,175	**3,332**

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	2013	2014	2015	2013	2014	2015	2013	2015
Source material								
Waste/residual material	677	791	156	1,598	1,596	1,251	28	0.04
Barley	1,100	1,082	1,353	.	.	.	.	.
Corn	10,761	9,576	10,313	152	33	.	.	
Palm oil	.	.	.	.	.	.	.	
Rapeseed	.	.	.	.	.	.	.	.
Rye	3,534	3,231	2,292	.	.	.	.	.
Soy	.	.	.	.	.	.	.	.
Sunflowers	.	.	.	.	.	.	.	.
Triticale	352	1,094	2,717	.	.	.	.	.
Wheat	6,911	9,012	9,395	.	.	.	.	.
Sugar cane	1,290	627	650	.	.	.	.	.
Sugar beets	8,013	6,987	4,177	.	.	.	.	.
Total	**32,638**	**32,400**	**31,053**	**1,750**	**1,630**	**1,251**	**28**	**0.04**

Source: BLE
[1] Differences in totals are the result of rounding
[2] No data in 2014
[3] No data in 2014 and 2015

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

Fuel type	Bioethanol			Biomethane			Biomethanol[3]	
Quota year	2013	2014	2015	2013	2014	2015	2013	2015
Source material								
Waste/residual material	26	30	6	32	32	25	1	0.002
Barley	42	41	51	.	.	.	.	.
Corn	407	362	390	3	1	.	.	.
Palm oil	.	.	.	.	.	.	.	.
Rapeseed	.	.	.	.	.	.	.	.
Rye	134	122	87	.	.	.	.	.
Soy	.	.	.	.	.	.	.	.
Sunflowers	.	.	.	.	.	.	.	.
Triticale	13	41	103	.	.	.	.	.
Wheat	261	341	355	.	.	.	.	.
Sugar cane	49	24	25	.	.	.	.	.
Sugar beets	303	264	158	.	.	.	.	.
Total	**1,233**	**1,224**	**1,173**	**35**	**33**	**25**	**1**	**0**

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 inr 2014
[4] No data in 2014 and 2015

FAME			HVO			Vegetable oil			UCO[3]	
2013	2014	2015	2013	2014	2015	2013	2014	2015	2012	2013
15,740	19,311	20,549	.	.	227	.	.	.	568	23
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.		.	.
5,757	3,276	4,776	20,559	14,646	7,132	1	.	.	.	.
43,442	52,339	48,251	.	7	.	367	151	343	.	.
.	.	.	.	.	.	.	.	.	.	.
3,392	824	164	.	.	.	0.03	.	.	.	.
.	.	139	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
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.	.		.	.	.	.	.	.	.	.
68,330	**75,750**	**73,878**	**20,559**	**14,653**	**7,359**	**368**	**151**	**343**	**568**	**23**

FAME			HVO			Vegetable oil			UCO[4]	
2013	2014	2015	2013	2014	2015	2013	2014	2015	2012	2013
421	517	550	.	.	5	.	.	.	15	1
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
154	88	128	472	336	164	0.02	.	.	.	.
1,162	1,400	1,291	.	0.2	.	10	4	9	.	.
.	.	.	.	.	.	.	.	.	.	.
91	22	4	.	.	.	0.001	.	.	.	.
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1,828	**2,027**	**1,977**	**472**	**336**	**169**	**10**	**4**	**9**	**15**	**1**

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

Region	Africa			Asia			Australia		
Quota year	2013	2014	2015	2013	2014	2015	2013	2014	2015
Source material									
Waste/residual material	41	75	191	887	2,403	2.755	53	16	36
Barley	.	.	.	.	.	.	.	.	.
Corn	.	.	.	45	.	.	.	.	.
Palm oil	.	.	.	26,316	17,916	11,907	.	.	1
Rapeseed	22	.	.	347	255	47	2,635	1,865	448
Rye	.	.	.	.	.	.	.	.	.
Soy	.	.	.	.	.	.	8	48	.
Sunflowers	.	.	.	.	.	.	.	.	.
Triticale	.	.	.	.	.	.	.	.	.
Wheat	.	.	.	.	.	.	.	.	.
Sugar cane	.	.	74	2	.	.	.	.	.
Sugar beets	.	.	.	.	.	.	.	.	.
Total	**63**	**75**	**265**	**27,598**	**20,573**	**14,709**	**2,695**	**1,929**	**485**

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

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

Region	Africa			Asia			Australia		
Quota year	2013	2014	2015	2013	2014	2015	2013	2014	2015
Source material									
Waste/residual material	1	2	5	24	64	73	1	0.4	1
Barley	.	.	.	.	.	.	.	.	.
Corn	.	.	.	2	.	.	.	.	.
Palm oil	.	.	.	626	423	291	.	.	0.03
Rapeseed	1	.	.	9	7	1	71	50	12
Rye	.	.	.	.	.	.	.	.	.
Soy	.	.	.	.	.	.	0.2	1	.
Sunflowers	.	.	.	.	.	.	.	.	.
Triticale	.	.	.	.	.	.	.	.	.
Wheat	.	.	.	.	.	.	.	.	.
Sugar cane	.	.	3	0.1	.	.	.	.	.
Sugar beets	.	.	.	.	.	.	.	.	.
Total	**2**	**2**	**8**	**660**	**494**	**366**	**72**	**51**	**13**

Source: BLE
[1] Differences in totals are the result of rounding
[2] onversion to tonnage was based on the evidence that was taken into account for the quota

Europe			Central America			North America			South America		
2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
15,855	17,357	17,711	0,4	3	.	1,146	1,678	1,211	84	167	279
1,100	1,082	1,353	.	.	.	.	.	.	.	.	.
9.,577	8,464	10,313	.	.	.	1,290	1,146	.	.	.	.
.	.	.	.	.	.	.	.	.	.	6	.
40,719	50,240	48,097	.	.	.	.	.	.	87	136	2
3,534	3,231	2,292	.	.	.	.	.	.	.	.	.
14	24	.	.	.	.	3	21	.	3,367	730	164
.	.	139	.	.	.	.	.	.	.	.	.
352	1,094	2,717	.	.	.	.	.	.	.	.	.
6,911	9,010	9,240	.	2	.	.	.	.	.	.	155
.	.	.	106	229	253	.	.	.	1,182	398	323
8,013	6,987	4,177	.	.	.	.	.	.	.	.	.
86,074	**97,490**	**96,038**	**106**	**234**	**253**	**2,439**	**2,845**	**1,211**	**4,721**	**1,438**	**924**

Europe			Central America			North America			South America		
2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
422	463	466	0.01	0.1	.	30	45	32	2	4	8
42	41	51	.	.	.	.	.	.	.	.	.
359	319	390	.	.	.	48	43	.	.	.	.
.	.	.	.	.	.	.	.	.	.	0.1	.
1,090	1,344	1,287	.	.	.	.	.	.	2	4	0.1
134	122	87	.	.	.	.	.	.	.	.	.
0.4	1	.	.	.	.	0.1	1	.	90	20	4
.	.	4	.	.	.	.	.	.	.	.	.
13	41	103	.	.	.	.	.	.	.	.	.
261	340	349	.	0,1	.	.	.	.	.	.	6
.	.	.	4	9	10	.	.	.	45	15	12
303	264	158	.	.	.	.	.	.	.	.	.
2,624	**2,936**	**2,894**	**4**	**9**	**10**	**78**	**89**	**32**	**139**	**43**	**30**

Table 14: Total source materials of biofuels[1]

	[TJ]				[kt]			
	2012	2013	2014	2015	2012	2013	2014	2015
Source material								
Waste/residual material	19,334	17.859	21,698	22,183	513,458	475	579	586
Barley	1,174	1,100	1,082	1,353	44,369	42	41	51
Corn	10,676	10,882	9,610	10,313	401,231	409	363	390
Palm oil	23,108	24,805	17,922	11,908	547,234	591	424	291
Rapeseed	57,219	43,559	52,496	48,594	1,531,126	1,166	1,405	1,300
Rye	1,447	3,534	3,231	2,292	54,685	134	122	87
Soy	2,903	3,321	824	164	77,684	89	22	4
Sunflowers	41	.	.	139	1,109	.	.	4
Triticale	546	353	1,094	2,717	20,632	13	41	103
Wheat	9,300	6,945	9,012	9,395	351,409	262	341	355
Sugar cane	479	1,290	627	650	18,111	49	24	25
Sugar beets	10,261	7,977	6,987	4,177	387,710	301	264	158
Total	**136,489**	**121,624**	**124,582**	**113,884**	**3,948,757**	**3,530**	**3,624**	**3,353**

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

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

	Emissions [t CO_{2eq}/TJ]				Savings [%][2]			
	2012	2013	2014	2015	2012	2013	2014	2015
Biofuel type								
Bioethanol	42.34	39.97	38.06	24.53	49.47	52,30	54.58	70.73
Biomethane	25.12	24.93	20.66	13.17	70.02	70.25	75.34	84.28
Biomethanol	26.16	26.98	.	22.60	68.78	67.81	.	73.03
FAME	46.32	42.78	41.36	24.62	44.73	48.95	50.65	70.62
HVO	42.96	39.94	45.87	32.03	48.73	52.34	45.26	61.78
Vegetable oil	37.50	36.03	36.15	35.70	55.25	57.00	56.86	57.40
UCO	14.00	.	.	.	83.29	.	.	.
Weighted average of all biofuels	**44.71**	**41.30**	**40.75**	**24.98**	**46.65**	**50.72**	**51.36**	**70.19**

Source: BLE
[1] Differences in totals are the result of rounding
[2] Saving potential compared to the reference value of 83,8 g CO_{2eq}/MJ for fossil fuels

Table 16: Emissions and emissions savings of bioliquids[1]

	Emissions [t CO_{2eq} / TJ]				Savings [%][2]			
	2012	2013	2014	2015	2012	2013	2014	2015
bioliquid type								
from the pulp industry	2.29	2.23	1.87	1.58	97.49	97.55	97.94	98.26
FAME	37.83	37.56	35.44	46.47	58.43	58.72	61.06	48.93
HVO	32.00	.	.		64.84	.	.	.
Vegetable oil	28.48	36.26	37.19	36.90	68.70	60.16	59.13	59.45
UCO	36.00	36.00	19.31	14.00	60.44	60.44	78.78	84.62
Weighted average of all bioliquids	**4.43**	**5.47**	**5.55**	**5.88**	**95.14**	**93.99**	**93.90**	**93.54**

Source: BLE
[1] Differences in totals are the result of rounding
[2] Saving potential compared to the reference value of 91 g CO_{2eq} / MJ for bioliquids

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Publisher:

UNION ZUR FÖRDERUNG VON
OEL- UND PROTEINPFLANZEN E. V. (UFOP)
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