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

BIODIESEL & CO. 2019/2020

REPORT ON PROGRESS AND
FUTURE PROSPECTS – EXCERPT
FROM THE UFOP ANNUAL REPORT

ufop

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The effects of climate change are being increasingly felt. Youth protests are becoming more and more compelling and are supported by leading climate scientists all over the world. Effective measures for avoiding and reducing greenhouse gas emissions are being demanded. The glaringly obvious drought damage in German forests clearly demonstrates the need for action. At the same time, the European Union is having to face up to the challenge of a global economic crisis in the wake of the corona pandemic. This poses immense challenges for the new President of the EU Commission, Ursula von der Leyen, and for the German Presidency of the European Council, which began in July 2020. The EU Commission published its proposal for a "European Green Deal" in December 2019. Since early March 2020, however, the political agenda in Europe and worldwide has been dominated by the corona pandemic. Now, as part of an all-encompassing programme, the EU Commission's "Green Deal" has to reconcile the measures for achieving the fastest possible effective climate protection with the fight against an economic recession in the EU member states.

Climate protection, Green Deal and Next Generation EU – the burden of the next generation

The historic yet complex finance package (Next Generation EU – NGEU) comprising 750 billion euro in total is intended to help the EU member states ride out the recession in the fastest possible time. For the first time ever, the EU Commission is empowered to raise this amount on the capital markets. According to the decision taken by the European Presidents, these funds have to be closely linked with those of the Multiannual Financial Framework (MFF). This dictates, in addition to the framework of the common agricultural policy (CAP), the terms for climate protection measures. It is specified that the EU climate protection goal – climate neutrality by 2050 – has to be reflected in the sectoral legislation for the national subsidy programmes, for transport, energy and agriculture for example.

The member state measures financed or co-financed from EU funds must be compatible with the climate protection goals in Paris. This is because the contracting party for fulfilling obligations is the European Union, not the member state concerned. The resolution therefore provides that at least 30% of the amount from the EU budget or the NGEU has to be dedicated to achieving climate protection goals. The European Parliament must approve both the MFF and the NGEU, but has expressed resistance across the groups. The budget for climate protection measures in particular is criticised as being inadequate. Moreover, the Green Deal cements the objective, the empowerment of the EU Commission, to tap additional sources of income as capital resources: Taxes on non-recyclable plastic waste, the introduction of a CO_2 limit compensation system (from 01/2023 onwards), digital tax and taxes from the revised Emissions Trading System, which is to be expanded to the air and maritime transport systems. These funds are to be used to repay the NGEU funds.

At the heart of the Green Deal is a more comprehensive and complex approach to revising existing and creating new statutory regulations for fulfilling the climate goals (see Fig. 1). These plans are to be submitted in 2020 and 2021 respectively. The EC Commission submitted a draft regulation for a European "Climate Act" in early March 2020, the aim being to establish as binding, in the shortest possible time and for all member states, the EU Council resolution on achieving climate neutrality by 2050. This Act will provide for an increase in achieving the climate protection goal by 2030 from the previous level of 40% to 50 or 55%, Before the end of November 2019, the European Parliament had declared a "climate state of emergency", which was already critically regarded by many members of the EP, in order to exert pressure on the EU Commission. It would appear that the dissent in parliament continues. Even the Environment Committee has so far been unable to agree on a climate protection goal by 2030 going beyond the Commission's proposal. The Finnish correspondent Jytte Guteland, who covers climate protection legislation, proposed in her draft a greenhouse gas reduction of 65% by 2030. This proposal was met with resistance in the committee itself and also in other bodies such as the economic supervisory council. The ambitious goal was justified in the draft report by the still available global greenhouse gas budget. In order to achieve the 1.5 degree target and hence climate neutrality in 2050, no more than around 400 gigatonnes of CO_2 equivalent can be emitted into the atmosphere globally.

Fig. 1: EU Green Deal – Measures and roadmap

Roadmap	Measures
March 2020	Proposal for a climate act to achieve climate neutrality by 2050
Autumn 2020	EU Commission: Initiative to uprate the climate goal for 2030 to up to 55% (submission of the impact assessment)
By June 2021	EU Commission Proposals: - Change to the EU Emissions Trading System - Change to the burden sharing ordinance - Change to the ordinance on LULUCF - RED II Directive - CO_2-Emissions standards for passenger cars and light commercial vehicles, - Evaluation of the definitive national energy and climate plans
2021	Revision of the Energy Tax Directive
2021	EU Commission Proposals: - for a CO_2 border adjustment system for selected sectors - for more stringent thresholds for harmful emissions from vehicles with combustion engines
2020/21	Agricultural sector Proposals for measures for a "farm-to-fork" strategy Including legislative measures: - for reducing the use and risk of pesticides and fertilizers - to prevent loss of biodiversity - deforestation-free supply chains

Approx. 40 gigatonnes are released every year and so in ten years – at the end of the upcoming commitment period from 2021 to 2030 – the budget will have been depleted. There is therefore a proposal to establish a European Climate Council to assess the measures of the member states and identify corrections if needs be, just like the German Climate Council. The final vote on the draft report is expected in September 2020.
In its comment to the Green Deal, the UFOP criticised the

implementation of the climate protection aims with the legal crowbar and the lack of openness to dialogue, particularly vis-à-vis the agricultural sector. The UFOP felt there was a need to set priorities that would give appropriate consideration to sustainable biofuels from cultivated biomass for decarbonising the transport sector. The UFOP indicated that, as a result of Brexit, some 360 million tonnes of CO_2 equivalent have to be divided between the member states as an additional commitment to reduction. Given the upcoming commitment period up to 2030, consideration would have to be given to all GHG reduction options, insisted the UFOP repeatedly.

National energy and climate plan – too late and imprecise

The unbalanced setting of priorities was also a key point of criticism by the UFOP on the National Energy and Climate Plan (NECP), which the Federal Government, submitted to the EU Commission, as the last EU member state to do so, almost six months late at the end of June 2020 – i.e. shortly before the start of the EU Council Presidency. In the slip stream of the semi-effective announcement of the national hydrogen strategy by Federal Minister for Economic Affairs Peter Altmaier, the Federal Government published the overdue energy and climate plan (see Link). The 300 page "plan" describes the measures for meeting the sector-specific targets. Special emphasis is placed on the German/French declaration of 18 May 2020 in Meseberg. Both governments welcome the EU Commission's initiative to uprate the EU climate protection goal in the commitment period from 2021 to 2030 to at least 50% or 55%. The Federal Government has already voluntarily increased the goal to 55% for Germany. Evidently, the government wants to implement this minimum goal at EU level under its Council Presidency. National elections are to take place in Germany in 2021. It can be expected that the young and now very well networked climate activists of the "Fridays for Future" movement (https://fridaysforfuture.org/) will use the general public to promote more efficient climate protection.

The climate protection programme 2030 adopted by the Federal Government (see Link) comprises the sector-specific measures that are congruent with those indicated in the NECP. The UFOP consider these measures to be relatively non-binding in their phraseology, measured by the emission levels specified in climate protection legislation for each sector (see UFOP Management Report 2018/2019, page 47, para. 8b). This raises the question of whether the measures can be implemented quickly and efficiently, in order to still avoid the purchase of emission rights from other member states from tax revenue. In 2019, some 9.5 million tonnes of CO_2 equivalent were saved through biofuels. The price of CO_2 (08/2020) is around 23 euro/t. This means that the equivalent value of greenhouse gas emission savings achieved through biofuels is 220 million euro, and the trend is increasing. This is where the criticism of the biofuel associations starts. The position paper of the German Association for Bioenergy (BBE) "EU climate act and climate protection legislation immediately call for effective climate protection measures in the transport sector – to use the potential of sustainable biomass and biofuel now" (see Link) It also underlines the urgency of climate protection measures in the transport sector and criticises the fact that the hydrogen strategy and the strategy for promoting e-mobility – where measures such as a buyer's premium of up to 9,000 euro plus tax incentives are being supported by billions of euros of tax revenue – mean that practically no climate protection contribution can be made for the commitment period from 2021 to 2030. The contribution of these two strategies make to climate protection does not depend only on technology implementation and product placement (infrastructure!). It hinges instead on whether it is possible to accelerate the expansion of additional renewable energy production. The opposite situation, however, is currently true. According to the Federal Environment Agency, greenhouse gas emissions in the overall fuel mix in 2019 was still approx. 400 g CO_2 per kWh.

The greenhouse gas balance of electric vehicles is contentious and will remain so if the entire life cycle, including the battery (recovery of raw materials, production in China with coal-fired electricity and so on) is taken into consideration. At the same time, economists are facing the question of whether the tax revenue strategy employed is efficiently reducing GHG emissions. It will soon become clear that the acquisition subsidy is having the opposite effect. This is because an additional power requirement is being generated, and this currently has to be covered by coal-fired power stations. The report by the Institute for the World Economy "Electromobility and Climate Protection: A substantial miscalculation (see Link) therefore recommends that the tax revenues are invested instead in reducing coal-fired power generation, which explicitly contradicts the funding approach being taken by the Federal Government. The call for action is clear to see. The expansion of onshore wind power and transmission lines in particular is failing to make progress due to opposition within the population and in the agricultural sector. Currently, the expansion of wind power in North Rhine-Westphalia – measured by production capacity – is actually regressing. In Lower Saxony, this expansion is stagnating because the EEC funding has run out. The "urban-rural gap" is obvious.

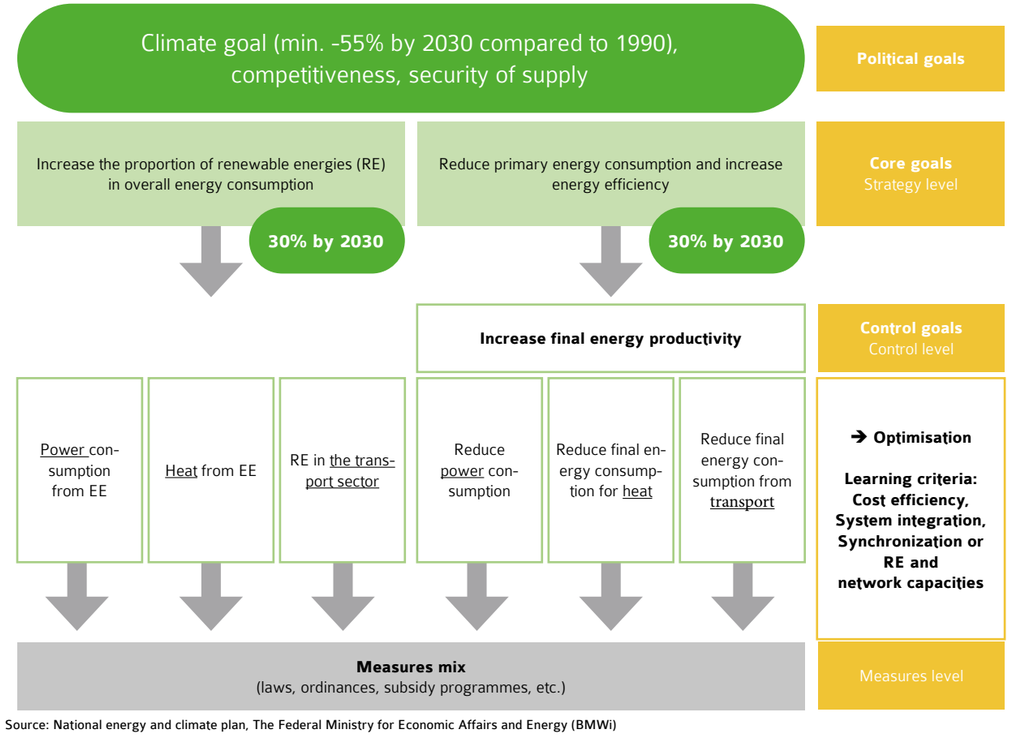
At the same time, other competitors are appearing as consumers. The chemical industry, for example, which is also committed to be producing "climate-neutral" by 2050. Generating approximately 113 million tonnes of CO_2 equivalent, this sector accounts for about an eighth of all greenhouse gas emissions. To achieve climate neutrality, the demand for renewable electricity would have to increase more than tenfold. A further issue is the demand for renewable electricity by the mineral oil industry, which wants to gradually supply the existing refineries with green hydrogen (hydrogenation) and produce synthetic fuels (e-fuels) in the future. The German or rather the European petroleum industry has presented the politicians with a concept called "Clean Fuels for All" (see Link), announcing at the same time that investments will begin as soon as the politicians have established the necessary framework conditions. Indeed, the national energy and climate plan pronounces an acceleration and improvement to the connectivity of the electricity grids, and also of the network expansion as part of target architecture 2030 (see Fig. 2). The interdependencies in the markets, however, have made the framework conditions and requirements so complex that the politicians may be the cause of their own failure should they omit to take the public on this journey with them.

Bioenergy associations, who continuously submitted proposals for the sustainable use of cultivated biomass, as well as residual and waste materials, are under the impression that the sector is to be gradually sidelined by the politicians. The substantial contribution towards the decarbonisation of the transport sector or rather the economy at large is being completely overlooked. According to the German Biogas Association, around 250 biogas plants had been closed down by 2020 – the reduced capacity is apparent. Perspectives on this situation must now be identified, including the alternative use of biofuel, one of the calls in the BBE position paper. Which alternative marketing strategies could the Federal Government otherwise offer for more than 2 million hectars of energy plant cultivation space – rapeseed, maize, cereals and sugar beet? None so far! If the Federal Government continues to pursue the bioenergy policy as a "shutdown" waiting to happen, arable products would be produced and used elsewhere, resulting in the loss of the numerous positive effects of coupling cultivation and processing (including GMO-free feedstuff) of protein and energy plants.

Alternative fuels and powertrains – achieving the goal together

Even with an optimum ramp-up of e-mobility by 2030, there would still be around 40 million vehicles powered by combustion engines on the road. In addition, numerous studies are questioning how the demand for renewable energies will be covered in the short to medium term. There is a substantial need for action here. For the NECP, the required expansion of renewable electricity is wishful thinking going by the targets for reducing greenhouse gas emissions within the commitment period of 2021 to 2030. Alongside measures for promoting e-mobility, the UFOP therefore repeatedly requested support for biofuels, especially alternative fuel technologies, and raw materials. The GHG quota system, which was increased in 2020 from 4 to 6%, has reaped rewards in this respect. In the NECP, the Federal Government announced an adjustment, though this related to biofuels generated from residual and waste materials. The UFOP believes that the investment incentive for residual product-based biofuels should be questioned, especially since market access through a sanction-linked increase in the sub-quota is practically a legal obligation. As with biofuels from used oils, international competition for the raw materials,particularly biofuels, will develop here too.
As part of a project assigned in 2020 by the EU Commission, the list of residual materials itemised in Annex IX of RED II are to be evaluated, adding other residual materials and hence additional potentials where necessary. In contrast to used oils and fats, new structures for collecting, storing and treating have to be developed for residual materials. Residual materials from biomass also have the disadvantage of having a very low energy density, meaning that transport over long distances is of limited value. Moreover, studies on potentials sometimes overlook the fact that these raw materials also come at a price that is based on market demand, as is the case with crop straw (see Fig. 3). No consideration has yet been given to the effects of introducing CO_2 pricing for fossil combustibles and fossil fuels from 2021 onwards. The fact that residual materials such

Fig. 2: 2030 target architecture of the national energy and climate plan



Source: National energy and climate plan, The Federal Ministry for Economic Affairs and Energy (BMWi)

as crop straw are becoming increasingly attractive as a substitute for heating oil is clear to see. In addition to the recovery process in biogas plants, further competition for using residual materials is also emerging from the agricultural sector. Because of the low conversion efficiency and possible weather-related loss of yield, the quantities and the space requirement involved are substantially greater than is the case with biofuels from cultivated biomass.

In accordance with the targets of RED II, the plant operators also have to demonstrate the safeguarding of carbon stock in the soil at their suppliers, in other words at the agricultural holdings. The agricultural sector has a keen interest in maximising the carbon fraction in the soil in order to improve the soil quality and contribute to climate protection. Due to the stricter regulations concerning nitrogen fertilisation in several member states, not only Germany, the UFOP is expecting the crop rotation systems to expand to the detriment of grain. Nonetheless, it has to be emphasised that biofuels certified as sustainable are much more cost effective than other renewable alternative fuels and – just like the raw materials themselves – excel because they have a high energy density and are therefore worth transporting.

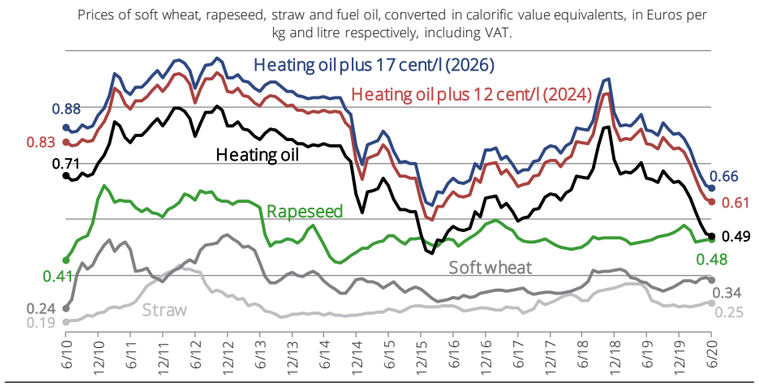
While e-fuels still seem a long way off, biofuels have become the norm in international trading: Biofuel raw materials are produced in and imported from third countries only if the EU sustainability regulations (RED II), as a precondition for market access, are satisfied – similar to a supply chain for demonstrating sustainability. There is, to date, no life cycle certification for batteries. Furthermore, there is no need to build a parallel infrastructure for biofuels as there is for hydrogen (fuel cell) and e-mobility. Fossil fuels are decarbonised in the tanks of existing vehicle fleets and the process can be further expanded.

Ambitious development of the EU Fuel Quality Directive (FQD) and the 10th Federal Pollution Control Act (BImSchV)

However, an evolutionary process is at odds with the EU Fuel Quality Directive (FQD) and the German Fuel Qualify Ordinance (10th BImSchV). The existing regulations indicate the lack of a biofuel and fuel strategy at European and national level. Consequently, there is no basis for increasing the incorporation rate of biodiesel and bioethanol in diesel or petrol fuels. The FQD is also currently being evaluated by the EU Commission. The UFOP is campaigning for an increase in the incorporation rate of biodiesel in diesel fuel from 7 to 10% (B10) for all diesel vehicles. In addition, B20/B30 market access (i.e. 20 or 30% biodiesel in the diesel) for closed fleets (heavy goods vehicle traffic) needs to be facilitated in Germany, as set out in the FQD. By way of an incentive, the UFOP is asking that vehicle manufacturers be allowed to offset biofuel quantities that exceed the requirement to fulfil the GHG quota against the CO_2 fleet thresholds. Demonstration projects from the biodiesel industry are required here to increase the fleet operators interest in this fuel mix.

The UFOP has already repeatedly rejected public criticism and calls by the environmental organisations to withdraw the basis for funding biofuels from cultivated biomass as quickly as possible. The UFOP reacted to this sweeping criticism that fails to differentiate between raw materials and origins. UFOP addresses the contradictory nature of the customer demand for largely GMO-free feedstuffs cultivated with raw materials in the EU and to the sale of rapeseed oil for biodiesel marketing that is essential to the economic efficiency of rapeseed cultivation. Unfortunately, it is not only the environmental organisations that are calling for an end to the promotion of biofuels from cultivated biomass: The Federal Ministry for the Environment and the EU Commission are also announcing such calls. European farmers, who have been struggling under cost pressure and low incomes from arable farming operations, and who are now set to lose an important sales market without a replacement, are being left behind. Of around 6 million hectares (2020) of rapeseed, approx. 4 million hectares are being cultivated for the production of biodiesel. The associated production of GMO-free rapeseed meal will replace approx. 6 million tonnes of soya bean imports, approx. 2.3 million hectares of arable land in third countries, above all in South America. The UFOP is therefore demanding, in the measures package for the Green Deal and the national biofuel policy, a macroeconomic and ecological reassessment of the production chain for rapeseed, starting with the cultivation (crop rotation effects) to the GHG evaluation of the fuel, the by-products (substitution effect of rapeseed meal and glycerine) to the macroeconomic savings effects (avoiding having to purchase emission rights, reducing raw oil/diesel imports). This requires an urgent revision of the system thresholds for greenhouse

Fig. 3: Electricity price development



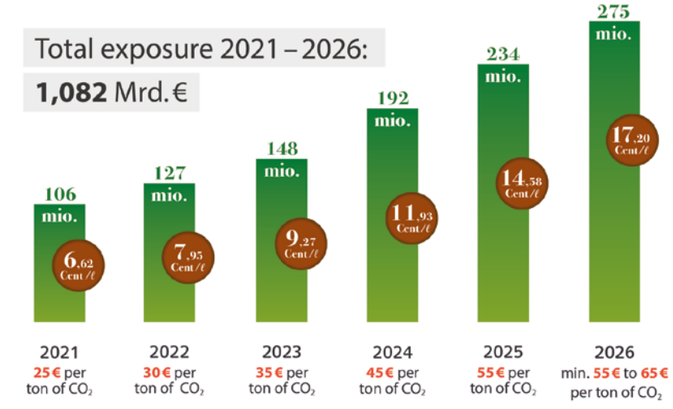
Converted ex-farm prices of agricultural products per calorific value equivalent (1 litre of fuel oil = 1.35 kg rapeseed, = 1.95 kg soft wheat, = 2.9 kg straw) and fuel oil price for deliveries of 3,500 litres or more free buyer's address.

Source: AMI

gas evaluation. If rapeseed meal were fully offset against the GHG balance for biodiesel from rapeseed oil, this native raw material would come out the winner in GHG and especially sustainability. Biofuels from palm and soya oil would be squeezed out. The overall ecological footprint must, in future, be the basis for a greenhouse gas or sustainability evaluation.

The cultivation and use of rapeseed for biofuel processing is an example of a networked bio-economy that has developed in Germany over many years – as described in the Federal Government's bio-economy strategy. Unfortunately, both the Federal Government (see Coalition Agreement) and the EU Commission want, at most, to freeze the support rather than properly develop it further. Instead of the European regulations being amended in this sense, since August 2020 the EU Commission has had to deal with the issue of palm oil in biofuels in panel proceedings brought before the World Trade Organisation (WTO) by Indonesia. The reason behind the proceedings is the delegated regulation, established in RED II and to be implemented by the member states, for limiting and phasing out the offsetting of biofuels from palm oil by 2030 at the latest.

Fig. 4: Increase in the price of diesel fuel in Agriculture through CO_2 pricing



Sources: UFOP, calculation acc. to SESTA

Fuel Emissions Trading Act – Germany steps up

The Fuel Emissions Trading Act (BEHG), as an instrument for controlling demand and a new income stream for the Federal Government, came into force at the end of 2019. The pricing policy affects sectors that had not previously been subject to emissions trading: Transport and building sectors; agriculture is not (yet) included. Given the measures proposed in the Federal Government's 2030 climate protection programme, the question of financing does of course arise. In addition, a consensus was reached within the Federal Government to introduce a measure with the broadest possible steering effect with a view to consumers and the economy at large adapting their consumer and investment behaviour. The BEHG was amended in the conciliation committee between the lower and upper house of German Parliament. Both parties agreed that the pricing levels initially proposed had not achieved the desired steering effect. Environmental organizations, however, stuck to their criticism despite the resolution on increased levels (see Fig. 4). Fig. 4 shows how this impacts the fuel costs for agricultural operations in terms of additional charges (quantity basis 1.6 billion l). The additional expenditure will increase from approx. 180 million euro in 2021 to approx. 275 million euro in 2026 (without the double taxation from value added tax). The impact severity of the CO_2 pricing on fuel stations, for example, depends on other factors, in particular the development of crude oil and diesel prices. After the historical crashes caused by the global economic crisis, market experts are not expecting a fast recovery and return to pre-crisis levels. Any withdrawal of the subsidy cutback agreed among the OPEC members would impede a possible price increase and hence the desired steering effect. It will be interesting to see whether,and if so, how the Federal Government and/or the EU member states confront this dilemma. 2021 should actually herald the start of a new era in climate protection politics, which are gradually creeping into every household and company.

Biofuels in agriculture and forestry: Is the tax concession set to end in 2020?

As of the editorial deadline, there was uncertainty over whether, in accordance with § 57 of the Energy Control Act, it would be possible to maintain the tax concession on biofuels in the agriculture and forestry sectors after 2020. The EU Commission had not granted a similarly long-term state-aided approval, as it had for fossil diesel fuel. The EU Commission guideline for state-aided approval states that the tax subsidy for biofuels from cultivated biomass will expire at the end of 2020. The German Farmers' Association (DBV) and the European Farmers' Association and Cooperative Union (COPA/COGECA) therefore asked the directorate general responsible in the EU Commission at the end of July 2020 to continue approving the tax refund on biofuels as part of the fundamentally essential extension to the fixed term for the guidelines on state aid for environmental protection and energy. The reasoning set out in the correspondence is unequivocal: Biofuels from cultivated biomass fulfil, irrespective of their purpose, all legal requirements for sustainability in accordance with RED II. Stopping the agricultural sector as a raw material supplier from having its own fuel supply certified as sustainable is incomprehensible. This is the reasoning with which the UFOP also approached the Federal Agricultural Ministry and the European Parliament.

Biodiesel consumption stagnates – Rapeseed oil: the most important raw material

At around 2.35 million tonnes, domestic consumption stood at the same level as 2018. As in the previous year, 6.2% of biodiesel was added to diesel fuel – the fuel standard for diesel,

DIN EN 590, states that 7% by volume is allowed. The admixture potential was therefore not fully exhausted. Information on raw material composition is provided by the evaluation of the "Nabisy" database of the Federal Agency for Agriculture and Food (BLE). The registered biofuel producers enter the sustainability guarantees into this system, which in turn serve as proof to mineral oil companies for offsetting the biofuel quantities purchased during the calendar year against the GHG quota commitment. The data is published in the annual evaluation report and case study and is available for calendar year 2018 (see Link). The report for calendar year 2019 is expected in November 2020.

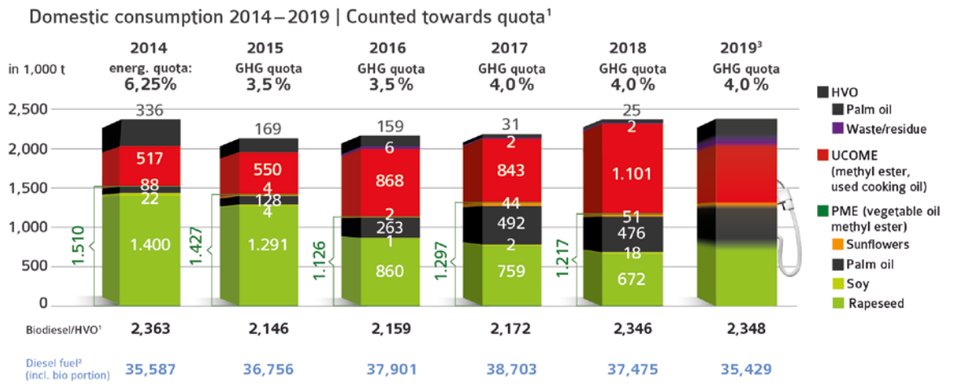
As Fig. 5 shows, the proportion of biodiesel from used oils (UCOME) in its total consumption amounts to approx. 1.1 million tonnes and hence now approx. 50%. Compared to 2017, the admixture of UCOME increased by approx. 0.26 million tonnes. Thanks to the better GHG balance with UCOME than RME, the GHG quota can be achieved with a lower physical quantity. As a result, surcharges are being paid, which explains the high price level of UCOME (Fig. 6). This development is set to continue through 2020 and possibly also into 2021, although the GHG quota of 6%, an increase on 2020, has to be fulfilled. Above all, the UFOP considers the "7% admixture cap" an obstruction to growing biodiesel sales and/or a cause of the squeeze out effect. For 2019 as well, the UFOP is expecting a similar raw material composition to that of 2018. The UFOP is therefore demanding a technology-neutral further development of the GHG quota. Used oil and vegetable oils should be capable of being made into hydrated vegetable oil (HVO) or co-processed in the crude oil refinery with green hydrogen. In doing so, higher admixture quotas could quickly be achieved and a faster decarbonisation of the fuel in existing fleets could be realised in a shorter time. This "drop-in" approach also eliminates the problem of approval being granted by the vehicle manufacturers.

According to the Association of the German Biofuel Industry (VDB) rapeseed oil nevertheless remains the preferred raw material among the German biodiesel manufacturers. In 2019, rapeseed oil accounted for 57% of the total production of approx. 3.4 million tonnes of biodiesel. However, the high market share of UCOME means that RME, in turn, has to be exported. The UFOP is questioning this development, since we are no longer seeing recycling in the true sense of a closed loop economy. The actual situation is high-priced value creation (see Fig. 7) with a corresponding import surge. According to the non-government organisation "Transport & Environment" (T&E) (see Link), a total of 2.8 million tonnes of biodiesel were produced from used oils in the EU in 2019. To that end, some 1.5 million tonnes of used oils were imported from third countries, particularly from China as well as Malaysia and Indonesia, the world's largest palm oil producers. The UFOP is demanding that the 1.7% cap for biofuels from used oils and fats specified in RED II has to be maintained in all member states and verified as necessary. The quantity potential and hence the limit has to be based on the used oil quantities accruing in the member country in order to prevent a waste tourism situation. Ultimately, the export countries with biofuels from used oils will also want to, and have to, make their contribution to climate protection and to complying with the terms of the climate protection treaty.

Outlook for association work – identifying the key issues

With its evaluations dated for 2020/21 and amendments to central directives and ordinances, the "Green Deal" is defining the funding policy framework conditions for the entire production chain, from biomass cultivation to processing and use as a biofuel in the transport sector. The measures itemized in Fig. 1 are generally complex because they cannot be seen in isolation. Instead, they have to evaluated with their interaction effects. As an interprofessional organization, the UFOP and its committees have the expertise needed. In addition to projects on the use of biodiesel as a fuel (see project proposal in next chapter), the UFOP projects on the "Evaluation of expanded crop rotation systems with rapeseed and grain legumes" will pave the way ahead. The UFOP expects the results of this project to also provide indicators for the macroeconomic and ecological evaluation of future crop rotation systems. Such indicators are important to gain public acceptance for producing rapeseed not only as a raw material for biofuel production. These discussions concerning biofuels are of the up most importance, irrespective of where these biofuels end up being used: whether in the fuel tank, on the dinner plate or in a feeding trough.

Fig. 5: Sales development and raw material composition of biodiesel/HVO

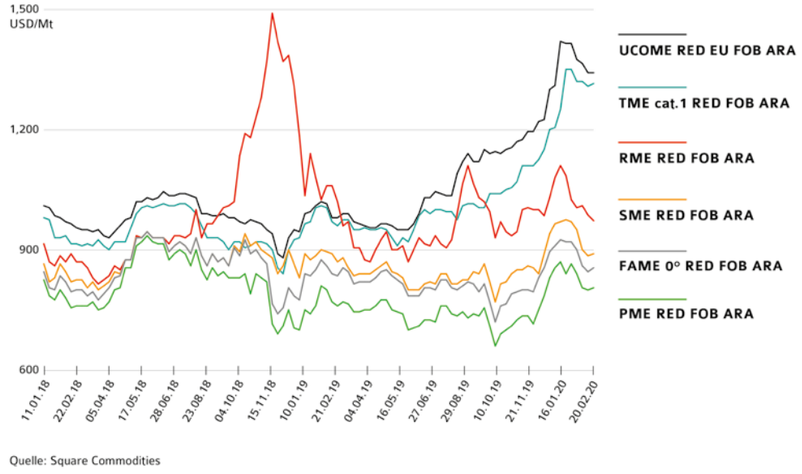


Sources: ¹Federal Office for Agriculture and Food: Evaluation and Progress Report 2019, October 2019; ²BAFA: Mineral Oil Statistics, ³BLE evaluation report 2019 expected for October 2020

Position Paper: Action areas and the need for research in biofuels

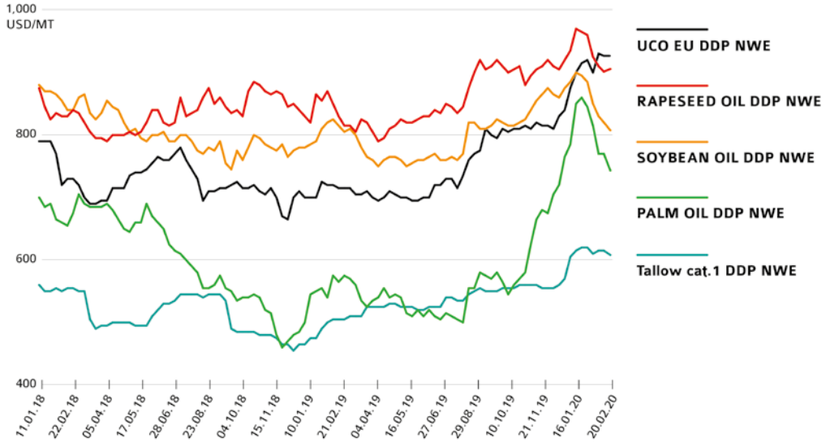
The experts of the UFOP expert commission "Biofuel & renewable raw materials" have summarised the meaning and the need for action and research on biofuels (biodiesel). The authors show the current state of the need for action, to make sustainable biofuels future-proof, in view of the constantly increasing emission and motortechnical requirements. Also taken into account is the necessary qualitative development of the fuel mixtures themselves, because engine and fuel must match. (Article available: FUEL, Volume 268)

Fig. 6: Global price development of biodiesel 2018–2020



Quelle: Square Commodities

Fig. 7: Price development of used cooking oil



Quelle: Square Commodities

UFOP EXPERT COMMISSION "BIOFUELS AND RENEWABLE RESOURCES"

The meeting was planned in conjunction with the 4th Conference of the Fuels Joint Research Group (JFRG) "Fuels for the mobility of tomorrow" in Dresden. Due to the corona pandemic, this event concept will take place in 2021. Instead, the meeting was held in the form of a web conference.

Dieter Bockey, UFOP, reported on the contents and regulation subject matters concerning the transport sector and biofuels in both the EU Commission's "Green Deal" and the National Energy and Climate Plan (NECP). The proposal for a climate act, announced by the EU Commission with the Green Deal, which has now been submitted, will intensify the discussion between the EU Council and the European Parliament regarding climate protection ambitions. The draft ordinance provides for an uprating of the climate protection goal for 2030 to 50% or even 55% ;the environment committee is discussing 65%. Another challenge is to negotiate Brexit by the end of the year. This means that the climate protection commitments in Britain concerning the non-emission trading sectors (including transport and agriculture) will have to be redistributed amongst the EU-27.

As expected, the Federal Government has incorporated the regulation subject matters pursuant to climate protection legislation into the NECP and with it the dated sector-specific targets by 2030. In doing so, the Federal Government is committing to a significantly higher renewable energy target than the 14% specified for the transport sector in RED II. The Expert Commission sees this revision as an extraordinary challenge. Even more sobering was the speech given by Prof. Christian Küchen, Petroleum Industry Association (MWV), who presented the key points of the Fuels Europe strategy "Clean Fuels for All". This strategy pursues the aim of helping to achieve climate neutrality by 2050 with low-CO_2 liquid fuels, specifically by

- producing synthetic fuels from renewable electricity (E-Fuels),
- using biofuels from residual and waste materials,
- CCS/CCU
- using green hydrogen in refineries.

The estimated capital expenditure of the strategy amounts to 30 billion euro by 2030 and approx. 400-650 billion euro by 2050. For road traffic, the concept starts with the vehicle fleet (energy density/fuel quality) and, for the existing infrastructure, is the key to the market ramp-up. Prof. Küchen emphasised the macroeconomic significance of this strategy, the aim being to develop more efficient combustion engines and secure value creation potentials (workplaces/production location in Germany, and so on). The prerequisites for investment, repeatedly demanded by the MWV, include the conversion from energy taxation to CO_2 taxation and the offsetting of low-CO_2 fuels against the CO_2 fleet threshold for new vehicles.

With time running out for climate protection, and given the willingness of the petroleum industry to drive forward the market launch of low-CO_2 fuels from its own resources, the Expert Commission is unable to understand the persistent lack of consensus within the National Sustainable Mobility Platform Working Group (NPM) to approve, or even endorse, alongside electric drives, green hydrogen and liquid renewable fuel alternatives,ranging from biofuels to e-fuels, as an additional development strand.

The Expert Commission also discussed the future fuel quality in the event of this strategy being implemented. It was agreed that the Expert Commission would have to align itself to the quality requirements of the European Standard for Diesel Fuel EN 50 as a prerequisite for releasing new and existing fleets. Consequently, it will be mainly paraffinic fuel mixtures that dictate the quality and the quota in the future fuel mix. In future, it will be possible to use sensors to permanently check the quality of fuel in the fuel tank (see UFOP project proposal). Besides that, it is already possible to make a contribution to climate protection with biodiesel and rapeseed fuel in specific fields of applications in off-road transport (agriculture and farming).

This discussion was a key aspect of preparing the Expert Commission Paper entitled "Fields of action and research requirement for biofuels". In the 70 page paper, the team of authors explained the need for climate action, the international importance of biofuels, the need to bring fuel quality in line with engine developments, augmented by the results of UFOP-funded projects, which culminate in an overview of the future research requirement and research recommendations. The UFOP stressed the international importance of the results and recommendations of these funding projects. For that very reason, the Expert Commission Paper was not only published in a scientific forum, but also in English in "FUELS".

UFOP project proposal
Multi-fuel tractor level V ("MuSt5-Trak")

Project support: John Deere GmbH & Co. KG, Mannheim

The project will entail developing and applying an engine model, in order to support and optimise the realisation of a reliable fuel detection system and an automated, specific engine setting for various vegetable oil and diesel fuels and the mixtures thereof. The fuel detection system and the automated engine setting are to be realised using existing sensors in the engine and waste gas the treatment system or other vehicle sensors (waste gas temperature, injection quantity, etc.), implemented on a real tractor and their functionality validated under real operating conditions. The aim of the investigations is to establish whether an adequately reliable fuel detection system can be realised without additional sensors.

Projects completed in the reporting period:
Fuels for Plug-in-Hybrid Electric Vehicles (PHEV)

Project support: Oel-Wärme-Institut GmbH, Herzogenrath; TAC Automotive Technology Centre of Coburg University of Applied Sciences

The Federal Government is promoting the purchase of electric vehicles and vehicles with hybrid drive. Vehicle owners have very different preferences when it comes to opting for an electric or fuel-powered engine. Behaviour concerning refuelling and hence the time the fuel is left in the vehicle tank therefore also varies. However, this is not a homogeneous mixture. It is made up of various fossil components, depending on the origin of the crude oil and organic contents such as biodiesel and/or hydrated vegetable oil (HVO). Prolonged times in the tank lead to interaction and/or ageing processes which can be influenced by biodiesel as an oxygen carrier.

Development of an on-board sensor system for early identification of deposit formations in fuels containing biodiesel

Project support: Coburg University of Applied Sciences, Coburg

The aim of the project proposal is to develop a sensor that not only prevents misfuelling, but, especially in connection with the engine management, ensures that the emissions standard EURO VI can be fulfilled with B7 or various mixture proportions of biodiesel and diesel fuel. Furthermore, the ageing degree of the fuel in the vehicle is to be determined so that the use and/or the required exchange of fuel can be displayed by a signal when necessary. In this case, the combustion engine starts up and consumes the ageing fuel.

SAVEbio – Strategies for deposit prevention at injection nozzles for the multi-fuel use of biogenic fuels

Project support: Oel-Wärme-Institut GmbH (Project Coordinator), Herzogenrath

At the centre of this extensive joint project lies the question of deposit formation of vegetable oil fuels in modern common rail engines. Increasingly higher injection pressures, the need for lower fuel consumption and optimised combustion behaviour by means of multiple injection are increasingly reducing the tolerance ranges in the injection systems, especially with respect to the injectors. Even the smallest deposits can lead to significant carbonisation effects, performance reduction and increased exhaust emissions. At the TFZ in Straubing, the bench tests are carried out using tractors. After the endurance tests, the injectors are removed from the injection nozzles and evaluated. The results are in turn compared to test bench runs (ENIAK) for evaluating the deposit formation at the OWI Institute. Corresponding test bench runs (injection pressures, processes, temperatures etc. ...) can be simulated at the test bench of the OWI.

TABULAR ANNEX

Legend/explanation of symbols in the tables:

– nothing or less than one unit
. no information available until editorial deadline
0 less than half of 1 in the final digit shown, but more than nothing
/ no information, since the numeric value is not reliable enough
() Numeric value statistically relatively unreliable

Biofuels

Table 1: Germany: Development of fuel consumption since 1990

Year	Biodiesel[1)]	Vegetable oil	Bioethanol	Total renewable fuel supply
				Data in 1,000 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**
2017	2,216	0	1,156	**3,372**
2018	2,324	0	1,187	**3,511**
2019	2,348	0	1,161	**3,509**

Sources: BAFA, BLE
[1)] as of 2012 incl. HVO

Table 2: Germany: Domestic consumption of biofuels 2014 – 2019 in 1,000 t

	2014	2015	2016	2017	2018	2019
Biodiesel admixture	2,310.5	2,144.9	2,150.3	2,215.9	2,323.3	2,348.0
Biodiesel pure fuel	4.9	3.5	.	.	.	.
Total biodiesel	**2,315.4**	**2,144.9**	**2,150.3**	**2,215.9**	**2,323.3**	**2,348.0**
Vegetable oil	5.5	2.0	3.6	.	.	.
Total biodiesel & veg oil	**2,320.9**	**2,150.3**	**2,153.9**	**2,215.9**	**2,323.3**	**2,348.0**
Diesel fuel	35,587.1	36,756.4	35,751.0	36,486.7	35,151.7	35,428.9
Share of admixture in %	6.5	5.8	5.7	5.7	6.2	6.2
Total fuels	**35,597.5**	**36,761.8**	**35,754.6**	**38,702.5**	**37,475.0**	**37,776.9**
Bioethanol ETBE	138.8	119.2	128.8	111.4	109.9	88.0
Bioethanol admixture	1,082.0	1,054.2	1,046.7	1,045.1	1,077.4	1,073.0
Bioethanol E 85	10.2	6.7	.	.	.	.
Total bioethanol	**1,231.0**	**1,174.5**	**1,175.4**	**1,156.5**	**1,187.4**	**1,161.0**
Petroleum fuels	18,526.6	17,057.0	17,062.3	17,139.5	16,649.7	16,852.6
Petroleum + bioethanol fuels	18,535.1	18,230.4	18,237.7	18,296.0	17,837.1	18,013.6
Share of bioethanol in %	6.6	6.9	6.4	6.3	6.7	6.4

Sources: German Federal Office of Economics and Export Control, AMI

Table 3: Germany: Monthly domestic consumption of biofuels 2014 – 2019 in 1,000 t

	2014	2015	2016	2017	2018	2019
Biodiesel admixture						
January	167.03	159.92	174.56	160.22	182.81	192.96
February	172.77	173.73	167.74	134.45	176.12	152.81
March	176.93	188.86	194.59	206.45	203.28	175.12
April	198.67	190.02	191.14	174.91	196.00	185.02
May	216.23	204.96	184.26	178.44	204.94	182.96
June	187.11	191.21	203.36	190.17	197.08	194.30
July	207.78	190.25	194.50	205.92	225.16	226.62
August	211.41	185.33	186.81	207.11	212.19	218.42
September	189.59	165.14	172.73	200.18	190.39	207.73
October	190.92	159.41	159.06	189.94	184.91	202.37
November	200.01	167.24	160.88	193.99	173.29	208.20
December	192.06	168.83	160.68	174.14	177.17	201.46
Average	**192.54**	**178.74**	**179.19**	**184.66**	**193.61**	**195.66**
Total volume	**2,310.48**	**2,144.90**	**2,150.29**	**2,215.90**	**2,323.33**	**2,347.94**
Bioethanol						
January	94.99	78.98	93.38	88.22	104.92	99.72
February	83.84	85.04	80.02	77.26	87.45	87.53
March	86.36	90.78	89.75	90.33	98.15	83.33
April	107.83	98.76	90.30	99.86	95.30	91.17
May	114.48	108.24	98.41	105.50	106.85	103.28
June	96.42	100.65	107.85	95.47	103.01	100.93
July	110.17	107.01	112.06	106.32	104.91	101.47
August	117.60	109.16	103.16	102.98	109.72	95.06
September	99.66	99.39	96.38	96.11	92.64	97.55
October	98.00	99.15	101.30	102.59	95.94	102.81
November	98.20	94.53	99.65	91.55	93.70	101.96
December	121.75	101.78	103.20	100.33	94.75	96.14
Average	**102.44**	**97.79**	**97.95**	**96.38**	**98.95**	**96.75**
Total volume	**1,229.29**	**1,173.48**	**1,175.45**	**1,156.52**	**1,187.36**	**1,160.95**

Note: Data for 2019 provisional
Source: German Federal Office of Economics and Export Control, AMI

Table 4: Germany: Foreign trade with biodiesel 2014 – 2019 in t

	2014	2015	2016	2017	2018	2019
Biodiesel import						
January	17,431	43,895	48,778	43,930	85,583	97,338
February	19,252	27,362	61,229	45,251	78,473	71,163
March	31,719	32,017	78,121	58,354	115,706	86,856
April	43,875	50,179	105,342	67,174	116,581	122,073
May	49,385	54,036	66,152	69,232	138,737	124,666
June	56,013	58,882	61,900	57,016	130,556	107,136
July	81,779	57,543	75,016	78,880	121,159	159,543
August	74,013	48,775	60,430	80,471	92,421	126,501
September	58,514	38,478	74,432	75,286	127,237	155,297
October	40,081	28,195	50,256	82,373	79,313	112,613
November	52,173	35,383	40,634	70,296	55,765	111,581
December	59,742	46,227	34,433	59,883	75,638	130,672
Total	**583,977**	**520,972**	**756,722**	**788,145**	**1,217,168**	**1,405,438**
Biodiesel export						
January	150,584	139,212	86,117	113,367	141,104	183,590
February	128,301	100,653	105,759	121,281	156,687	193,992
March	143,442	89,716	103,757	101,721	143,594	205,928
April	112,718	134,858	102,930	152,217	172,016	169,000
May	105,689	127,422	138,783	137,679	114,487	230,393
June	157,472	120,061	121,659	148,797	166,584	163,145
July	145,959	137,746	135,787	114,460	155,086	172,055
August	162,282	116,958	130,781	127,871	191,730	192,742
September	169,149	134,234	118,485	155,532	173,519	197,228
October	164,607	141,910	178,807	165,812	181,676	193,140
November	163,970	124,179	180,361	120,172	170,864	181,609
December	109,276	124,996	139,180	149,643	176,551	177,904
Total	**1,713,449**	**1,491,944**	**1,542,406**	**1,608,550**	**1,943,897**	**2,260,727**

Note: Data for 2019 provisional
Sources: Federal Statistics Office of Germany, AMI

Table 5: Germany: Export of biodiesel [FAME] (2014 – 2019) in t

	2014	2015	2016	2017	2018	2019
Belgium	117,930	120,899	89,366	84,487	132,413	264,411
Bulgaria	366	981	1	1	1	1
Denmark	29,146	39,953	43,271	88,317	39,511	27,269
Estonia	.	.	.	24	.	.
Finland	8,729	855	8,512	12,734	9,156	2,626
France	221,641	182,315	85,006	76,339	64,945	53,701
Greece	808	25	6	2	3	1
Britain	68,243	29,623	12,581	40,016	50,581	107,902
Ireland	14	2,225	886	.	.	.
Italy	77,297	44,221	12,954	11,698	5,410	12,829
Croatia	.	.	.	.	.	500
Latvia	5	143	.	.	50	0
Lithuania	76	769	407	1,198	660	977
Luxembourg	.	0	.	0	308	417
Malta	.	43	.	.	.	.
Netherlands	600,089	419,613	588,598	583,289	667,121	855,472
Austria	107,803	134,615	71,627	97,500	185,335	171,617
Poland	163,724	125,453	229,517	236,404	242,008	239,225
Portugal	0	0		9	8	8
Romania	1,925	0	11,912	0	0	0
Sweden	55,829	111,136	60,176	73,089	138,524	135,833
Slovakia	10,376	155	939	5,595	12,486	21,271
Slovenia	201	1,530	165	1,651	14,988	34,917
Spain	49,312	7,799	30,865	33,388	274	350
Czech Republic	60,411	120,092	98,446	88,212	61,155	56,036
Hungary	25,637	7,664	56	3,488	4,902	315
Cyprus	15,796	81	.	.	.	.
EU-28	**1,615,358**	**1,350,189**	**1,345,289**	**1,437,439**	**1,629,839**	**1,985,675**
USA	8,544	10,870	84,953	70,091	197,412	183,250
Switzerland	10,086	17,813	45,321	70,152	97,819	83,865
Other countries	79,461	113,072	66,843	30,868	18,827	7,937
Total	**1,713,449**	**1,491,944**	**1,542,406**	**1,608,550**	**1,943,897**	**2,260,727**

Note: Data for 2019 provisional
Sources: Federal Statistics Office of Germany, AMI

Table 6: Germany: Import of biodiesel [FAME] (2014 – 2019) in t

	2014	2015	2016	2017	2018	2019
Belgium	48,852	82,412	101,252	136,199	236,150	293,421
Bulgaria	.	.	3,664	20,388	33,142	24,954
Denmark	.	29	217	3,599	532	1,001
Estonia	.	.	.	.	.	23
France	7,826	22,446	8,774	14,283	9,678	21,749
Britain	1,845	942	954	608	709	5,992
Italy	20,643	15,776	.	3,003	827	33
Lithuania	.	.	.	.	536	.
Netherlands	315,859	132,452	286,324	300,959	618,523	713,114
Austria	41,371	60,225	95,174	92,837	90,538	80,536
Poland	34,472	64,119	93,602	70,498	88,955	94,316
Romania	.	.	.	.	.	25
Sweden	0	277	168	140	1	9
Slovakia	682	1,096	15,604	6,549	959	1,464
Slovenia	.	76	1,190	1,929	1,341	.
Spain	.	.	10	.	1,001	27
Czech Republic	5,058	5,989	12,384	2,460	922	12,987
Hungary	.	.	50	193	.	.
Cyprus	75	.	.	.	.	.
EU-28	**476,684**	**385,837**	**619,369**	**653,647**	**1,083,813**	**1,249,650**
Malaysia	100,348	132,041	129,042	124,458	128,109	153,182
Philippines	.	.	686	2,989	2,988	1,517
Norway	586	491	547	1,024	593	472
Other countries	**6,359**	**2,603**	**7,078**	**6,027**	**1,665**	**617**
Total	**583,977**	**520,972**	**756,722**	**788,145**	**1,217,168**	**1,405,438**

Note: Data for 2019 provisional
Sources: Federal Statistics Office of Germany, AMI

Table 7: Biodiesel production capacities 2020 in Germany

Operator / Plant	Location	Capacity (t/year)	
ADM Hamburg AG - Hamburg plant	Hamburg	not available	●
ADM Mainz GmbH	Mainz	not available	●
Bioeton Kyritz GmbH	Kyritz	80,000	
BIO-Diesel Wittenberge GmbH	Wittenberge	120,000	
Viterra 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/Some names abbreviated
DBV and UFOP recommend the biodiesel reference from the members of the working group
Status: July 2020

Table 8: EU production of biodiesel 2012 – 2019 in 1,000 t

	2012	2013	2014	2015	2016	2017	2018	2019
Belgium	308	300	446	248	235	290	252	270
Denmark	109	200	200	140	140	120	130	130
Germany	2,600	2,600	3,000	3,085	3,119	3,208	3,344	3,400
United Kingdom	249	267	143	149	342	467	476	520
France	2,120	2,100	2,174	2,230	1,888	2,095	2,299	1,900
Italy	287	459	580	577	576	692	752	750
Netherlands	332	606	734	650	636	929	839	807
Austria	265	217	292	340	307	295	287	290
Poland	592	648	692	759	871	904	881	966
Portugal	304	306	335	359	334	333	338	285
Sweden	127	130	157	139	109	66	258	130
Slovenia	6	15	0	0	0	0	0	0
Slovakia	110	105	101	125	110	109	110	110
Spain	472	581	894	971	1,160	1,515	1,767	1,615
Czech Republic	173	182	219	168	149	157	194	248
EU others	**666**	**720**	**718**	**748**	**804**	**810**	**923**	**949**
EU-28	**8,471**	**9,169**	**10,542**	**10,539**	**10,438**	**11,523**	**12,374**	**11,850**

Source: F.O. Licht

Table 9: Global biodiesel and HVO production 2012–2019 in 1,000 t

	2012	2013	2014	2015	2016	2017	2018	2019
Biodiesel production								
EU-28	8,471	9,169	10,542	10,539	10,438	11,523	12,374	11,850
Canada	88	154	300	260	352	350	270	350
USA	3,299.9	4,523.2	4,230.1	4,216.8	5,226	5,316	6,185.3	5,742.3
Argentina	2,455.3	1,997.8	2,584.3	1,810.7	2,659.3	2,871.4	2,429	2,147.3
Brazil	2,391.4	2,567.4	3,009.5	3,464.8	3,345.2	3,776.3	4,708	5,193
Colombia	490.1	503.3	518.5	513.4	447.8	509.8	555	530
Peru	16	16	2	1	0	33	99	100
India	44	110	65	55	75	65	75	90
Indonesia	1,880	2,411	3,162	1,283	2,877	2,742	3,550	7,360
Malaysia	238	446	538	581	642	807	1,095	1,500
Philippines	121	136	151	180	199	194	199	170
Thailand	788.7	923.6	1,032	1,089	1,084.2	1,256.3	1,391.8	1,470
Rest of the world	1,236.9	1,221	1,029.9	1,295.9	1,637.9	1,888	1,861	2,332.9
TOTAL	21,520.3	24,178.3	27,164.3	25,289.6	28,983.4	31,331.8	34,792.1	38,835.5

HVO production*	2012	2013	2014	2015	2016	2017	2018	2019
EU-28	1,337	1,400	1,903	2,076	2,093	2,750	2,665	3,018
USA	150	480	1,075	875	1,050	1,300	1,450	1,750
Rest of the world	757	821	893	958	1,000	960	768	975.0
TOTAL	2,244	2,711	3,886	3,924	4,158	5,025	4,898	5,743
Sum total Biodiesel/HVO production world-wide	**23,764.30**	**26,889.30**	**31,050.30**	**29,213.60**	**33,141.50**	**36,356.80**	**39,690.10**	**44,578.50**

* HVO = Hydrogenated Vegetable Oil
Source: F.O. Licht, status 2020

Table 10: Global biodiesel and HVO consumption 2012–2019 in 1,000 t

Biodiesel production	2012	2013	2014	2015	2016	2017	2018	2019
EU-28	10,997	9,938	10,796	10,396	10,063	11,092	12,472	13,382
Canada	231	348	342	365	393	379	439	427
USA	2,994.5	4,759.2	4,719.3	4,976.7	6,946	6,611.6	6,311.9	6,032.1
Argentina	874.8	885	970.1	1,013.9	1,033.3	1,173.3	1,098.5	1,071
Brazil	2,304.4	2,510	2,879.6	3,367.7	3,332.5	3,753.4	4,677.8	5,166.6
Colombia	488.2	505.7	518.7	523.4	506	513.3	550	530
Peru	251	261.2	257.2	277.8	293.6	290.4	291.2	293.3
India	40	45	30	35	45	65	75	75
Indonesia	471	737	1,299	585	2,306	1,999	2,900	5,850
Malaysia	211	308	454	255	560	572	581	600
Philippines	121	135	143	177	192	180	170	180
Thailand	801.9	897.8	1,074.8	1,134.9	1,025.3	1,254.5	1,422.3	1,448.7
Rest of the world	1,684	1,953	4,085	1,905	2,030	2,015	3,216	3,457
TOTAL	21,469.8	23,282.9	27,568.7	25,012.5	28,725.8	29,898.6	34,204.7	38,512.6

HVO consumption*	2012	2013	2014	2015	2016	2017	2018	2019
EU-28	1,456	1,169	1,753	2,109	2,223	2,466	2,261	2,360
Canada	139	149	154	77	63	67	56	72
USA	303.1	1,230.2	1,440.4	1,515	1,745	1,779.4	1,817	2,675.2
Thailand	0	10	15	15	15	15	15	15
Rest of the world	101	43	184	123	161	354	186	263
TOTAL	1,999.1	2,601.2	3,546.4	3,839	4,207	4,681.4	4,335	5,385.3

Sum total biodiesel/ HVO consumption worldwide	**23,469**	**25,884.10**	**31,115.10**	**28,851.50**	**32,932.80**	**34,580**	**38,539.70**	**43,897.90**

* HVO = Hydrogenated Vegetable Oil
Source: F.O. Licht, status 2020

Biofuel mandates

Table 11: Biodiesel mandates in the EU in 2020 for selected member states[1]

a) Austria

	Total quota (energy content, % cal.)	Biodiesel (% cal.)	Bioethanol (% cal.)	Double assessment
Since 2012	5.75	6.3	3.4	Yes
2020	**5.75 plus 0.5 advanced biofuels**	**6.3**	**3.4**	**No**

Source: 2012 Fuel Ordinance, 2020 Version

*Double counting: Waste and residual materials from agricultural and forestry production, including fisheries and aquaculture, processing residues, cellulosic non-food materials or ligno-cellulose materials

b) Belgium

	Total quota	Biodiesel (% energy content)	Bioethanol (% energy content)	Double assessment
Up to 31st December 2016		6.0	4.0	
2017-2019		6.0	8.5	
1 January 2020 to 31 March 2020		8.5	8.5	**Possible with approval**
From 1 April 2020 to 31 December 2020		**9.9**	**9.9**	
From 1 January 2020		9.55	9.55	Max. 0.6%

Source: Law of July 7, 2013; Law of July 21, 2017; Law of May 4, 2018

c) Bulgaria

Biodiesel (% vol.)	Bioethanol (% vol.)		Upper limit for vegetable biofuels (% vol.)	2nd generation (% cal.)	Double assessment
5/1*	1 September 2018	8			**No**
	1 March 2019	9			
	1st January 2020	**10**	**7**	**0.05**	

*Since 1 September 2018, the mandate has been split into five percent conventional first generation biodiesel and one percent second generation biodiesel.

[1] **Source and further information: GAIN Report** "Biofuel Mandates in the EU by Member State in 2020" (No. GM18024, published 28.05.2020 in English), see also https://www.fas.usda.gov/data/european-union-biofuel-mandates-eu-member-state-2020

Table 11: Biodiesel mandates in the EU in 2020 for selected member states – continued

d) Croatia

	Total quota (% cal.)	Biodiesel	Bioethanol	Double assessment
2019	7.85	6.61	0.98	2nd generation & waste-based bio fuels
2020	**8.81**	**7.49**	**1.00**	

Source: Act on Biofuels for Transport (Official Gazette 65/09, 145/10, 26/11 and 144/12)
https://www.zakon.hr/z/189/Zakon-o-biogorivima-za-prijevoz
National Action Plan for Renewable Energy Sources to 2020:
https://mzoe.gov.hr/UserDocsImages/UPRAVA%20ZA%20ENERGETIKU/Strategije,%20planovi%20i%20programi/National_Action_Plan%20for%20Renewable%20Energy%20Sources%20to%202020.pdf .

e) Czech Republic

	Proportions of biofuels and renewable electricity in the transport sector by total consumption (% cal.)	Obligation to reduce total greenhouse gas emissions by [1), 5)] (%)	Biodiesel [1), 6)] (% vol.)	Bioethanol [1), 6)] (% vol.)	Double assessment[1)]
2019		3.5 [3), 4)]			
2020		**6** [3), 4)]	6	4.1	**Yes** [2)]

f) Denmark

	Total quota (% cal.)	Progressive biofuels (% cal.)	Biodiesel (% cal.)	Bioethanol (% cal.)	Double assessment
Since 2012	**5.75**				
2020	5.75	0.9*			

Source: Stratas
* The expanded mandate for progressive Biofuels excludes UCO and animal fats.

g) Finland

	Total quota (% cal)	Biodiesel	Bioethanol	Double assessment
2019	18			
2020 and after	**20**			

Source: Stratas.
The finish parliament has passed a law stipulating that the country gradually increase its biofuel-aim to a total 30% by 2029. In addition, Finland has passed a law which foresees an increase of the amount of advanced biofuel from 2% in 2023 to 10% in 2030. (Source: IEA country report).

Table 11: Biodiesel mandates in the EU in 2020 for selected member states – continued

h) France

	Bioethanol (target, % cal)	Biodiesel (target, % cal)	Double assessment
2019	7.9	7.9	Yes
2020	**8.2**	**8**	

i) Germany

	Total quota (% cal.) [1)]	% GHG (Greenhouse gas savings* (BImSchG)[1)]	Upper limit for biofuels recovered from agricultural raw materials) (% cal.)[3)]	2nd generation biofuels (% cal.)[3)]	Double assessment[2)]
2018-2019		4.0			
2020				0.05 a)	
2021				0.1 b)	
2022-2023		**6.0**	**6.5**	0.2 c)	**No**
2025 and beyond				0.5	

Source:
1) § 37a Federal Act on Protection against Air Pollution (Bundes-Immissionsschutzgesetz) http://www.gesetze-im-internet.de/bimschg/ 37a.html
2) § 37b Federal Act on Protection against Air Pollution http://www.gesetze-im-internet.de/bimschg/ 37b.html
3) §13 +14 of the 38th Implementation Ordinance on the Federal Act on Protection against Air Pollution http://www.gesetze-im-internet.de/bimschv_38_2017/ 13.html
http://www.gesetze-im-internet.de/bimschv_38_2017/ 14.html
*Percentage of greenhouse gas savings divided by the total fuel consumption (fossil and renewable) compared to the hypothetical greenhouse gas emissions if all fuels were fossil-based.
a) Companies that placed in circulation 20 PJ or fewer biofuels in the previous year are exempt from the tax
b) Companies that placed in circulation 10 PJ or fewer biofuels in the previous year are exempt from the tax
c) Companies that placed in circulation 2 PJ or fewer biofuels in the previous year are exempt from the tax.

Year	Penalty
Since 2015	0.47 euro pro kg CO_2 equivalent

Source:
§ 37c (2) Federal Act on Protection against Air Pollution
(Bundes-Immissionsschutzgesetz) http://www.gesetze-im-internet.de/bimschg/ 37c.html.

j) Greece

	Total quota (% cal.)	Biodiesel	Bioethanol	Double assessment
2019		7	1	
2020		**7**	**3.3**	No
2021		7	3.3	

Table 11: Biodiesel mandates in the EU in 2020 for selected member states – continued

k) Hungary

	Biodiesel (% cal.)	Bioethanol (% cal.)	Double assessment
1.1.2019 - 31.12.2019	6.4	6.4	No
1.1.2020 - 31.12.2020	**8.2**	**6.1**	**No**

Source:
Government Decree No. 343/2010 on requirements and certification of sustainable biofuel production (overruled in 2017)
Government Decree No. 279/2017 on sustainability requirements and certification of biofuels
Double counting: §2 (4) of CXVII/2010 Act on promoting the use of renewable energy and the reduction of greenhouse gas emission of energy used in transport
Hungary's National Renewable Energy Action Plan.

i) Ireland

	Total quota (% vol. in fossil fuels)	Corresponding to % vol. of total fuel consumption	Double counting
2019	11.11	10	**UCO, Cat. 1 Tallow, used bleached earth (SBE), waste water from palm oil mills (POME), whey permeate**
From 2020	**12.359**	**11**	

Further information on Ireland's Biofuels Obligation Scheme can be found at:
http://www.nora.ie/biofuels-obligation-scheme.141.html
Section 44C(3)(b) of the NATIONAL OIL RESERVES AGENCY ACT 2007
http://revisedacts.lawreform.ie/eli/2007/act/7/revised/en/html#SEC44C.

m) Italy

	Biofuels total (% by energy content)	including progressive biofuels (% by energy content, double-counted)	Progressive biofuels required to reach the targets. (% by energy content)	
			% of "progressive" bio-methane	% of other "progressive" biofuels
2019	**8**	**0.2**	**0.60**	**0.20**
2020	9	1.0	0.68	0.23
2021	9	1.6	1.13	0.38
2022 and beyond	9	2	1.39	0.46

n) Netherlands

	Total quota (% cal.)	Including progressive biofuels (% cal.)	Upper limit for biofuels recovered from agricultural raw materials (% cal.)	Double counting
2019	12.5	0.8	4	**Yes**
2020	**16.4**	**1.0**	**3**	

Source: Dutch Emission Authority.

Table 11: Biodiesel mandates in the EU in 2020 for selected member states – continued

o) Poland

	Total quota (% cal.)	Biodiesel (% cal.)	Bioethanol (% cal)	Double counting
2019	8			**Yes**
2020	**8.5**			

Source: FAS Warsaw.

p) Portugal

	Total quota (% cal.)	Biodiesel (% cal.)	Bioethanol / ETBE (% cal.)	Double counting
2019	7	-	-	**Yes**
2020	**10**			

Sources: Consumption targets: Decree-Law 117/2010, Decree-Law 69/2016, Law 42/2016 , Budget Law for 2018 and 2019.
Double counting: Decree-Law 117/2010 and Annex III in Implementing Order 8/2012.

q) Romania

	Total quota (% cal.)	Biodiesel (% cal.)	Bioethanol (% cal.)	Double counting
2019		6.5	8.0	**Yes**
2020	**10**	**6.5**	**8.0**	

Sources: Government Decisions 1121/2013 and 931/2017.

r) Slovakian Republic

	Total quota (% cal.)	2nd generation biofuels (% cal.)	Double counting
2018	5.8		**Yes**
2019	6.9	0.1	
2020	**7.6**	**0.5**	
2021	8		
2022-2024	8.2		
2025-2030		0.75	

Source: Act no. 309/2009 amended by Act no. 309/2018 on Support of Renewable Energy Resources.

s) Slovenia

	Total quota (% cal.)	Biodiesel (% cal.)	Bioethanol (% cal.)	Double counting
2010	5			**Yes**
2011	5.5			
2012	6			
2013	6.5			
2014	7			
Since 2015	**7.5**			

Source: Stratas

Table 11: Biodiesel mandates in the EU in 2020 for selected member states – continued

t) Spain

	Total quota (% cal.)	Biodiesel (% cal.)	Bioethanol (% cal.)	Double counting
2014	7	-	-	Yes
Since 2015	**8.5**	**-**	**-**	

u) Sweden

The Swedish government submitted a proposal in 2017, which was later implemented on 1 July 2018. The framework's structure builds upon an incremental reduction of greenhouse gas emissions through the addition of biofuels in both petrol and diesel. From 1 July 2018, the framework is to reduce diesel emissions by 19,2% and petrol emissions by 2.6%. The reduction targets are to be progressively increased in line with the 2030 aim of reducing greenhouse gas emissions by 40% (Source: IEA country report).

v.) United Kingdom

	Total share (% cal)	Development fuel target (% cal)	Double counting
2019	9.180	0.109	**Specific waste/residual-material, alongside energy crops and renewable fuels of a non-biological origin; development fuels.**
2020	**10.637**	**0.166**	
2021	10.679	0.556	
2022	10.714	0.893	
2023 - 2031	Rising every year In 0.025 percent Volume steps until:	Rising every year in 0.23 percent Volume steps Up to	
2032	10.959	3.196	

Tables of the German Federal Office for Agriculture and Food

Table 12: Germany: Feedstocks of the biofuels in Terajoules [TJ][1]

Fuel type	Bioethanol			Biomethane			FAME			HVO			Vegetable oil		
Quota year	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Feedstock															
Waste/residual material	118	46	419	1,373	1,615	1,329	32,422	31,508	41,144	269	80	77			
Ethiopian mustard									52						
Barley	1,435	1,665	1,326												
Maize	9,983	14,369	15,484												
Palm oil							9,816	18,373	17,790	6,928	1,361	1,106			5
Rapeseed							32,154	28,381	25,105				246	26	19
Rye	2,028	2,272	1,439												
Silage maize						80			675						
Soya							46	62	1,898						
Sunflowers							79	1,631							
Triticale	2,341	1,753	1,956												
Wheat	9,647	7,940	8,622												
Sugar cane	2,466	1,071	498												
Sugar beets	2,176	875	1,042												
Total	**30,195**	**29,991**	**30,785**	**1,373**	**1,615**	**1,408**	**74,517**	**79,955**	**86,663**	**7,197**	**1,442**	**1,184**	**246**	**26**	**24**

Source: BLE
[1] Discrepancies in totals are due to rounding

Table 13: Germany: Feedstocks of the biofuels in 1,000 t[1,2]

Fuel type	Bioethanol			Biomethane			FAME			HVO			Vegetable oil		
Quota year	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Feedstock															
Waste/residual material	4	2	16	27	32	27	868	843	1,101	6	2	2			
Ethiopian mustard									1						
Barley	54	63	50												
Maize	377	543	585												
Palm oil							263	492	476	159	31	25			0.1
Rapeseed							860	759	672				7	1	1
Rye	77	86	54												
Silage maize						2									
Soya							1	2	18						
Sunflowers							2	44	51						
Triticale	88	66	74												
Wheat	365	300	326												
Sugar cane	93	40	19												
Sugar beets	82	33	39												
Total	**1,140**	**1,133**	**1,163**	**27**	**32**	**28**	**1,994**	**2,140**	**2,319**	**165**	**33**	**27**	**7**	**1**	**1**

Source: BLE
[1] Discrepancies in totals are due to rounding
[2] the values are calculated into tonnage based on the quantities in the analyses

Table 14: Germany: Feedstocks of the biofuels according to origin in Terajoules [TJ][1]

Region	Africa			Asia			Australia			Europe			Central America			North America			South America		
Quota year	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Feedstock																					
Waste/residual material	252	287	391	6,641	6,947	12,180	47	46	84	23,888	23,412	27,096	12	11	14	2,876	1,983	2,682	467	562	523
Ethiopian mustard																					52
Barley										1,435	1,665	1,326									
Maize			9							9,983	14,369	15,475									
Palm oil				16,435	17,464	17,867							309	2,270	1,029						5
Rapeseed						17	341	333	3,104	32,059	28,075	22,002				0.1					
Rye										2,028	2,272	1,439									
Silage maize												80									
Soya									10		35	19							46	27	646
Sunflowers										79	1,631	1,898									
Triticale										2,341	1,753	1,956									
Wheat										9,647	7,940	8,622									
Sugar cane													464	324	247				2,002	746	251
Sugar beets										2,176	875	1,042									
Total	252	287	400	23,075	24,411	30,065	388	379	3,198	83,637	82,027	80,954	785	2,606	1,290	2,876	1,983	2,682	2,515	1,335	1,477

Source: BLE
[1] Discrepancies in totals are due to rounding

Table 15: Germany: Feedstocks of the biofuels according to origin in 1.000 t[1,2]

Region	Africa			Asia			Australia			Europe			Central America			North America			South America		
Quota year	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Feedstock																					
Waste/residual material	7	8	10	177	186	326	1	1	2	631	616	721	0.3	0.3	0.4	77	53	72	13	15	14
Ethiopian mustard																					1
Barley										54	63	50									
Maize			0.3							377	543	585									
Palm oil				413	462	474							8	61	28						0.1
Rapeseed						0.5	9	9	83	858	751	589									
Rye										77	86	54									
Silage maize												2									
Soya									0.3		1								1	1	17
Sunflowers										2	44	51									
Triticale										88	66	74									
Wheat										365	300	326									
Sugar cane													18	12	9	,			76	28	9
Sugar beets										82	33	39				,			,		
Total	7	8	11	590	648	800	10	10	86	2,534	2,503	2,490	26	73	37	77	53	72	90	44	42

Source: BLE
[1] Discrepancies in totals are due to rounding
[2] the values are calculated into tonnage based on the quantities in the analyses

Table 16: Germany: Total feedstocks of the biofuels[1]

	[TJ]			[kt]		
	2016	2017	2018	2016	2017	2018
Feedstock						
Waste/residual material	34,183	33,249	42,971	906	879	1,145
Ethiopian mustard			52			1
Barley	1,435	1,665	1,326	54	63	50
Maize	9,983	14,369	15,484	377	543	585
Palm oil	16,744	19,734	18,901	422	523	502
Rapeseed	32,400	28,408	25,124	867	760	672
Rye	2,028	2,272	1,439	77	86	54
Silage maize			80			2
Soya	46	62	675	1	2	18
Sunflowers	79	1,631	1,898	2	44	51
Triticale	2,341	1,753	1,956	88	66	74
Wheat	9,647	7,940	8,622	365	300	326
Sugar cane	2,466	1,071	498	93	40	19
Sugar beets	2,176	875	1,042	82	33	39
Total	**113,528**	**113,029**	**120,066**	**3,334**	**3,339**	**3,538**

Source: BLE
[1] Discrepancies in totals are due to rounding

Table 17: Germany: Emissions and emission savings of biofuels[1]

	Emissions [t CO_{2eq}/TJ]			Savings [%][2]		
	2016	2017	2018	2016	2017	2018
Biofuel type						
Bioethanol	20.58	14.58	12.69	75.44	82.6	86.4
Biomethane	8.03	7.77	9.19	90.42	90.73	90.23
Biomethanol			8.3			91.27
FAME	17.84	16.1	16.26	78.71	80.79	82.9
HVO	31.66	29.64	21.93	62.22	64.64	76.94
Vegetable oil	35.34	30.09	30.18	57.83	64.09	68.26
Weighted average of all biofuels	**19.37**	**15.75**	**15.32**	**79.89**	**81.2**	**83.81**

Source: BLE
[1] Discrepancies in totals are due to rounding
[2] Savings compared to fossil reference value for fuel 83.8 g CO_{2eq}/MJ

Table 18: Germany: Emissions and emission savings of bioliquids[1]

	Emissions [t CO_{2eq}/TJ]			Savings [%][2]		
	2016	2017	2018	2016	2017	2018
Bioliquid type						
from the cellulose industry	1.58	1.73	1.8	98.26	98.1	98.02
FAME	46.47	45.25	37.18	48.93	50.27	59.14
HVO		44.5	44.5		51.1	51.1
Vegetable oil	36.9	34.26	33.73	59.45	62.35	62.93
UCO	14			84.62		
Weighted average of all bioliquids	**5.88**	**5.65**	**5.99**	**93.54**	**93.79**	**93.41**

Source: BLE
[1] Discrepancies in totals are due to rounding
[2] Savings compared to fossil reference value for liquid fuel for electricity generation 91.0 g CO_{2eq}/MJ

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