USDA Foreign Agricultural Service
GAIN Report
Global Agricultural Information Network

Required Report - public distribution

Date: 7/15/2019
GAIN Report Number: NL9022

EU-28

Biofuels Annual

EU Biofuels Annual 2019

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Report Highlights: The EU set a ten percent target for renewable energy use in transport for 2020, and raised the target to 14 percent in 2030, with advanced biofuels counting double to the target. Taking double-counting into account, biofuels accounted for 7.1 percent of energy use in transport in 2018 and are forecast to increase to 7.3 percent in 2019, mainly supported by elevated imports. Further increase for 2019 is hampered by lagging domestic production of biodiesel in particular. The EU agreed to a seven percent cap for food-based biofuels, which is forecast at 4.6 percent in 2019. For advanced, non-food based biofuels, the EU set a climbing target of 0.2 percent in 2022 reaching 3.5 percent in 2030. Use of such advanced biofuels, made mostly from agricultural, forestry and municipal waste, is estimated at currently 0.2 percent and forecast to rise mainly based on tall oil. The EU set a limit of 1.7 percent by 2030 for advanced biofuels produced with waste fats and oils. The blending of these biofuels is estimated at currently one percent. The EU market for wood pellets is expected to continue its growth path during 2019, but further expansion could be limited by individual Member State sustainability requirements.

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I. Executive Summary

Policy and Programs for Transport Biofuels

The current EU policy for renewable energy is set in the EU Energy and Climate Change Package (CCP) and the Fuel Quality Directive (FQD). The CCP includes the "20/20/20" mandatory goals for 2020, one of which is a 20 percent binding target for renewable energy in the overall energy mix of the EU, and a ten percent renewable energy blending target (energy basis) for the transport sector. According to the EU's most recent biannual progress report (April 2019), the EU is on track to meet its 20 percent target and will likely meet the binding ten percent renewable energy target for the transport sector understanding that double-counting is used to achieve this target.

In the Renewable Energy Directive (RED), which is part of the CCP, specific sustainability requirements are defined for conventional liquid biofuels. The European Commission (EC) amended these sustainability requirements in the Indirect Land Use Change (ILUC) Directive, most notably by capping the use of food based biofuels at seven percent and setting non-binding national targets for non-food based biofuels such as cellulosic ethanol at 0.5 percent of overall energy use.

In 2016, the EC proposed a successor to the RED for the period of 2021-2030: the RED II. Following almost two years of debates, the RED II was published in the EU's Official Journal as Directive (EU) 2018/2001. The RED II sets a new overall renewable energy target of 32 percent by 2030 and a 14 percent target for the transport sector. The RED II caps the share of food based biofuels for each Member State (MS) to one percent above each MS's consumption level in the year 2020, limited to an overall cap of seven percent of final consumption of road and rail transport for each MS. The RED II also sets ambitious binding targets for the use of advanced, non-food based biofuels (not derived from fats and oils) to 3.5 percent by 2030, and a blending cap of 1.7 percent for advanced biofuels produced with waste fats and oils. Advanced biofuels will be double-counted towards both the 3.5 percent target and towards the 14 percent target.

With the RED II, the EU also introduced sustainability criteria for biomass and expanded sustainability criteria for liquid biofuels. The RED II will enter into force on January 1, 2021. The EC is now preparing implementing and delegated acts, most of which will need to be adopted before the enforcement of the Directive.

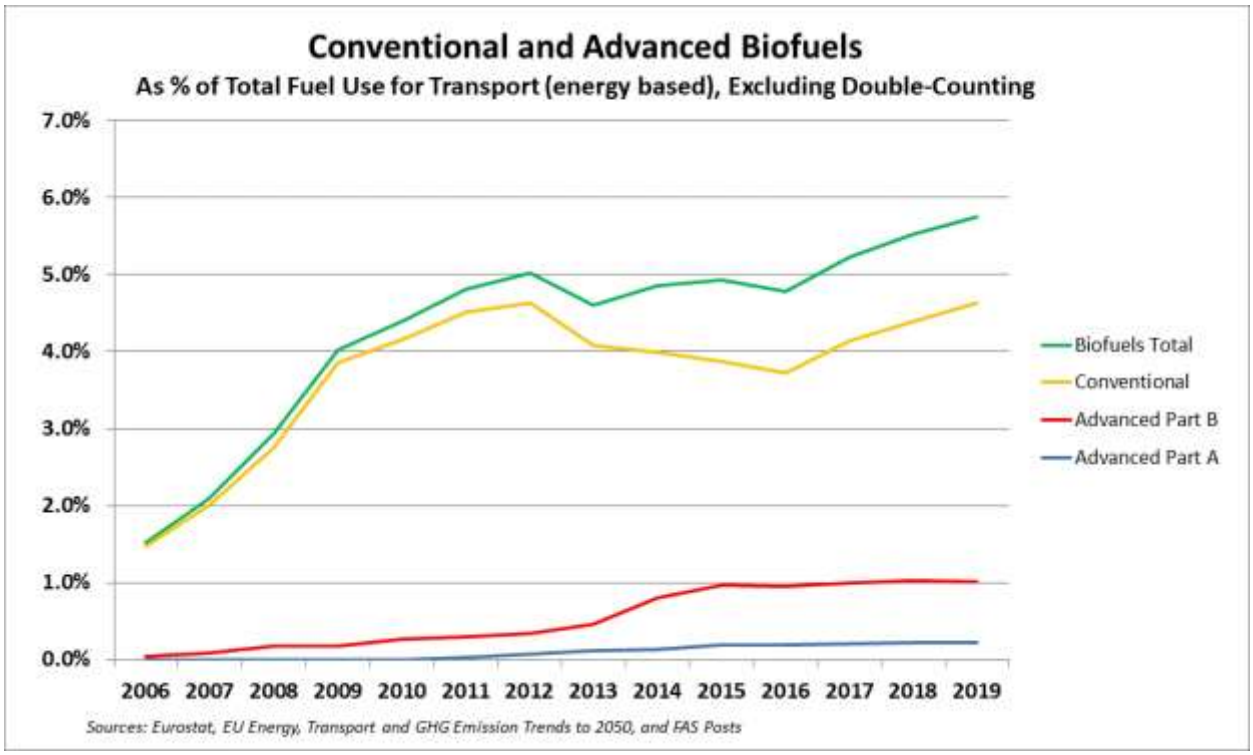
The EC, European Council and European Parliament are also currently negotiating the next Common Agricultural Policy (CAP), which programs all the EU-wide funding for agricultural and rural development. The EC released its legislative proposal for CAP post-2020 on June 1, 2018. The co-legislators in the European Parliament and Council are currently considering the proposal. The EC's legislative proposals suggested voluntary coupled support for sectors that would decrease dependence on fossil fuels.

Finally, there have been several recent developments related to the EU's Anti-Dumping (AD) duties on biofuels. In May 2019, the EU repealed the AD duties that were imposed on U.S. bioethanol exports since 2013. Earlier, in October 2018, the EU had repealed AD duties imposed on

Argentinean and Indonesia's biodiesel. However, in December 2018, the EU launched an anti-subsidy proceeding on imports of biodiesel from Indonesia. The result of the investigation is still pending but provisional measures could be put in place in September 2019. With regards to Argentina, in February 2019, the EU imposed a countervailing (CV) duty on Argentinean biofuels.

Conventional and Advanced Transport Biofuels

Based on the increasing MS mandates, consumption of both bioethanol and biodiesel is forecast to continue to increase in 2019. But due to the abolishment of AD duties on U.S. ethanol and especially Argentinean and Indonesian biodiesel a major share of this increase is forecast to be fulfilled with imports. Nonetheless, the rise in bioethanol imports is expected to be limited due to imposed sustainability requirements, and domestic bioethanol production is still forecast to increase in 2019. Also domestic production of hydrotreated vegetable oil (HVO) is expected to benefit from rising consumption. In contrast, EU biodiesel production is hampered by strong competition and is expected to decline by four percent. As a result, the production of rapeseed oil based biodiesel is forecast to be cut and the use of rapeseed oil is expected to decline from 6.3 mmt in 2017 and 5.2 mmt in 2018 to 5.0 mmt in 2019.

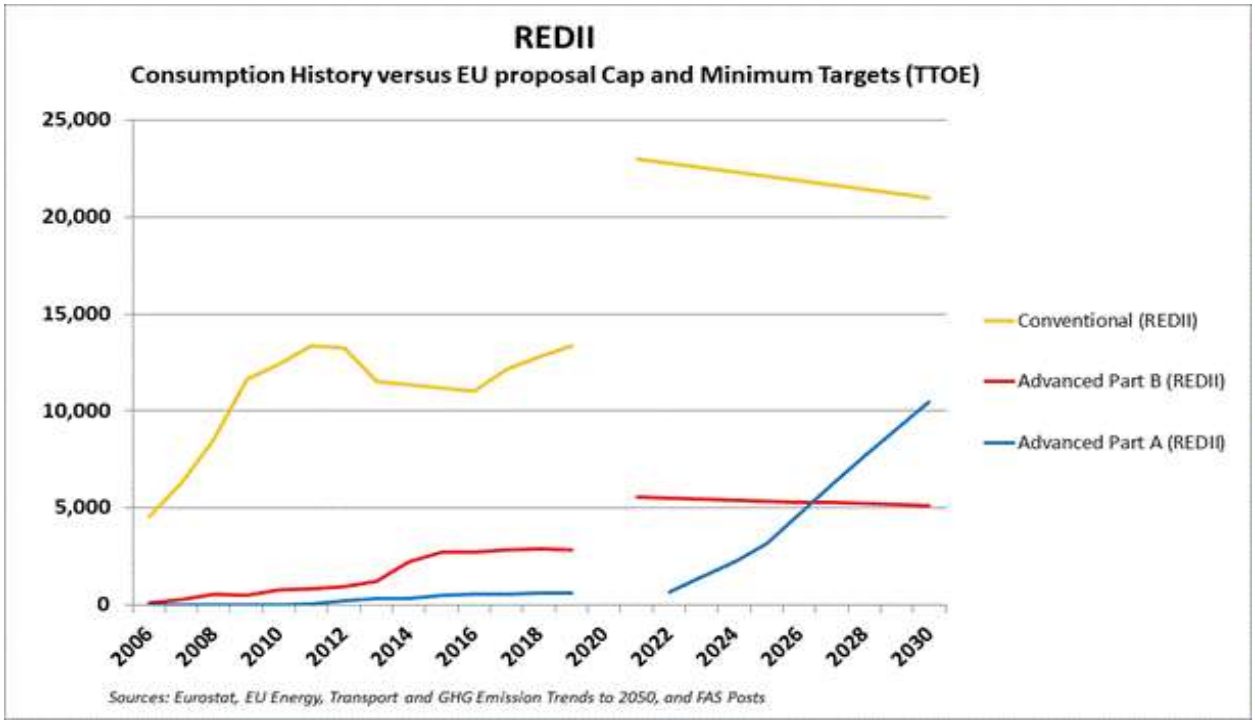


In 2019, total biofuels blending with fossil fuels (on energy basis and with double-counting of advanced biofuels) is forecast to reach 7.3 percent. This is a minor increase compared to the blending of 7.1 percent achieved in 2018. Excluding double-counting, total biofuel blending in 2019 is forecast to reach only 5.7 percent (see graph above), with 4.0 percent for bioethanol and 6.4 percent for biodiesel and HVO. Blending of food-based biofuels is estimated at 4.6 percent, still well below the seven percent cap set by the ILUC Directive, and for 2021-2030 by the RED II.

Blending of advanced, non-food and waste-based biofuels is estimated at 1.2 percent in 2019. The majority of these advanced biofuels, about one percent, is produced from waste fats and oils (listed in Part B of Annex IX of the RED II), and only a small percentage, 0.2 percent, is produced from agricultural and forestry by-products such pine oil and cellulosic feedstocks (listed in Part A).

Historical Eurostat transport fuel statistics and EC projections for transport fuel use (EU Energy, Transport and GHG Emission Trends to 2050) combined with the seven percent cap for conventional biofuels in the RED II translate to a consumption maximum of conventional and advanced biofuels combined of about 23,000 ttoe (thousand metric tons of oil equivalent) in 2022 and 21,000 ttoe in 2030 (see graph below). It should be noted that this volume can be cut by the proposed multipliers for reaching the overall mandate of 14 percent renewable energy in transport: electric transport (4x for road and 1.5x for rail transport), the use of biofuels by the aviation and maritime sector (1.2x), and advanced biofuels produced from agricultural and forestry by-products (Part A) and waste fats and oils (Part B) which both count double to the mandate. It should be noted that MSs may also decide to set limits below seven percent for the contribution from food-based biofuels.

Given the double-counting and the readiness of the technology, renewable diesel (HVO produced with Part B inputs) is likely to be a preferred transport biofuel, but RED II sets a limit of 1.7 percent. However, MSs can modify this limit if justified by taking into account the availability of the feedstock. Sourcing feedstocks from third countries could support a production expansion in order to keep these renewable transport fuels competitive. The EU already imports these feedstock and this trade opportunity is set to grow. The EC is able to add feedstocks listed in Part A and B of Annex IX, but cannot remove them.



Based on the proposed minimum blending rates for advanced biofuels produced with feedstocks listed in Part A of the RED II, the consumption of these second generation biofuels must increase significantly from 2020 (see graph above). The RED II target for advanced biofuels (Part A) of 0.2 percent in 2022 equals the current consumption level, but the target is set to increase to 3.5 percent in 2030, which requires a quantity of about 10,000 ttoe. This would almost equal the current production of conventional biofuels, and require about a hundred advanced biofuel plants with an annual capacity of 200 million liters each. This requires investments in domestic biorefineries and possible external sourcing of eligible feedstocks or as an alternative sourcing of such advanced biofuels outside the EU. The current available biofuels produced from feedstocks listed in Part A are produced from tall oil (renewable diesel), glycerol (biomethanol) and saw dust (bioethanol). The most significant production expansion of such advanced biofuels is forecast to take place in Finland and Sweden. This expansion will likely be based on the refining of tall oil and wood derived feedstocks.

Biomass for Heat and Power

With a consumption of about 27.4 mmt of pellets in 2018, the EU is the world's largest wood pellet market. Based on EC mandates and MS incentives, the demand is expected to expand further to 30 mmt in 2019. Residential use for heating, about forty percent of the total pellet market, is a relatively stable market compared to industrial heat and power generation. In some EU MSs, households receive subsidies or tax deductions for heating with biomass. In most countries, however, government funding is limited. Italy and Germany are the main growth markets for residential pellets.

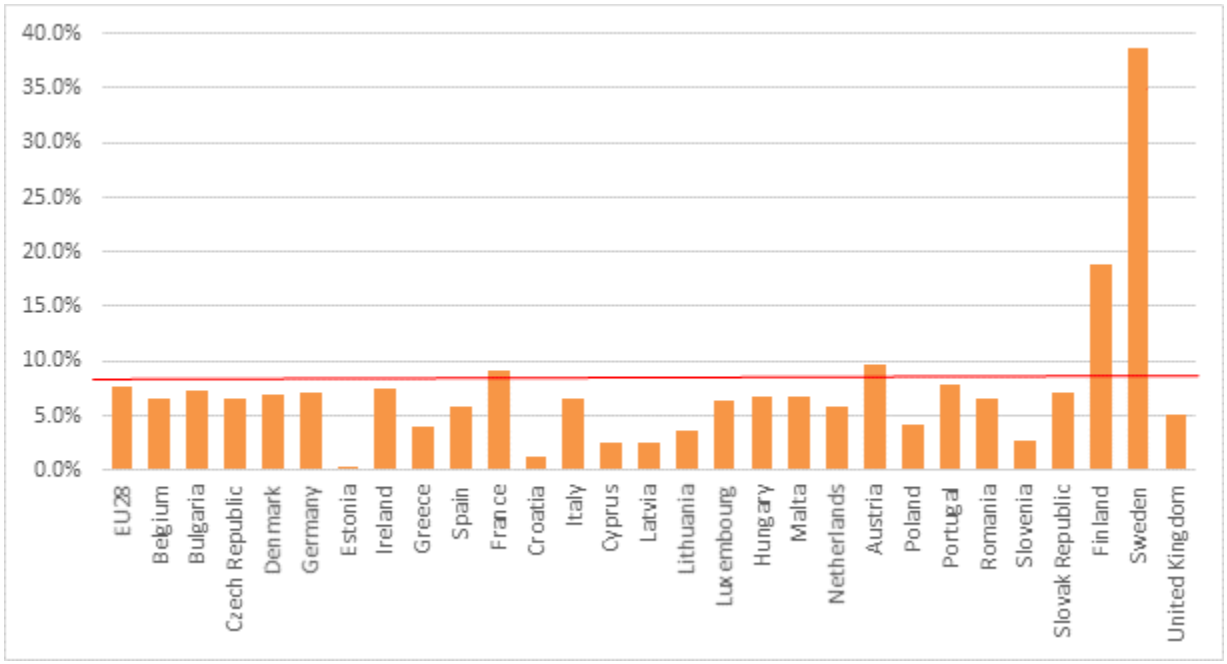
Demand for industrial pellets, mostly for power generation, depends primarily on MS mandates and incentives. The main market for industrial pellets is the United Kingdom, which is anticipated to further grow in 2019. Another important industrial market for pellets is Denmark. The Dutch power sector is preparing to scale up its co-firing but it is uncertain what the size of this market will be. If EU demand and trade flows remain consistent with current patterns, the United States has the potential to supply 65 percent of the EU import demand, which would represent a trade value of potentially US$1.6 billion in 2020. Third country imports could, however, be affected by the implementation of sustainability requirements by individual MS governments.

II. Policy and Programs

The EU's Renewable Energy Directive (RED)

The EU Energy and Climate Change Package (CCP) runs from 2010-2020. The Renewable Energy Directive (RED), which is part of the CCP package, entered into force on June 25, 2009 and expires on December 31, 2020. As noted above, the CCP requires the EU to achieve a binding target whereby 20 percent of its overall energy use would be powered from renewable sources by 2020. The RED also requires that the transport sector reach a renewable energy-use target of 10 percent. Concerned that several CCP measures were having adverse environmental impacts and that not all MS were contributing to the EU-wide 20 percent renewable energy

target, the European Commission (EC) adopted the Indirect Land Use Change or ILUC Directive in 2015; this amended both the RED and the Fuel Quality Directive (FQD). The amendment put a cap on the share of conventional, food-based biofuels that can be used to meet the transport sector's target at seven percent and a requirement that advanced biofuels comprise a minimum share of 0.5 percent of transport sector's energy use by 2020. To further incentivize advanced biofuel use, the amendment allowed MSs to double-count the contribution of advanced biofuels in meeting these binding targets. The EU is on track to meet its overall 20 percent target and will likely meet the binding 10 percent target (using double-counting) for the transport sector. In 2017, the EU as a whole achieved a 17.52 percent share of renewable energy with the transport sector achieving 7.6 percent. The graph below shows the share of renewable energy in the transport sector per MS achieved in 2017 (source: Eurostat, SHARES 2017).



Member States RED Initiatives

Under the RED, each MS is responsible for developing policy and tools to implement the provisions outlined by the RED. As such, the RED required that all MSs transpose RED legislation and targets into national legislation. MSs also had to develop National Renewable Energy Action Plans (NREAPs) by June 30, 2010. These NREAPs provided detailed roadmaps of how each MS expected to reach its legally binding 2020 targets. Every two years, the EC produces an EU-wide report based on the national reports and on other available data to assess progress in meeting RED's targets. The report also gives an overview of renewable energy policy developments in each MS. In April 2019, the EC published its most recent Renewable Energy Progress Report. This report concludes that the EU as a whole achieved a 17.52 percent share of renewable energy in 2017 and the vast majority of EU MSs are well on track to reach their 2020 binding targets for overall renewable energy use. One of the larger MSs lagging behind is the Netherlands which only achieved a share of 6.6 percent renewable energy use in 2017, with a country target of 14 percent in 2020.

The RED and Sustainability Criteria

To qualify for RED and FQD targets, biofuels consumed in the EU must comply with strict sustainability criteria provided in Article 17 of the RED. Rigorous requirements are set by the RED on the minimum level of greenhouse gas (GHG) savings, appropriate land use, and monitoring requirements for any potentially adverse effects. Therefore, to be considered sustainable, biofuels from older operations must achieve GHG savings of at least 50 percent in comparison to fossil fuels. This number rises to 60 percent for operations that have come online after January 1, 2017. Emissions are calculated using using direct LCA only covering cultivation, processing, and transport.

In order to demonstrate compliance with the EU sustainability criteria, biofuels need to be validated by either national verification systems or by one of the 17 voluntary schemes approved by the EC and valid in the EU. Please see below for more information about the voluntary schemes. Environmental sustainability criteria covering biodiverse and high-carbon-stock lands are also laid out in the RED. The biodiversity criteria applies to land that would have been classified as highly biodiverse in January 2008. The criteria state that biofuels may not be made from raw materials obtained from land with high biodiversity value, such as primary forests and other wooded lands, biodiverse grasslands, or areas designated for nature protection purposes. Biofuels can also not be made from raw materials produced on land with high carbon stock such as wetlands, peatlands, or continuously forested areas. Agricultural raw materials produced within the EU, including biofuels, must be produced in accordance with the minimum requirements for good agricultural and environmental conditions that are established in the common rules for direct support schemes under the Common Agricultural Policy (Cross compliance Article 17 § 6 of the RED).

GHG Savings

GHG impact of biofuels, bioliquids and their fossil fuel comparators are calculated using 'default' values outlined in the FDQ and listed in the RED Annex V. The EC Joint Research Center (JRC) defines the GHG emissions savings for various raw materials, and production and supply pathways associated with the cultivation of the biomass, processing, transport, and distribution. Emission savings and carbon emissions resulting from land-use change, adoption of improved agricultural practices, carbon capture and storage, or generation of excess electricity through cogeneration are also included. For fuel production pathways that are not included in Annex V, life cycle analyses (LCAs) must be developed to calculate carbon intensities.

Table 1. Carbon Savings for Biofuels Produced with No Net Carbon Emissions from Land-use Change

CROP	Typical GHG savings	Default GHG Savings
Rape seed biodiesel	45%	38%
Soy bean biodiesel	40%	31%

Sun flower biodiesel	58%	51%
Palm oil biodiesel (Process not specified)	36%	19%
Palm oil biodiesel (process with methane capture at oil mill)	62%	56%
Corn ethanol, Community produced (natural gas as process fuel in combined heat & power plant)	56%	49%
Sugar beet ethanol	61%	52%
Sugar cane ethanol	71%	71%
Waste vegetable or animal oil biodiesel	88%	83%

Source: EU Official Journal, RED 2009/28/EC

When the default values are calculated, the EC applies a "discount factor" from the typical value to ensure that the biofuel pathway is not inflated. For example, the RED's GHG savings default value for soy diesel is 31 percent, which is below the minimum 35 percent GHG threshold defined in the RED sustainability criteria. The default GHG value for soybeans was calculated using a pathway where soybeans were first shipped from Brazil, and then transformed into soy oil and biodiesel in the EU. If the GHG value was calculated for soy-based biodiesel produced in the United States and shipped from the United States then it would have a GHG savings value of 40 percent and be above the 35 percent threshold. However, EC officials have stated they do not wish to have GHG saving numbers for different geographical areas, but prefer to base GHG numbers on specific pathways, such as no-till farming, to allow for easier updates. Amendments to Annex V of the RED (rules for calculating the GHG impacts of biofuels and bioliquids) and Annex IV of the FQD (environmental specifications for market fuels to be used for vehicles equipped with compression ignition engines) were made by Directive (EU) 2015/1513. The adoption of these amendments created alterations to how GHG impacts of biofuels, bioliquids, and their fossil fuel counterparts were calculated.

Voluntary Schemes

One way to ensure that biofuels meet the sustainability and GHG savings requirements of the RED is to have the biofuel certified by a voluntary scheme. Some of the MSs have developed national voluntary systems, while others rely on voluntary schemes adopted by the EC. The EC considers voluntary schemes as its preferred means of obtaining certification, and there have been no negotiations for bilateral agreements with third countries on biofuels certification even though this option was mentioned in the RED. A full listing of the 17 schemes approved by the EC is available on DG Energy's website. On January 30, 2019, the EC announced the recognition of a voluntary scheme developed by the U.S. soy industry demonstrating compliance with the EC's sustainability criteria. Commission Implementing Decision 2019/142 recognizing U.S. Soybean Sustainability Assurance Protocol (SSAP-RED) program entered into force on February 19, 2019 and shall apply until June 30, 2021.

Biomass Sustainability

While the current RED sets clear sustainability criteria guidelines for liquid biofuels, the EC deferred setting mandatory sustainability criteria for pellets and other forms of solid biomass. In the absence of EU-wide binding criteria for solid biomass, several MSs including Belgium, Denmark, and the Netherlands, developed their own rules in response to the growing use of

imported wood pellets, particularly in industrial power plants. All MS sustainability schemes on biomass have to be notified to the EC even though there are no specific EU criteria on sustainability. An EU-wide criteria, discussed below, was introduced in RED II.

The Fuel Quality Directive

The FQD complements the RED and mirrors some of the RED's content such as the sustainability criteria. A key requirement of the FQD is that all fuel suppliers must meet a six percent reduction (from the 2010 baseline) in GHG emissions by 2020 across all fuel categories supplied to the market. This is designed to be consistent with the 10 percent use of biofuels and shift demand towards biofuels with higher GHG savings. In addition, the FQD limits ethanol blends to 10 percent or less when ethanol is used as an oxygenate, and places limits on palm oil and soy oil content of biodiesel. The EC does not plan to extend the six percent GHG reduction target beyond 2020. Instead, the EC addressed the issue of the decarbonization of transport fuels after 2020 in RED II.

The Renewable Energy Directive II (RED II)

The European Union adopted the new RED for the period 2021-2030 (RED II) after two years of debate in June 2018 and the full text was published in the Official journal in December 2018. Directive 2018/2001 will enter into force on January 1, 2021.

RED II Renewables targets

RED II sets an overall binding renewable energy target of at least 32 percent by 2030 with a 14 percent target for the transport sector, with a clause for a possible upwards revision by 2023. Within the 14 percent transport sector target, food-based biofuels are capped at MS' 2020 levels up to one percent higher, but with a maximum cap of seven percent for each MS. If the cap on first generation biofuels in a MS is less than seven percent, the country may reduce the 14 percent transport target by the same amount (for example, a country with a food and feed crop cap of six percent could set a transport target at 13 percent). MSs can also set a lower limit for conventional biofuels than prescribed in RED II.

For advanced biofuels, the RED II introduces two different sets of targets for feedstock listed in Part A of Annex IX and feedstock listed in Part B. Feedstock listed in Part A must be supplied at a minimum of 0.2 percent of transport energy in 2022, one percent in 2025 and increasing to at least 3.5 percent by 2030. Biofuels produced from feedstock listed in Part B will be capped at 1.7 percent in 2030. Advanced biofuels will be double-counted towards both the 3.5 percent target and towards the 14 percent target. The EC will be able to add to feedstocks listed in Part A and B of Annex IX, but cannot remove them.

Table 2. Advanced Biofuel Sources, Part A and Part B of Annex IX in RED II	
Part A	**Part B**
• Algae if cultivated on land in ponds or photobioreactors • Biomass fraction of mixed municipal waste • Biowaste from private households subject to separate collection • Biomass fraction of industrial waste not fit for use in the food or feed chain • Straw • Animal manure and sewage sludge • Palm oil mill effluent and empty palm fruit bunches • Crude glycerin • Bagasse • Grape marcs and wine lees • Nut shells • Husks • Cobs cleaned of kernels of corn • Biomass fraction of wastes and residues from forestry and forest-based industries • Other non-food cellulosic material • Other ligno-cellulosic material except saw logs and veneer logs	• Used cooking oil • Some categories of animal fats

RED II Sustainability Criteria for Biofuels, Biomass and Bioliquids

The RED II introduces EU-wide sustainability criteria for biomass. Notably, RED only had sustainability criteria for liquid biofuels. Biomass sustainability will be assessed at the country level or at the sourcing level, and not at the forest-holding level, as originally proposed by the EC. This move should enable the United States to efficiently demonstrate the sustainability of its wood pellets and continue to export to the EU. MSs will be able to adopt additional sustainability criteria for biomass fuels. The EC has until January 31, 2021 to define implementation guidelines.

With regards to the sustainability criteria for biofuels and bioliquids, most of the criteria are the same as the ones in RED. The EC has until 2021 to specify detailed implementing rules, including adequate standards of reliability, transparency and independent auditing for voluntary schemes for the production of biofuels. RED II also introduces specific criteria for high-risk ILUC biofuels which have been under intense scrutiny during the legislative process.

High-risk ILUC biofuels

One of the more heated debates of RED II surrounded the use of biofuels produced from areas that had undergone recent deforestation or the conversion of grasslands to croplands. These areas are referred to indirect land use change (ILUC) areas. During the negotiations, the European Parliament wanted palm oil biofuel to be phased out in the EU. Hesitations in the European Council and worries of such a proposal being non-WTO compliant pushed the EU institutions to ask the EC to come up with a high-risk ILUC biofuel definition. Any biofuel feedstock that is determined to be "high risk" will be phased out by 2030. In May 2019, the EU published in the Official Journal Delegated Regulation 2019/807 the determination of high risk ILUC biofuels. The EC determines high ILUC-risk feedstock as feedstock for which the share of expansion of the production into land with high carbon stock is higher than 10 percent since 2008 with an annual expansion of more than one percent. Given the calculations of the EC, only palm oil falls under this definition. The delegated act gives the possibility for producers to certify their feedstock as low-risk ILUC. In this case they will need to comply with the general sustainability criteria of RED II as well as be produced through "additionally measures" such as cultivation on unused or abandoned land or cultivation by small holders (less than 2 hectares). The use of high-risk ILUC biofuels will be capped at the 2019 level until 2023 and then phased out by 2030.

RED II GHG Savings

RED II introduces new GHG emission criteria that biofuels used in transport must comply with in order to be counted towards the overall 14 percent target. The EC is allowed to revise and update the default values of GHG emissions when technological developments make it necessary. Economic operators have the option to either use default GHG intensity values provided in RED II or to calculate actual values for their pathway.

Table 3. Greenhouse gas savings thresholds in RED II

Plant operation start date	Transport biofuels	Transport renewable fuels of non-biological origin	Electricity, heating and cooling
Before October 2015	50%	-	-
After October 2015	60%	-	-
After January 2021	65%	70%	70%
After January 2026	65%	70%	80%

The sustainability criteria apply to plants with a total rated thermal input above 20MW for installations producing power, heating, cooling or fuels from solid biomass fuels, and to plants with total rated thermal input capacity equal to or exceeding 2MW for installations using gaseous biomass fuels.

The Common Agricultural Policy (CAP), 2021-2027

The CAP funds agricultural and rural development support throughout the EU and represents a significant portion of the total EU budget today, around 38 percent. At present, EU decision makers are looking back at the current CAP performance to date and considering those results to shape programming for the CAP post-2020. Beyond the questions of program design, policy makers are also considering how various political developments such as Brexit, migration, and security issues, may shrink the available budget for the CAP. On June 1, 2018, the EC published its legislative proposals for CAP 2021-2027. The proposal allows MSs to develop individual Strategic Plans covering the 2021-2027 period, setting out how they intend to meet nine EU-wide economic, environmental and social objectives. The EC wants to strengthen the environmental aspect of the CAP transforming the current "green" payment in a series of environmental obligations for farmers decided by each MS. Moreover, the EC introduced the concept of eco-schemes, an incentive payment scheme for care of the environment and climate. The proposals also cut direct subsidies paid to farmers in most MSs except those in the Baltic countries and other Eastern Member States where subsidy payments actually increased.

Additionally, the proposal allows MSs to allocate a maximum of 10 percent of their direct payments to coupled income support with an additional two percent that can be set aside to support protein crops. The EU has been continuously pushing for an increase in domestic production of plant proteins to reduce dependence on imports. The EU imports more than 75 percent of its animal protein supply.

In November 2018, the EC published a report to encourage the production of plant protein by European farmers. These new policy tools may stimulate oilseed production in the EU and have an effect on biofuels market. For more information about the report, please see the FAS Brussels GAIN Report - *European Union Unveils Its Protein Plan*, dated December 18, 2018. The Agricultural Committee of the European Parliament adopted its position on the EC's proposal in April 2019. However, it is more than likely that following the European elections of May 26, parliamentarians will go back to the drawing board on this plan.

Market Access

Duties

General duty rates for biofuels are listed in Table 4 below. For a historical discussion of how the EU harmonized system (HS) customs codes have changed and influenced trade please see, the EU Biofuels Annual 2017.

Table 4. MFN Duty Rates for Fuels

HS Code	Description	Duty Rate
38260010	FAMAE 96.5-100%	6.5%
38260090	FAMAE below 96.5%	6.5%
271020	B30 and below	3,5%
220710	Undenatured Ethanol	€19.2/hl

220720	Denatured ethanol	€10.2/hl

In December 2017, the EU published a new regulation (2017/2321) changing how the EU calculates anti-dumping duties. The EC then instituted new rules for all AD and anti-subsidy investigations after June 8, 2018. The rules shorten the investigation period for provisional measures to seven months, made changes to "lesser duty rules" that allow the EU to impose higher duties, and expanded the ability to incorporate the cost of compliance with EU social and environmental legislation.

Bioethanol Anti-dumping Duties

In February 2018, the EC initiated a 15-month review of then existing anti-dumping (AD) on U.S. bioethanol, which were set to expire that month. The EC had originally put in place these definitive measures in February 23, 2013 (Regulation 157/2013) on undenatured and denatured ethanol (HS/CN 220710 and 220720) and on the pure ethyl alcohol content of products found in other chapters originating from the United States that can be used as fuel. This measure combined with the already high duties (noted in the above table) effectively constrained U.S. fuel ethanol shipments. Ethanol for uses other than fuel remained exempt from the AD duty. The EU General Court ruled against the duties in 2016, which the EC appealed. For background information on this case development, see the EU Biofuels Annual 2017. On May 15, 2019, the European Union concluded the 15-month investigation and repealed the AD duty on bioethanol imports from the United States (Regulation 2019/765). For more information about the tariffs see the Trade section of the Bioethanol chapter.

Biodiesel Anti-dumping and Countervailing Duties

In 2009, the EU initiated AD and countervailing (CV) duties of up to €409.20 per mt on imports of U.S. biodiesel (HS/CN 382600), renewable diesel, and biodiesel content of petroleum oils containing biodiesel up to 30% by volume (HS/CN 271020) due mainly to the U.S. blenders tax credit of US$1/gallon on biomass-based diesel which covers both biodiesel and renewable diesel (Council Regulation 598/2009 and Council Regulation 599/2009). In July 2014, the EC initiated a 15-month review of the AD duties against U.S. biodiesel. On September 15 2015, the EU extended the duties against U.S. biomass-based diesel an additional five years to September 2020 with Commission Regulation 2015/1519. This combined AD and CV duties continues to effectively curtail U.S. shipments to the EU.

There have been several other recent developments related to AD duties and market defense. On September 19, 2017, the EC removed AD duties on Argentine and Indonesian biodiesel exports, in response to losing a five-year dispute with these countries in the WTO in October 2016, see: WTO final report. The EC had imposed these duties since May 2013. The final duties were imposed in November 2013. The AD duties applied on Argentina were 22-25.7 percent for listed companies and 25.7 percent for all other companies, for Indonesia they ranged from 8.8-20 percent for listed companies and 20.5 percent for all other companies. At the time, Argentina was the top biodiesel supplier to the EU market, with Indonesia following closely behind in second position. These duties effectively curtailed shipments from both countries, and Malaysia emerged as the only major supplier until the duties were lifted. Since the end of the AD duties in

September 2017, Argentina and Indonesia have re-emerged at the major suppliers to the EU (see Trade section of Biodiesel chapter).

However, days after lifting the AD duties on biodiesel from Argentina and Indonesia, the EC announced a Notice of Initiation of anti-subsidy proceedings for Argentina in January 2018. In February 2019, the EC imposed countervailing (CV) duty on Argentinean biofuels with a rate between 25.0 and 33.4 percent depending on the companies (Implementing Regulation 2019/244). The duty is linked to an undertaking offer by the Argentine industry, which aims to prevent prices from falling below a certain floor price. Implementing Decision 2019/245 establishes price and volume limits, not disclosed publicly, for Argentinean biodiesel. It spares producers who agree to a minimum price from the imposition of CV duties. This is in line with Article 18 of the WTO Agreement on subsidies and countervailing measures. The EU industry is concerned with this decision of the EC to accept these undertaking offers and called on the EC to be vigilant when monitoring biodiesel prices. In December 2018, the EC also announced a Notice of Initiation of anti-subsidy proceedings for Indonesia. The result of the investigation is still pending but provisional measures could be put in place in September 2019.

New Free Trade Agreements

The EU is in advanced negotiations for a Free Trade Agreement with Argentina, Brazil, Paraguay and Uruguay (Mercosur), but a major sticking point is market access for ethanol.

III. Gasoline and Diesel Pools

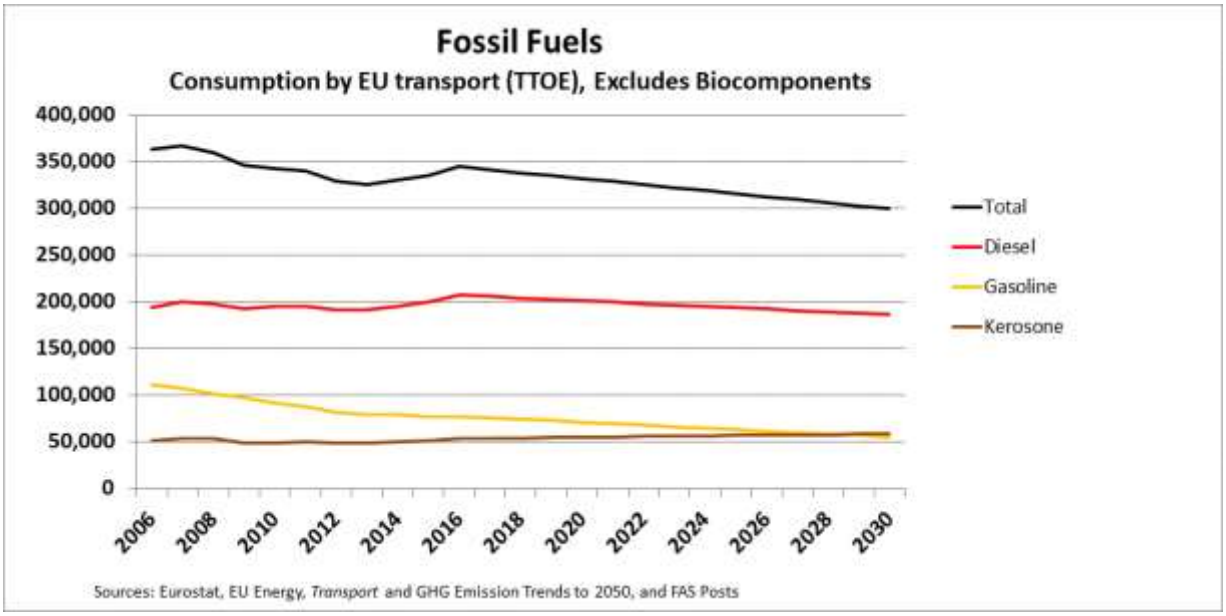
Table 5. Fuel Use (Million liters), Includes Biocomponents

Calendar Year	2012	2013	2014	2015	2016	2017[e]	2018[e]	2019[f]
Gasoline Total	112,247	108,337	108,060	106,095	106,111	104,354	102,474	100,550
Diesel Total	241,715	240,713	241,067	248,440	252,562	257,450	262,500	267,550
On-road	188,969	189,043	194,008	199,143	205,366	210,000	215,000	220,000
Agriculture	11,193	11,281	11,059	11,279	11,575	11,600	11,600	11,600
Constr./mining	3,142	3,326	3,333	3,614	3,698	3,700	3,750	3,800
Shipping/rail	6,052	5,177	4,831	4,964	4,853	4,850	4,850	4,850
Industry	5,611	4,656	4,237	4,703	4,301	4,300	4,300	4,300
Heating	26,748	27,229	23,599	24,736	22,769	23,000	23,000	23,000
Jet Fuel Total	56,066	55,823	56,296	58,280	60,622	61,051	61,481	61,910
Total Fuel	410,029	404,874	405,423	412,815	419,295	422,855	426,455	430,010

Source: Eurostat. Figures of 2017, 2018 and 2019 are Post's estimates.

Based on the current outlook of positive economic growth, the European Commission (EC) projects the transportation sector to continue growing until 2030. While passenger road mileage is forecast to increase, the efficiency of vehicles is also expected to improve. In addition, the demand for electrically chargeable vehicles is forecast to emerge as a more viable option for consumers. Both the increased efficiency and electrification will reduce the size of the ethanol-gasoline pool significantly by 2030. The size of the biodiesel-diesel and renewable

diesel pool is expected to remain relatively stable. Due to limited fuel switching, they continue to be the primary fuels for heavy duty vehicles used on road, in agriculture, construction and mining, and by other heavy industries with improving engine efficiency offsetting increased demand tied to economic growth.



Regarding international shipping, fossil fuels continue to be by far the dominant energy source. Well publicized for more than a decade, air transport is projected to be the highest growing sector of all passenger transport modes due to increased transport activity and despite improvements in efficiency. Commercial and private jet transport has made no progress yet to decarbonize operation through the use of offtake agreements with biofuel suppliers. The very first are just being announced mostly with future implementation dates. For more information see the publication of the EC: EU Energy, Transport and GHG Emission Trends to 2050.

IV. Ethanol

Bioethanol (ethyl alcohol) or simply ethanol is made by fermenting the carbohydrate components of plant materials. The most commonly used feedstocks are grains (corn, other coarse grains, and wheat kernels) and sugarcane. 'Synthetic' ethanol made from petroleum fuels is restricted to a very small market and is not included in this report. Ethanol used as transport fuel is referred to as bioethanol in this report

EU Production, Supply and Demand Table

Table 6. Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)								
Calendar Year	**2012[r]**	**2013[r]**	**2014[r]**	**2015[r]**	**2016[r]**	**2017[e]**	**2018[e]**	**2019[f]**
Beginning Stocks	322	91	256	422	381	239	190	237
Fuel Begin Stocks	284	57	219	384	335	204	157	204
Production	5,348	5,741	5,949	6,080	5,685	6,044	6,115	6,180
Fuel Production	4,658	5,000	5,190	5,165	4,982	5,380	5,443	5,505
-of which cellulosic (a)	0	0	50	50	50	50	10	10
Imports	1,536	1,245	1,068	878	879	888	1,155	1,220
Fuel Imports	886	595	418	228	229	238	505	570
-of which ETBE (b)	188	197	109	107	24	9	7	7
Exports	145	113	113	92	78	91	141	145
Fuel Exports	95	63	63	42	28	41	91	95
Consumption	6,970	6,708	6,738	6,906	6,628	6,890	7,082	7,220
Fuel Consumption	5,676	5,370	5,380	5,399	5,315	5,624	5,810	5,950
Ending Stocks	91	256	422	381	239	190	237	270
Fuel Ending Stocks	57	219	384	335	204	157	204	235
Production Capacity, First Generation								
Number of Refineries	70	71	66	60	55	58	58	58
Capacity	8,468	8,480	8,560	8,430	8,530	8,600	8,660	8,660
Capacity Use (%)	63	68	69	72	66	70	70	71
Production Capacity, Cellulosic Ethanol								
Number of Refineries	0	0	1	1	1	2	2	2
Capacity	0	0	50	50	50	60	60	60
Co-product Production(c) (1,000 MT)								
DDG	2,962	3,223	3,379	3,454	3,415	3,720	3,796	3,830
Corn Oil	136	148	159	150	141	147	144	145
Feedstock Use for Bioethanol (1,000 MT)								
Wheat	3,285	3,200	3,303	3,649	3,799	5,181	5,613	5,665
Corn	4,687	5,092	5,479	5,169	4,850	5,073	4,956	5,000
Barley	400	647	448	429	374	381	428	430
Rye	367	790	821	753	642	524	415	418
Triticale	725	567	745	1,034	1,244	725	716	720
Sugar Beet	10,588	11,694	11,351	10,114	8,573	8,333	7,909	8,145
Cellulosic Biomass	0	0	200	200	200	200	50	50
Market Penetration (Million Liters)								
Fuel Ethanol	5,676	5,370	5,380	5,399	5,315	5,624	5,810	5,950
Gasoline*	112,247	108,337	108,060	106,095	106,111	104,354	102,474	100,550
Blend Rate (%)	5.1	5.0	5.0	5.1	5.0	5.4	5.7	5.9

Sources/Notes: r = revised / e = estimate / f = forecast EU FAS Posts. Original data collected in mt, then converted to liters using a conversion rate of 1 mt = 1,267 liters for bioethanol. Ethanol production: Eurostat statistics, ePure, and FAS Post projections. Production capacity as of December 31 of year stated. Ethanol use: EC, Eurostat statistics and FAS Posts

projections. The ethanol exports and imports for industrial chemicals is estimated at respectively 650 and 50 million liters per year. Trade data: See Notes section. (a) For more information see section Advanced Biofuels. (b) ETBE (HS code 29091910) contains 45 percent ethanol by volume; only the pure ethanol portion is reported. (c) Data is not available; figures represent estimates by EU FAS posts. Calculated co-product production (theoretical maximum) based on estimated feedstock use in fuel ethanol production. *Includes biocomponents.

Consumption

Table 7. Fuel Ethanol Consumption Main Consumers (million liters)								
Calendar Year	**2012[r]**	**2013[r]**	**2014[r]**	**2015[r]**	**2016[r]**	**2017[e]**	**2018[e]**	**2019[f]**
Germany	1,581	1,532	1,557	1,485	1,485	1,465	1,505	1,505
United Kingdom	981	1,038	808	789	757	911	911	925
France	790	778	797	803	823	842	861	880
Spain	395	337	371	375	253	278	320	350
Poland	305	305	311	323	329	329	335	340
Netherlands	244	246	252	278	237	254	278	305
Italy	463	362	267	281	287	230	259	260
Sweden	406	356	327	263	215	205	200	205
Total	5,676	5,370	5,380	5,399	5,315	5,624	5,810	5,950

r = revised / e = estimate / f = forecast EU FAS Posts. Source: EU FAS Posts

During 2013-2016, domestic consumption of bioethanol stabilized at around 5,350 million liters. The stagnating use is a result of high import duties, double-counting waste-stream biodiesels and renewable diesel, adjustments to national blending mandates, and a declining fuel pool. Since 2017, bioethanol consumption picked up and is forecast to increase to 5,950 million liters in 2019. This new trend is a result of the gradual increase of blending targets towards the 2020 mandate, the improved competiveness of bioethanol versus gasoline, and the rising imports from mainly the United States. For more information about the rising mandates see the GAIN report - *Biofuel Mandates in the EU by Member State in 2019*.

Details of the forecast 2019 recovery for bioethanol consumption in the United Kingdom, France, Spain, Poland, the Netherlands, Sweden, Hungary, Romania and Greece:

- In the United Kingdom, consumption increases due to an adjustment of the blending mandate in new biofuels legislation. However, the gradual reduction to the year 2032 for the four percent to two percent cap on crop-based biofuels, even if E10 were introduced, limits increases in ethanol demand compared to biodiesel. In addition, ethanol is unlikely to qualify for as many double-counting certificates.
- In France, consumption increases due to expansion of gas stations selling E10 and E85 combined with a lower price for these fuels compared to alternatives. E85 represents less than one percent of gasoline sales in France but consumption is growing fast because it is cheap. E85 can only be used in FlexFuel vehicles. However, since December 2017 most vehicles can be turned into a FlexFuel vehicle using “DriveCleanBox”. Since 2016, a new fuel called ED95 has been commercialized, containing 95 percent bioethanol and 5 percent additives. It is exclusively consumed by buses and trucks with specific motors.

- In Spain, the 2016 elimination of the bioethanol-specific targets reduced market size. Since 2014, gasoline demand is growing which results in a larger fuel pool. A slight growth in bioethanol consumption is anticipated for 2019 based on the increasing gasoline demand and the larger overall mandate.
- Polish consumption of bioethanol is expected to slightly increase during 2019 as mandates gradually rise, and a limited share is fulfilled through double-counting biodiesels.
- In the Netherlands, consumption increases with higher mandates, but the main share of the combined mandate is filled with double-counting, waste-based biodiesel. In October 2019, fuel distributors are obligated to offer E10 at their stations (at least half of the offered blends must be E10) which supports consumption mainly starting 2020 and later.
- In Sweden, consumption recovers in 2019 after have fallen since 2012. Gasoline sales, including lower ethanol blends, are falling, but E85 is gaining competiveness at the pump due to increasing gasoline prices.
- In Hungary, the Renewable Energy Action Plan aims at achieving ten percent renewable energy content in transport fuels by the end of the decade. The biofuel percentage ratio is set at 4.9 percent until December 31, 2018, then as of January 1, 2019, the ratio rises to 6.4 percent.
- In Romania, consumption rises once the blending mandate nearly doubled in January 2019 from 4.5 percent to 8 percent. In the absence of local production, fuel retailers increased imports to cover the larger demand. However, the import share will change assuming a successful start-up of a second generation cellulosic bioethanol plant in 2020.
- Effective January 1, 2019, Greece mandated producers and distributors of petrol to blend their fuels with one percent of bioethanol. The quota for 2020 will be increased from one to 3.3 percent.

Details on forecast 2019 stagnation or decline in bioethanol consumption in Germany, Italy, Belgium, the Czech Republic and Austria:

- In 2018, German consumption increased by three percent, mostly as a result of higher bioethanol blending while ETBE use was lower. After the rise in 2018, consumption is forecast to stagnate again this year.
- In Italy, consumption stagnates. The cellulosic ethanol plant with a capacity of about 50 million liters, started production in 2013 and has been closed since November 2017.
- In Belgium, the demand for bioethanol increased when the blending mandate was adjusted upwards from 4 to 8.5 percent on January 1, 2017. Based on this mandate, Belgian consumption is forecast to remain relatively stable during 2018–2019.
- In the Czech Republic, consumption stagnates with no change in the volume based mandate which remains 4.1 percent since 2017.
- In Austria, consumption continues to stagnate since 2014.

A surplus of bioethanol will be available this year in Hungary, Belgium, the Netherlands, Spain, Austria, France and the Slovak Republic. Germany, Italy, the United Kingdom, Finland and Romania are expected to remain the main deficit markets in 2018 and 2019.

Production & Production Capacity

After a dip in 2016, EU bioethanol production recovered. This recovery is supported mainly by increased domestic consumption. A limiting factor is the rising prices for corn and wheat, which are deteriorating profit margins. In addition, the domestic ethanol sector will have to compete with expanding imports, mainly from the United States. Despite these limiting factors, EU bioethanol production used as fuel is forecast to increase to about 5.5 billion liters in 2019.

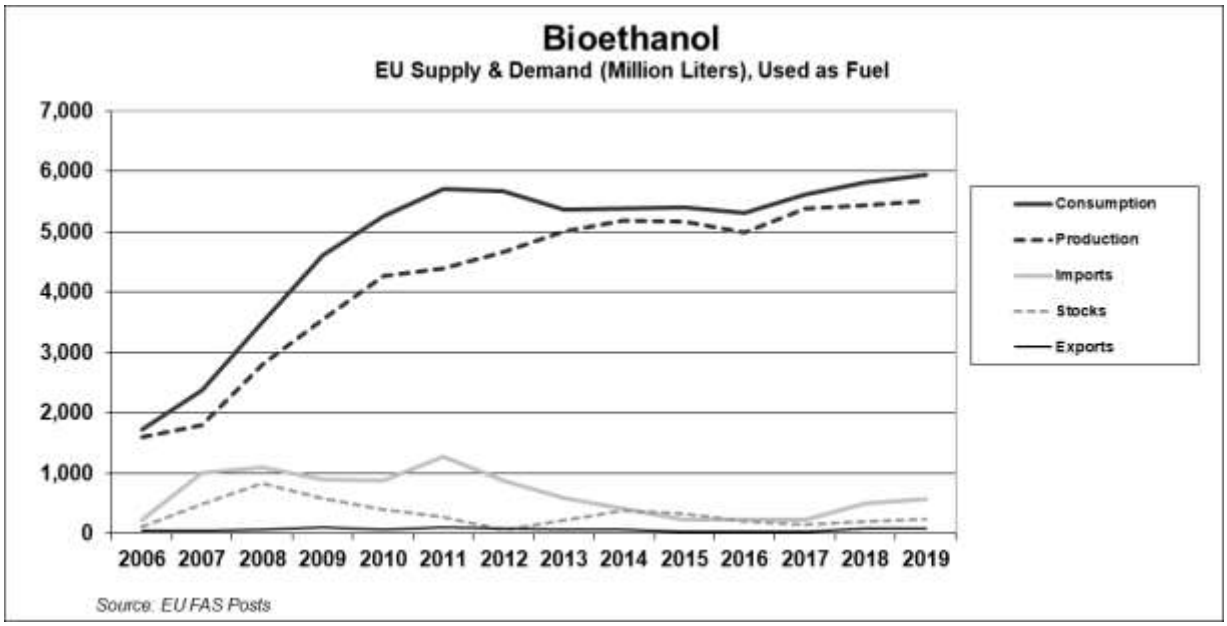


Table 8. Fuel Ethanol Production Main Producers (million liters)								
Calendar Year	**2012[r]**	**2013[r]**	**2014[r]**	**2015[r]**	**2016[r]**	**2017[e]**	**2018[e]**	**2019[f]**
France	829	995	1,018	1,039	987	1,000	1,000	1,000
Germany	776	851	920	937	934	852	776	785
United Kingdom	215	278	329	538	658	684	684	695
Hungary	291	392	456	591	633	633	645	645
Belgium	410	451	557	557	570	620	645	645
Netherlands	451	524	519	563	443	532	563	565
Spain	381	442	454	494	328	377	522	522
Poland	213	235	181	214	241	258	259	265
Austria	216	223	230	223	224	235	235	235
Total	4,658	5,000	5,190	5,165	4,982	5,380	5,443	5,505

r = revised / e = estimate / f = forecast EU FAS Posts. Source: EU FAS Posts

EU Member States that are increasing production in 2019 include Germany, the United Kingdom and Poland:

- In 2018, German bioethanol production decreased by nine percent and amounted to 776 million liter. The German Bioethanol Industry Association attributes the decline to the drought in 2018 which increased feedstock costs substantially. A slight recovery of production is forecast for this year.
- In the United Kingdom production is increasing solely due to the increased use of the existing three plants. The total capacity is estimated at 1,125 million liters. The increase of the blending mandate in the UK's new biofuel legislation was welcome news for UK bioethanol production. However, the gradual reduction of the cap on crop-based biofuels means that waste biodiesel is likely preferred above domestically produced wheat and sugar beet ethanol.
- In Poland, capacity in bioethanol production is below thirty percent. It is anticipated that increasing domestic demand will result in higher use of this capacity. Due to the significant surplus of production capacity further investments in this area are not expected.

Production stabilized and is expected to remain flat this year in France, Hungary, Belgium, the Netherlands, Spain, Austria, Sweden, and the Czech and Slovak Republic.

- In France, the number of plants and production capacity are stable. Bioethanol production is expected to remain at the same level in 2018 and 2019 as it was in 2017. Production may increase if cellulosic ethanol is produced at a commercial scale but this is not expected to happen within the next two years.
- In Hungary, both capacity and production expanded significantly during the past five years. Fuel grade ethanol is produced by two plants each processing about 1.1 million mt (mmt) of corn. Hungarian bioethanol production is fully corn-based. Combined, these plants produce about 645 million liters of fuel ethanol annually. Besides fuel ethanol, these plants produce a wide variety of other products such as isoglucose, dextrose, gluten, starch, corn oil, animal feed and ethanol for pharmaceuticals, food and beverages. About 500 million liters of the fuel ethanol produced in Hungary is exported to other EU Member States. In 2017, a new ethanol plant with a capacity of 530,000 mt of corn was opened. The final phases of the construction will be completed in June 2019. Then, the factory's portfolio will include starch, gluten, ethanol (not fuel grade), and feed products. These investments will increase the country's annual production capacity to about 885 million liter of ethanol by the end of 2019. However, fuel grade ethanol production is expected to remain flat. Investments in second generation bioethanol production are not likely.
- Belgium has three bioethanol plants, two of which are wheat based, while the third one processes imported corn. As the production exceeds Belgian domestic bioethanol consumption by a factor three, much of the bioethanol is exported, mainly to Germany.

Except for continued efforts to increase fermentation efficiency, bioethanol production is fairly stable.

- During 2017 and 2018, production expansion in the Netherlands was caused by the increasing use of existing capacity. The main ethanol plant in the Netherlands is located in the port of Rotterdam, and can switch between feedstocks, such as wheat, corn, barley and sorghum, and produces in total about 1.2 million tons per year. Since 2013, the plant ran mainly on corn, imported from Ukraine. The plant currently runs at full capacity.
- Spanish bioethanol production levels are anticipated to remain fairly stable. A steady recovery in production levels after a production halt in 2016 has resulted in over nominal capacity use since 2018, which is anticipated to be continued in 2019.
- Austria has one single plant that produces bioethanol with a capacity of 245 million liters. In 2017, production totaled at 235 million liters. The major feedstock is wheat and corn.
- In Sweden, bioethanol production is anticipated to remain at a low level in 2019 after a steep reduction in 2018. This drop was a result of high cereal prices. The dry summer in Northern Europe was most evident in Scandinavia, and buoyed cereal and fodder prices. The Swedish wheat harvest reportedly halved in 2018.

Total EU ethanol production capacity, for fuel, industrial and food uses, is estimated at about 9.3 billion liters in 2018. Further expansion of first generation bioethanol is expected to be limited. Expansion of cellulosic bioethanol production is restrained due to the lack of certainty in EU policy (see Policy and Advanced Biofuels Chapter) and high investment costs of commercial production.

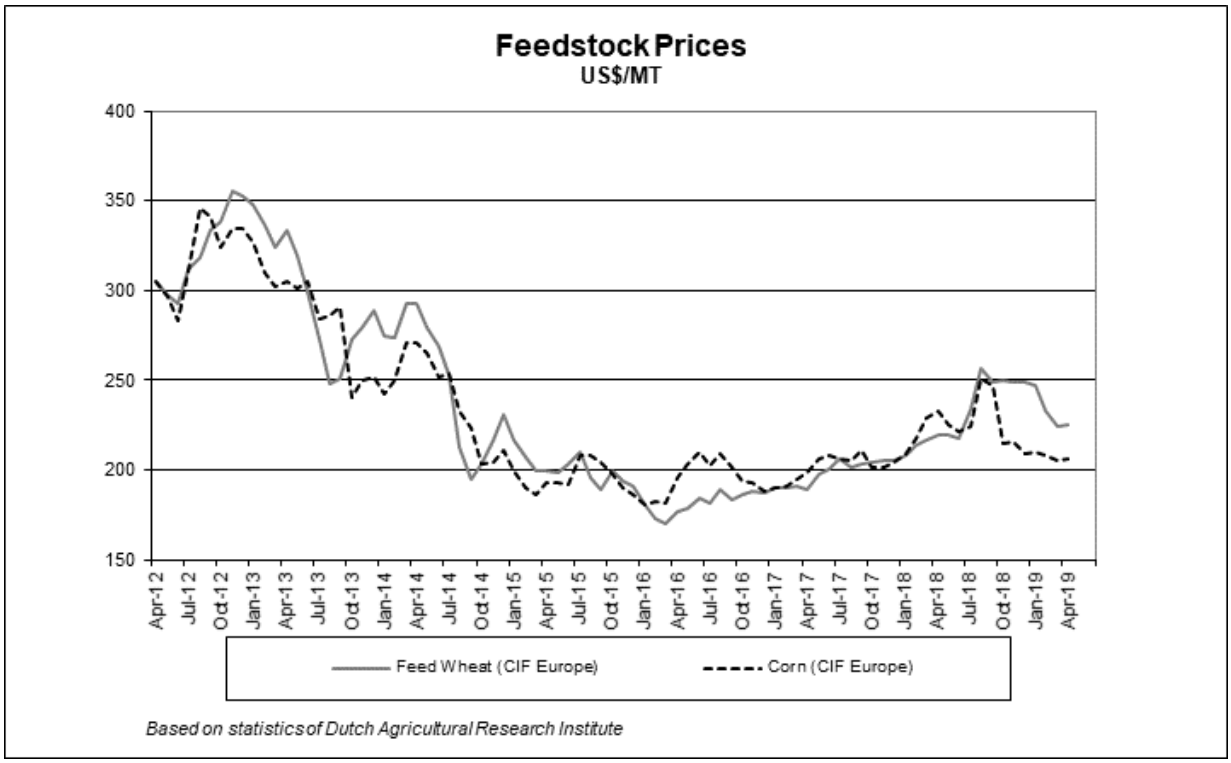
Feedstock Use and Co-products Production

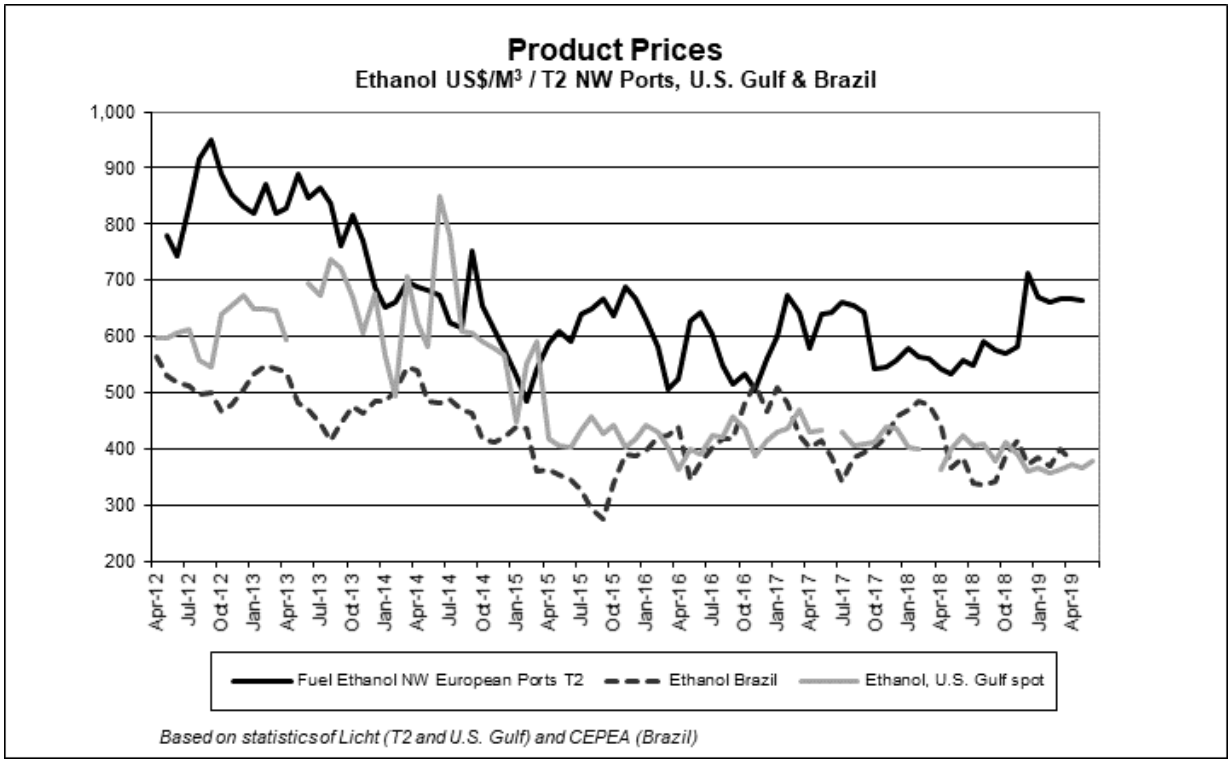
In the EU, conventional bioethanol is produced from grains and sugar beet derivatives. Wheat is mainly used in Germany, France and the United Kingdom, while corn is predominantly used in Central Europe. An abundance of corn on the domestic market benefits production in Central Europe, in particular Hungary. Corn is also the preferred grain in the Netherlands and Spain, where the majority of the ethanol plants are located at sea ports. The corn is predominantly sourced from the Ukraine. This is partly because of its non-genetically modified (non-GM) content, since producers in northwestern Europe prefer to market their distillers dried grains (DDG) as non-GM to the domestic feed market. In 2018, the EU grain harvest was lower than normal due to a dry and hot summer. For more information see the GAIN Report - *EU Grain and Feed Annual*, dated on April 15, 2019. This affected the profitability of the ethanol sector, and in some MSs, such as Germany and Sweden, ethanol production was cut.

In France, Germany, the United Kingdom, the Czech Republic, and Belgium sugar beets and its derivatives are also used for the production of bioethanol. Sugar beets are only processed for bioethanol in a few sugar beet processing plants in France that have on-site ethanol distillation capacity. In some other MSs, like Austria and Belgium, beet pulp may serve as a feedstock for ethanol production. Bioethanol produced from sugar beets faced tough competition from decreasing grain prices (see graph below), and as a result fell during 2013-2017. During 2018

and 2019, beet ethanol production was limited by a low beet harvest in 2018. For more information see the GAIN Report - *EU Sugar Annual*, dated April 23, 2019.

In the EU, the required volume of cereals for 2019 production (5.5 billion liters of bioethanol) is estimated at 12.2 mmt. This is about 6.9 percent of total EU cereal production. Co-products of the bioethanol production are DDG (Distillers Dried Grains), wheat gluten and yeast concentrates. In 2019, the maximum theoretical production of co-products is forecast to reach 3.8 mmt. This is about 2.2 percent of total EU feed grain consumption.

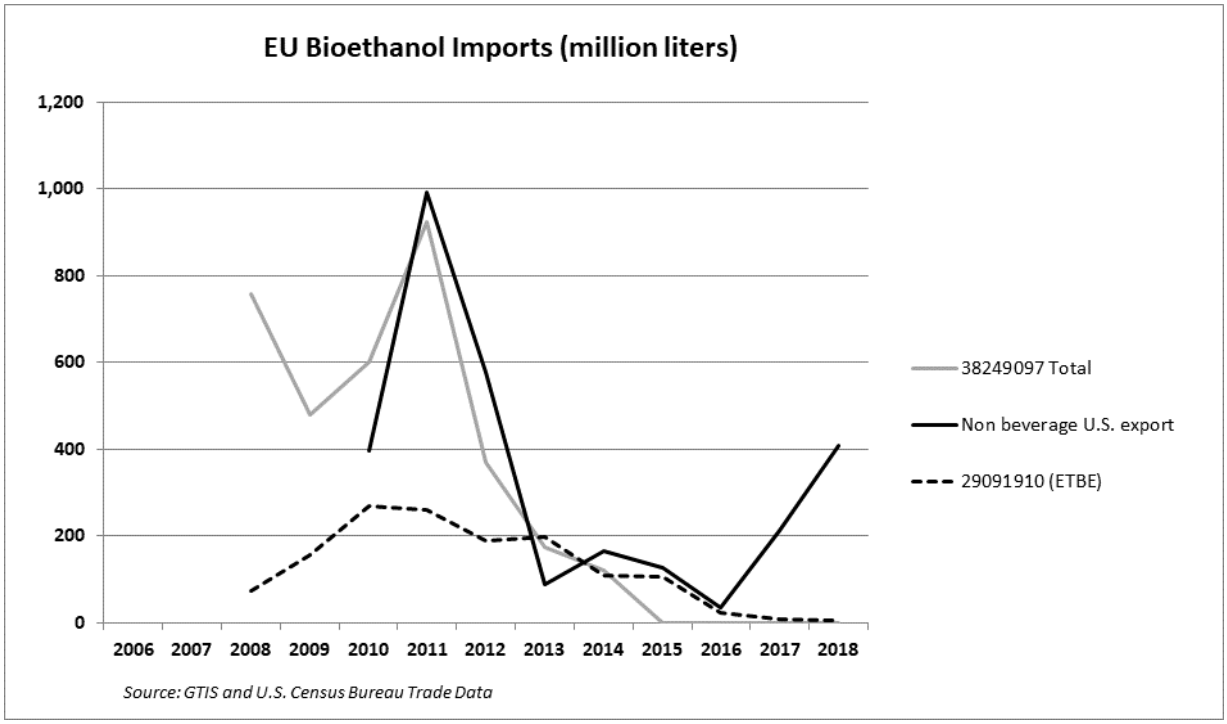




Trade

On February 23, 2013, the EC imposed a definitive anti-dumping duty on ethanol imports from the United States, both pure ethanol classified in HS/CN Chapter 22 as well as the ethanol content of "light" fuels (mostly gasoline) classified in Chapter 27. The duty was set at €62.3 per ton for five years (see the Policy Chapter). Adding to the already high Most Favored Nation (MFN) import tariffs of €102 per 1,000 liters for denatured ethanol and €192 per 1,000 liters for undenatured ethanol, the total duty on 1,000 liters of U.S. denatured and undenatured ethanol rose to €151.2 and €241.2, respectively. These rates significantly suppressed U.S. exports of bioethanol to the EU.

But despite the competitive disadvantage of high duties at the border, 463 million liters of U.S. non-beverage ethanol classified under Chapter 22 was shipped to the EU in 2018, representing a value of $186 million. This is a significant increase compared to only 45 million liters shipped in 2016 when the price spread between ethanol at the U.S. Gulf and imported at Northwestern European ports (T2) narrowed considerably. Since January 2016, this price spread widened to the advantage of U.S. suppliers and has supported larger shipments of denatured and undenatured ethanol. According to some sources the majority was destined for use as fuel in the EU market and not transshipped elsewhere. During 2018, the EU imported about seven million liters of bioethanol as ethyl-tert-butylether (ETBE). In addition, the EU imported an estimated 90 million liters of bioethanol under a zero duty regime, mainly from Pakistan and Guatemala. Combined EU bioethanol imports increased from about 238 million liters in 2017 to 505 million liters in 2018. Any "light oils" that may contain ethanol are not included in the balance or trade estimates, but any arriving in Europe in this form would not appreciably affect the balance.



On May 14, 2019, the EC repealed the anti-dumping duty on bioethanol imports from the United States. With the lifting of this duty, the remaining key limiting factors for the export of U.S. bioethanol to the EU are the high MFN duties that remain unchanged and the sustainability requirements, most importantly the required minimum 50 percent Greenhouse Gas (GHG) emissions savings over fossil fuels and plant certification under an existing scheme. Given the remaining constraints and reasonable expectations for the Gulf-T2 price spread, the near-term impact of dropping the AD duty is not expected to result in more than a modest sales increase remaining far short of the one billion liters sold in 2011.

V. Biodiesel / Renewable Diesel

Unless mentioned otherwise in this chapter, the term biodiesel includes traditional biodiesel (fatty acid methyl ester (FAME)) and hydrotreated vegetable oil (HVO) also referred to as renewable diesel.

The EU is the world's largest biodiesel producer. Biodiesel is also the most important biofuel in the EU and, on an energy basis, represents about 75 percent of the total transport biofuels market. Biodiesel was the first biofuel developed and used in the EU, adopted by the transportation sector in the 1990s. At the time, rapid expansion was driven by increasing crude oil prices, the *Blair House Agreement* and resulting provisions on the production of oilseeds under Common Agricultural Policy (CAP) set-aside programs, and generous tax incentives, mainly in Germany and France. EU biofuels goals set out in Directive 2003/30/EC (indicative goals) and in the RED 2009/28/EC (mandatory goals) further pushed the use of biodiesel.

EU Production, Supply and Demand Table

Table 9. Biodiesel & Renewable Diesel (HVO) (Million Liters)								
Calendar Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019[f]**
Beginning Stocks	575	580	520	565	590	585	640	930
Production	11,382	12,064	14,097	14,449	14,384	15,375	14,442	14,170
>HVO Production	960	1,604	2,311	2,473	2,600	2,743	2,797	3,030
Imports	3,294	1,392	631	540	629	1,097	3,366	3,400
Exports	115	416	181	245	408	397	664	420
Consumption	14,556	13,100	14,502	14,719	14,610	16,020	16,854	17,380
Ending Stocks	580	520	565	590	585	640	930	700
Production Capacity, Biodiesel (Million Liters)								
Number of Biorefineries	264	245	220	201	196	188	188	188
Nameplate Capacity	25,494	25,024	22,634	21,928	21,445	20,289	21,181	21,230
Capacity Use (%)	41	42	52	55	55	62	55	53
Production Capacity, Renewable Diesel (HVO) (Million Liters)								
Number of Biorefineries	4	5	10	11	11	12	12	14
Nameplate Capacity	1,694	1,828	2,831	3,395	3,395	3,395	3,395	5,000
Capacity Use (%)	57	88	82	73	77	81	82	60
Feedstock Use for Biodiesel + Renewable Diesel (HVO) (1,000 MT)								
Rapeseed oil	6,500	5,710	6,200	6,400	6,060	6,300	5,200	5,000
UCO	800	1,150	1,890	2,400	2,620	2,770	2,860	2,750
Palm oil	1,535	2,340	2,240	2,340	2,315	2,650	2,570	2,640
Soybean oil	720	870	840	540	610	930	1,000	1,100
Animal fats	360	420	920	1,030	795	795	800	800
Sunflower oil	300	290	310	210	250	180	185	190
Other,pine/tall oils, fatty acids	220	335	370	560	615	635	680	700
Market Penetration, Biodiesel + Renewable Diesel (HVO) (Million Liters)								
Biodiesel+HVO, on-road use	14,508	13,053	14,461	14,189	14,127	15,600	16,500	17,000
Diesel, on-road use*	188,969	189,043	194,008	199,143	205,366	210,000	215,000	220,000
Blend Rate (%)	7.7	6.9	7.5	7.1	6.9	7.4	7.7	7.7
Diesel, total use	241,715	240,713	241,067	248,440	252,562	257,450	262,500	267,550

Sources/Notes: r = revised / e = estimate / f = forecast EU FAS Posts. Original data collected in mt, then converted to liters using a conversion rate of 1 mt = 1,136 liters for biodiesel; 1,282 liters for HVO; 969.8 liters for diesel. Production capacity as of December 31 of year stated. Diesel use 2009-2016: Eurostat; all other: FAS Posts. Trade data: Global Trade Atlas (GTA); per intel from Neste, EU Customs classify HVO trade under HS/CN 2710 but is mixed with other products at the 10-digit level and therefore difficult to identify. Feedstock use: Data is not available. The figures above represent estimates by EU FAS posts. Beginning/ending stocks: In the absence of reliable data and with the exception of 2009, 2017, and 2018, data for stocks is based on the assumption that average stocks amount to the equivalent of two weeks' supply of consumption. *Includes biocomponents, =2009-2016 Eurostat data in mt converted to liters using a conversion rate of 1 mt = 969.822 liters.

Consumption

Biodiesel (FAME and HVO) consumption is driven almost exclusively by MS mandates and, to a lesser extent, tax incentives. Only when biodiesel is cheaper than fossil diesel will

consumption exceed the mandated volumes. For more information, see the GAIN report - *Biofuel Mandates in the EU by Member State in 2019*. While biodiesel use has continued to expand since 2017, the rate of expansion has been reduced due to the use of biodiesel that counts double against the mandates thus reducing physical volumes used to meet them.

In 2018, France, Germany, Spain, Sweden, and Italy were the largest biodiesel consumers, accounting for 63 percent of the total EU biodiesel consumption (see Table 10). Projections for 2019 indicate that the mandate increases do not change the MS consumption ranking. In 2018, EU biodiesel consumption is estimated to have increased 5 percent as a result of 1) mandate increases in Finland, the Netherlands, Poland, Spain, and the United Kingdom; and 2) recovery of overall diesel use such as in Spain. At the same time, consumption decreased in Italy, Sweden, and the Czech Republic. The reduction in Sweden was the combined effect of 1) the abolition of tax waivers for biodiesel in connection with the introduction of a greenhouse gas (GHG) reduction target for the diesel sector on July 1, 2018; and 2) local legislation that cut the use of palm fatty acid distillates (PFAD)-based biofuel on the grounds of traceability issues.

For 2019, EU biodiesel consumption is expected to increase3 percent as a result of mandate increases in a number of MSs (Croatia, Finland, Hungary, Ireland, Italy, the Netherlands, Poland, Slovakia, and the United Kingdom) and a rebound in the Czech Republic. The highest relative increases are expected in Hungary, the Netherlands, the Czech Republic, Spain, and Ireland with plus 37, 18, 15, 15, and 13 percent, respectively. The largest increases by volume are expected in Spain, the United Kingdom, the Netherlands, the Czech Republic, and Hungary. In Portugal, consumption is expected to decrease following a mandate reduction.

Table 10. EU Biodiesel/HVO Consumption
Main Consumers (Million Liters)

Calendar Year	2011	2012	2013	2014[r]	2015[r]	2016[r]	2017[r]	2018[e]	2019[f]
France	2,624	2,653	2,658	2,931	2,954	2,954	2,954	3,025	3,025
Germany	2,756	2,874	2,581	2,752	2,483	2,498	2,522	2,644	2,600
Spain	1,921	2,563	941	1,036	1,091	1,293	1,546	1,979	2,275
Sweden	289	415	569	805	1,129	1,613	1,772	1,674	1,610
Italy	1,654	1,598	1,447	1,269	1,581	1,132	1,488	1,333	1,360
UK	1,034	493	863	839	736	724	750	1,100	1,200
Poland	1,079	837	843	730	795	909	954	966	970
Belgium	344	354	364	375	436	452	573	572	610
Austria	576	567	575	708	710	641	572	600	600
Finland	137	131	195	469	475	119	385	392	400
Others	1,949	2,072	2,064	2,587	2,329	2,275	2,504	2,697	2,730
Total	14,363	14,556	13,100	14,502	14,719	14,610	16,020	16,854	17,380

r = revised / e = estimate / f = forecast EU FAS Posts. Source: FAS EU Posts based on information collected in mt, then converted to liters using a conversion rate of 1 mt = 1,136 liters for biodiesel and 1,282 liters for HVO.

Production and Production Capacity

As a result of elevated imports and high stocks, EU FAME producers did not benefit from increased domestic consumption in 2018. EU-produced FAME faced strong competition from domestically produced HVO and even more so from cheap FAME imports from Argentina (mostly soybean oil methyl ester, SME) and Indonesia (palm oil methyl ester, PME). For details, see the Policy section further above and the Trade section below. As a result, EU FAME production decreased by 8 percent. The decreases were most pronounced in France, Germany, Italy, and Portugal. In contrast to the general downward trend, Spanish production increased, benefitting from export opportunities to other MSs, such as Italy, France and the Netherlands. HVO production increased less than forecast in last year's report as projected start-ups for new plants in Italy and France were delayed.

For 2019, HVO production is forecast to increase by 8 percent, with the two plants mentioned above entering commercial production. The plant in France started production in April 2019, and the plant in Italy is expected to do so by the end of 2019. FAME production, however, faces pressure from high stocks and continuing high imports and as a result, it is forecast to decrease by 4 percent.

Table 11. EU FAME Main Producers (Million Liters)

Calendar Year	2011	2012[r]	2013[r]	2014[r]	2015[r]	2016[r]	2017[r]	2018[e]	2019[f]
Germany	3,408	3,106	3,307	3,808	3,505	3,542	3,644	3,100	3,000
Spain	787	538	659	1,017	1,103	1,319	1,721	2,000	1,850
France	2,090	2,175	2,170	2,386	2,442	2,215	2,181	1,700	1,650
Netherlands	558	974	790	1,056	795	638	1,116	1,100	1,050
Poland	414	673	736	786	861	985	1,019	1,000	1,000
Italy	704	326	521	452	625	398	599	568	490
Belgium	536	568	568	568	535	521	511	500	490
UK	261	352	640	554	572	496	490	490	490
Portugal	419	356	357	393	416	385	406	376	370
Austria	352	301	247	332	386	349	335	335	330
Other	1,667	1,214	416	134	735	936	610	425	370
Total	**11,037**	**10,422**	**10,410**	**11,486**	**11,976**	**11,784**	**12,632**	**11,650**	**11,140**

Ranked by production in 2019 r = revised / e = estimate / f = forecast. Source: FAS EU Posts based on information in mt and converted to liters using a conversion rate of 1 mt = 1,136 liters.

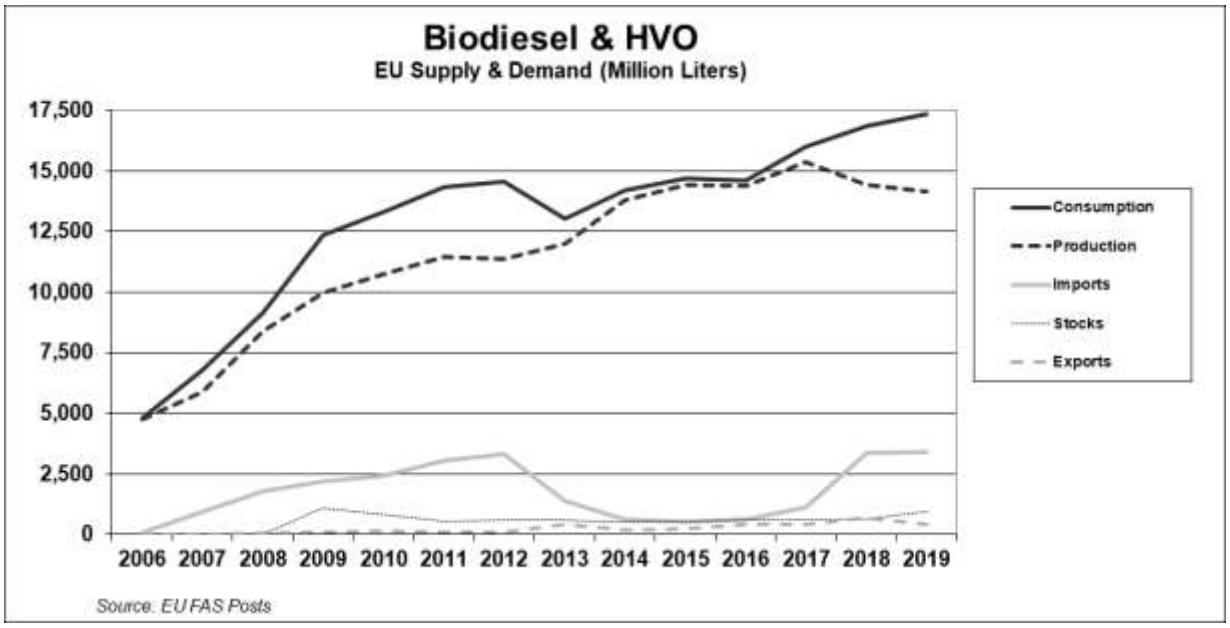
Table 12. EU HVO Production (Million Liters)

Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018[e]	2019[f]
Netherlands	-	410	872	1,013	1,192	1,154	1,218	1,218	1,218
Finland	250	317	392	438	536	545	545	545	545
Spain	28	73	179	377	262	418	465	482	490
Italy	-	-	-	323	323	323	323	323	387
Sweden	160	160	160	160	160	160	160	192	200
France	-	-	-	-	-	-	-	-	128
Portugal	-	-	-	-	-	-	32	37	40

Total	**438**	**960**	**1,604**	**2,311**	**2,473**	**2,600**	**2,743**	**2,797**	**3,010**

Ranked by production in 2019 e = estimate / f = forecast. Source: FAS EU Posts based on information in mt and converted to liters (conversion rate of 1 mt = 1,282 liters).

The structure of the EU biodiesel sector is very diverse. Plant sizes range from an annual capacity of 2.3 million liters owned by a group of farmers to 680 million liters owned by a large multi-national company. Conventional biodiesel (FAME) production facilities exist in every MS with the exception of Finland, Luxembourg, and Malta. In contrast, HVO production is occurs in only six countries (see table above). The majority of HVO capacity consists of dedicated HVO plants, while in Spain and Portugal HVO is co-processed with conventional fuel in oil refineries.



FAME production capacity increased by 4 percent in 2018 due to an expansion in Italy. For 2019, a further marginal increase of 0.2 percent is forecast, due to an increase in Greece. However, numerous plants throughout the EU are being run well below full capacity or are shut down. HVO production capacity remained flat in 2018 as the start of commercial production in new plants in Italy and France was delayed. Both plants are now expected to become operational in 2019 and will take HVO production capacity to 5 million liters, an increase of 47 percent over 2018.

Feedstock Use and Co-products Production

Rapeseed oil is still the dominant biodiesel feedstock in the EU, accounting for 39 percent of total production in 2018. However, its share in the feedstock mix has continuously decreased since its peak in 2008, when it accounted for 72 percent. This is partly due to higher use of recycled vegetable oil/used cooking oil (UCO) and palm oil in Europe. In addition, EU rapeseed oil-based FAME (RME has a hard time competing with cheap imported soybean oil methyl ester (SME) and palm oil methyl ester (PME). For 2019, rapeseed oil use is forecast to take a further

dip due to continued competition from lower cost feedstock and biodiesels as well as because the prohibition on the use of three insecticides of the neonicotinoid class (clothianidin, imidacloprid and thiametoxam) is expected to take a toll on EU rapeseed production.

UCO was the second most important feedstock in 2018, making up 22 percent of total feedstock. The use of UCO received a push after some MSs allowed double-counting (Austria, Belgium, Croatia, France, Hungary, Ireland, the Netherlands, Poland, Portugal, Slovenia, and the United Kingdom) and others introduced a GHG reduction component to their use mandates (Germany, Sweden, and the Czech Republic). Since 2016, increases have become smaller, and for 2019, the use of UCO is forecast to decrease by 4 percent because of lower FAME production. In 2018, the largest EU producers of UCO-methyl ester (UCOME) were the Netherlands, Germany, the United Kingdom, Portugal, and Austria, together accounting for 90 percent of use for this feedstock. Smaller amounts are used in Spain, France, Italy, Ireland, Poland, and Hungary. For 2019, a small decline in UCO use is forecast in line with the lower biodiesel production forecast

Palm oil came in third place in terms of feedstock use in 2018 (19 percent). Its use decreased 3 percent compared to the previous year, mainly because of the availability of cheap PME from Indonesia. Palm oil was mainly used in Spain, Italy, France, and the Netherlands, and to a much lesser extent in Finland, Germany, and Portugal. Negligible amounts are being used in Greece, Romania, and Poland. For 2019, palm oil use is forecast to rebound due to increased HVO production.

The use of soybean and palm oil in conventional biodiesel is limited by the EU biodiesel standard DIN EN 14214. Soybean-based biodiesel does not comply with the iodine value prescribed by this standard (the iodine value functions as a measure for oxidation stability). Palm oil-based conventional biodiesel reportedly does not provide enough winter stability in northern Europe. However, it is possible to meet the standard by using a feedstock mix of rapeseed oil, soybean oil and palm oil. The vast majority of soybean oil is used in Spain, followed by the Netherlands and Germany. Smaller amounts are being used in Italy, France, Belgium, Portugal, Bulgaria, Romania, Austria, and Greece.

Animal fats benefitted far less from double-counting than UCO, as the range of MSs that allow double-counting for animal fat (Denmark, Finland, France, the Netherlands, and the United Kingdom) is smaller than that for UCO. In addition, in Germany, tallow methyl ester (TME) use does not count against the biofuel mandate at all and it is exported to other MSs. Increases of animal fat use are a result of new plants (or capacity increases of existing plants) rather than a function of feedstock prices, as using animal fat requires changes to the technical equipment. In 2018, the Netherlands was by far the largest user of animal fat for biodiesel production, followed by Finland and France. The United Kingdom, Germany, Denmark, Spain, Italy, Austria, Ireland, Portugal, Poland, and Hungary also used animal fats but to a much lower extent.

Sunflower oil only comprised one percent of the total biodiesel feedstock and is mainly used in Greece and Bulgaria, together accounting for 73 percent of EU sunflower oil-based biodiesel production. Small amounts of sunflower oil are being used in Hungary, Lithuania, France,

Romania, and Austria. The category "other" includes tall oil (Finland and Sweden), fatty acids (Finland and Germany), and cottonseed oil (Greece).

Origin of feedstocks and by-products of feedstock generation

While palm oil is imported, a large share of soybean oil is crushed from imported soybeans. In contrast, the majority of rapeseed oil is of domestic origin. The five mmt of rapeseed oil feedstock projected for 2019 is equivalent to about 12.5 mmt of rapeseed. This also generates about 7.5 mmt of rapeseed meal as byproduct, most of which is used for animal feed. Similarly, the one mmt soybean oil will have to be crushed from 5.5 mmt of soybeans. This will generate about 4.4 mmt soybean meal (see also the EU Oilseeds and Products Annual, published April 2, 2019).

Trade

In 2018, the dominant suppliers of biodiesel to the EU were Argentina and Indonesia, with 42 and 27 percent of EU biodiesel imports originating in those countries, respectively. After these two major suppliers, Malaysia and China accounted for most of remaining imports with much smaller volumes coming from Norway, Taiwan, Bosnia & Herzegovina, and India. In 2018, most biodiesel, about 3.3 billion liters, was imported under HS/CN code 3826.00.10 containing at least 96.5 percent biodiesel. The equivalent of 14 million liters was imported as blend under HS/CN code 3826.00.90 (containing between 30 and 96 percent of biodiesel), mostly from Bosnia & Herzegovina. Lastly, 1.7 million liters came in under HS/CN code 2710.20.11 (containing at most 30 percent biodiesel) from Saudi Arabia. It is assumed that most of the product traded under the last HS/CN code is B5. The majority of biodiesel imports occur through the Netherlands and Spain. EU biodiesel exports to destinations outside the bloc are marginal. They normally only amount to around one percent of production and are thus not discussed in this report.

The EU does not currently have a separate customs code for HVO so it cannot be tracked accurately using trade codes. HVO is mixed with other products under a HS/CN Chapter 27, for example 2710.19.43. Speaking with industry trade contacts, it is understood that EU imports of HVO thus far are small to nil. Reportedly, there were some imports from China at the end of 2018 and beginning of 2019. It also appears that EU exports of HVO are relatively very small. According to a U.S. Department of Energy survey, the EU shipped at a little more than 53 million liters of HVO to the United States in 2012, no more than seven and two million liters in 2013 and 2014, respectively, and nothing since then. Canada is the only other market receiving HVO shipments from the EU. Using sources available, it appears those shipments have been somewhat larger and more frequent than shipments to the United States, but it is difficult to estimate the trade flow due to the HS code issue. Due to estimation uncertainty, EU HVO consumption and trade is not separately identified in the Biodiesel/Renewable Diesel Balance (Table 9), but the exclusion of HVO trade data would appear to have little overall impact on the balance if it were added.

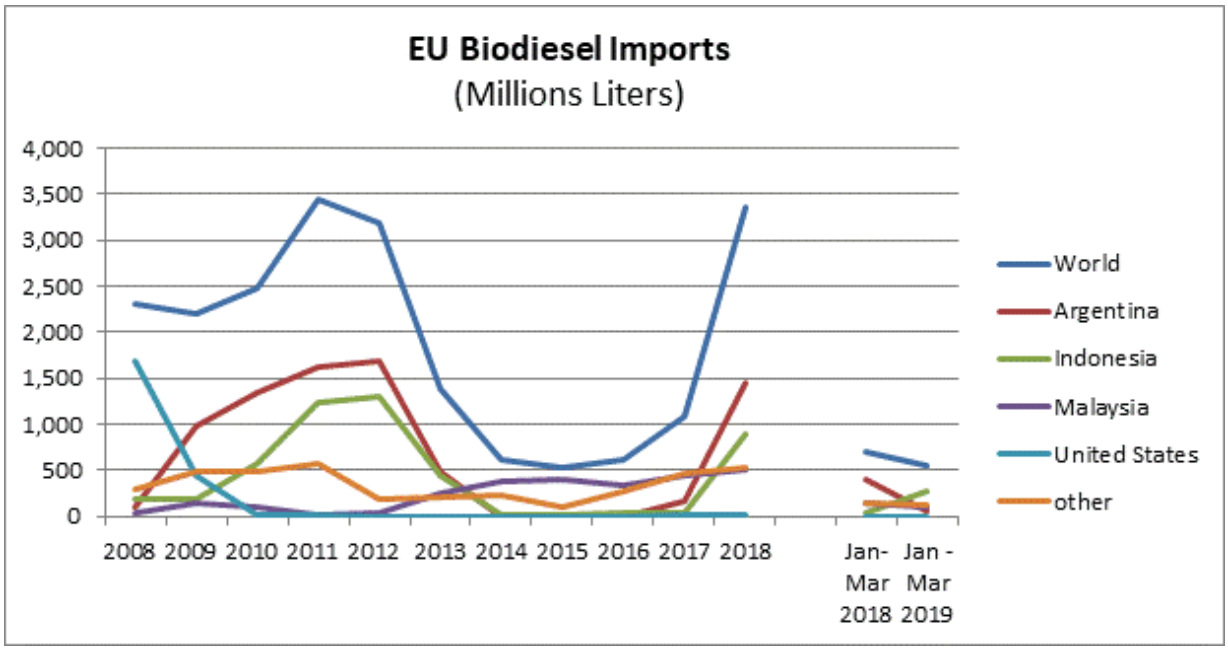
In 2018, EU imports of biodiesel surged three-fold to a record 3.37 billion liters (20 percent of consumption) due to the removal of anti-dumping (AD) duties on biodiesel from Argentina

(September 2017) and Indonesia (March 2018). For more details see the Policy section. In anticipation of the outcome of EU anti-subsidy proceedings against Argentina, which was expected to be announced at the beginning of 2019, European traders and petroleum companies accumulated large stocks at the end of 2018. For 2019, EU biodiesel/HVO imports are forecast to further increase but only slightly (one percent) to 3.4 billion liters with the likelihood of some decline in Argentine shipments are offset by some increase Indonesian shipments. Imports from Malaysia and China are expected to remain largely unchanged at 300-500 million liters each.

EU imports from Indonesia are expected to increase further as low CPO feedstock prices keep Indonesian PME highly price competitive. However, any potential increase is tempered by Indonesia's policy and efforts to extend B20 blending across its entire road transport sector. FAS's 2019 biofuels report from Indonesia clearly indicates that country is achieving some measure of success rolling out nationwide expansion of B20 in transport. This new development is absorbing a large part of its capacity to produce and thus exportable supply in 2019. EU imports from Indonesia were 892 million liters last year.

In response to the countervailing duties that the EU imposed in February 2019, Argentina offered a "price undertaking" (see the Policy section), which provided planning certainty for Argentine exporters and EU importers and is expected to help maintain this trade flow in 2019. However, prices during the first 4 months of 2019 have been low and little business was conducted during this period so the maximum annual quota of 1.52 billion liters may not be reachable. EU imports from Argentina were 1.9 billion liters last year.

The amount of PME used by MS in 2019 will set the upper limit for PME use in the EU for the following four years because the EU will cap the use of high risk ILUC biofuels at the 2019 level until 2023 (see the Policy section). It is uncertain if this might act as an incentive to import more PME than is commercially sensible as this would benefit also competitors without sharing the additional costs.



Stocks

In the absence of reliable data, the data for stocks is based on the assumption that average stocks amount to the equivalent of two weeks' supply of consumption. However, after the lifting of anti-dumping on biodiesel from Argentina and in anticipation of the outcome of EU anti-subsidy proceedings against Argentina, European traders and petroleum companies accumulated large stocks at the end of 2018. These are expected to be reduced throughout 2019 and by the end of the year should have fallen to the assumed average level.

VI. Advanced Biofuels

The Renewable Energy Directive (RED) establishes an overall policy for the production and promotion of energy using advanced biofuels in the EU. Since biofuels replace fossil fuels in the transportation sector and generally have lower greenhouse gas (GHG) emissions, they are considered an important component of the bio-economy. Under the EU's use of terminology, advanced or second generation biofuels – the latter using advanced technology platforms – must use non-food based waste streams, receive additional incentives through double-counting, and are allocated specific consumption targets under the RED and RED II. Because renewable diesel, with hydrotreated vegetable oil or animal fats (HVO) being the first commercialized at scale, can fully replace fossil diesel in engines it is considered an advanced biofuel in this report and thus covered in this section, but are not necessarily produced from non-food feedstock. As for Sustainable Aviation Fuel (SAF) or biojet fuel, also biomass-based and discussed in this section, there are several types which have been extensively tested and certified for use in commercial and military jets. Some can be produced from food-based feedstock as well.

The Second Renewable Energy Directive (REDII) and Advanced Biofuels

The European Commission (EC), European Council and European Parliament presented a proposal for REDII on November 30, 2016, December 18, 2017, and January 17, 2018 respectively. The proposals for RED II are listed in the table below with "conventional" defined as food-based and "advanced" defined as non-food based.

Table 13. Proposals for biofuel blending targets in the RED II – Usage as a Percentage of Total Energy Use in Transportation

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Maximum Conventional										
-Commission	7.0%	6.7%	6.4%	6.1%	5.8%	5.4%	5.0%	4.6%	4.2%	3.8%
-Council	7.0%									
-Parliament	2017 actuals or 2.0%									

Minimum Advanced Part A										
-Commission	0.5%	0.7%	0.9%	1.1%	1.3%	1.8%	2.2%	2.7%	3.1%	3.6%
-Council					1.0%	1.4%	1.8%	2.2%	2.6%	3.0%
-Parliament	0.5%	0.7%	0.9%	1.1%	1.3%	1.8%	2.2%	2.7%	3.1%	3.6%
Maximum Advanced Part B										
-Commission	1.7%									
-Council	No maximum, Double-Counting									
-Parliament	1.7%									

Note the targets include multipliers for electric transport, aviation, marine and rail (for more information see the Policy Chapter).

On June 14, 2018, the EC, EU Council and Parliament negotiators forged a political agreement on the new RED. The agreed RED II will adopted the seven percent cap for conventional biofuels put forward in the Council Proposal, and set a climbing target for advanced biofuels produced from agricultural and forestry by-products (Part A of Annex IX) of 0.2 percent in 2022 to 3.5 percent in 2030. These targets are set later and lower than proposed by the EC and EU Parliament, but impose a steep path up towards 2030. RED II sets a limit of 1.7 percent for biofuels produced with waste fats and oils (Part B of Annex IX) but MSs can modify this limit if justified by taking into account the availability of the feedstock. The EC is able to add feedstocks listed in Part A and B of Annex IX, but cannot remove them. In Part A, Annex IX of RED II, agricultural and forestry feedstocks listed are: palm oil mill effluent, tall oil, bagasse, grape residues, nut shells, husks, corn cobs, straw, forest residues and biomass sourced from forests except saw logs and veneer. Part B of Annex IX lists: used cooking oil (UCO) and animal fats not suitable for feeding. For more information about the policy related to advanced biofuels see the Policy section of this report.

Specific MSs mandates are important for the further commercialization of advanced biofuels. The following countries have implemented national mandates:

- In January 2016, Denmark approved a specific target for advanced biofuels, namely a 0.9 percent blending mandate by 2020 for use in transportation. The mandate excludes used cooking oil (UCO) and animal fats.
- An Italian Decree in December 2017 requires gasoline and diesel to contain at least 0.1 percent of advanced biofuels made of waste and non-food feedstocks as of January 2018, rising to 0.2 percent in 2019, and one percent in 2020.
- In 2018, the Netherlands introduced an obligation for advanced biofuels respectively of 0.6, 0.8 and 1.0 percent. The advanced biofuels must be produced from waste, not including used cooking oil and animal fats.
- In February 2019, Finland approved a law that mandates an advanced biofuel share of two percent in 2023, increasing to ten percent in 2030.
- Mandates for advanced biofuels will also go into effect in the United Kingdom and the Slovak Republic in 2019 and in Bulgaria and Germany in 2020.

For more information on applicable mandates please refer to the GAIN report - *Biofuel Mandates in the EU by Member State in 2019*.

Programs Targeting Advanced Biofuels and Other Biobased Products

With the goal to support the commercialization of advanced biofuels and a bio-based economy in general, the EC developed the following programs:

-On February 13, 2012, the EC adopted a strategy entitled "Innovating for Sustainable Growth: a Bioeconomy for Europe". The main goal of the strategy is to reduce the EU's dependency on fossil resources; for more information see the Bioeconomy website of the EC. One of the policy areas under the strategy is supporting biorefinery operations, including the production of biofuels. The EC funds biorefinery research and commercialization by the Horizon 2020 program.

-In July 2014, the Bio-Based Industries Joint Undertaking (BBI-JU) was launched. The BBI-JU is a €3.7 billion public-private partnership between the EC and the Bio-Based Industries Consortium. The fund is a summation of €975 million of EU funds (Horizon 2020) and €2.7 billion of private investments. The goal of the program is to convert biomass into common consumer products through innovative technologies by biorefineries. On April 4, 2019, the BBI-JU launched its sixth call for proposals, in a total of seven calls for the period between 2017-2020, with a total budget of €135 million.

Example of projects funded by BBI-JU are as follows.

On September 1, 2016, a consortium of fourteen companies announced the start of a demonstration project for the conversion of woody biomass into value-adding chemical building blocks. The project is called Bioforever and has the mission to take the last technical hurdle before the construction of commercial-scale biorefineries in logistical hubs such as the port of Rotterdam and other European ports. The demonstration project started in September 2016 and will run for three years. The overall budget is €16.2 million with a €9.9 million contribution from the EC.

A second example of an activity funded by the BBI-JU is the LIGNOFLAG project. The project aims to build and operate a commercial flagship production plant for biochemical lignocellulose conversion to cellulosic ethanol with a yearly production capacity of up to 75 million liters. The companies are located in Germany, Hungary and Austria. The project started in June 2017 and will run for 5 years. The overall budget is €35.0 million with a €24.7 million contribution from the EC.

Another example is the project OPTISOCHEM in which companies are cooperating to produce cellulosic bio-isobutene from straw. The bio-isobutene can be used as renewable feedstock to produce a wide range of chemicals such as biofuels, adhesives and flavors. The project is conducted in a pilot plant in France and in Germany. The project started in June 2017 and was granted €9.8 million by the BBI-JU as part of the EU's R&D Horizon 2020 program.

Production of Advanced Biofuels

Since 2012, the production of hydrotreated vegetable oils (HVO) has taken off in the EU. HVO can be produced from any vegetable oil or animal fat and can be fully substituted for petroleum fuels, such as kerosene or diesel. HVO plants use a wide range of feedstocks such as virgin vegetable oils, animal fats, fish, oil, and used cooking oil as well as oils produced as by-products of various industrial processes such as tall oil (a residue of wood pulp and the paper industry), technical corn oil (oil taken from DDGs, the co-product of grain ethanol plants), palm oil effluent, and palm fatty acid distillate. In 2018, HVO production is estimated at 2.8 billion liters, and is expected to increase slightly to 3.0 billion liters in 2019. But with new plants in France and Italy, production is forecast to surge in 2020 and 2021 to respectively 3.5 and 4.5 billion liters. These plants also have plans to produce HEFA+ (Hydroprocessed Esters and Fatty Acids), and sustainable aviation fuel.

The commercialization of cellulosic ethanol is lagging behind compared to the development of HVO. The main factors that prevent operators from investing in cellulosic biofuels are high research and production costs and regulatory uncertainty. The current capacity is about 60 million liters in the EU. But production has been halted in Spain and Italy (see section Cellulosic Ethanol). Expansion of capacity has been announced in Finland (100 million liters in 2021), Slovakia (65 million liters in 2020), Romania (65 million liters in 2020) and outside the EU, in Norway (70 million liters in 2021). It is anticipated that the EU capacity for cellulosic ethanol production could possibly increase to about 240 million liters in 2020. But the actual production is not expected to be more than 50 million liters.

Below is a table showing the operational or close to operational advanced biofuel plants at commercial scale in the EU.

Table 14. Advanced Biofuels Plants in the EU

Country	Process	Biofuel	Main Feedstock	*Capacity* (million liters per year)	Year of opening
Thermochemical					
Finland	H	HVO	Oils and fats	430 (2 lines)	2007
The Netherlands	P/FT	Methanol	Biogas	250	2010
Spain	H	HVO	Palm Oil	945 (7 plants)	2011
The Netherlands	H	HVO	Oils and fats	1,280	2011
Italy	H	HVO	Palm Oil	465 (715 in 2021)	2014
Finland	H	HVO	Tall Oil	115	2015
Sweden	H	HVO	Tall Oil	220	2015
Portugal	H	HVO	Palm Oil	40	2017
France	H	HVO	Oils and fats (50 percent palm oil)	640	2019
Italy	H	HVO	Palm Oil, oils and fats	960	2019
Biochemical					

Italy *(closed)*	HL/F	Ethanol	Wheat straw	75	2013
Finland	HL/F	Ethanol	Saw dust	10	2017

Source: EU FAS Posts BtL=Biomass to Liquid, DME=Dimethyl Ether, F=fermentation, FT=Fischer Tropsch synthesis, G=gasification, H=hydrotreating, HVO=Hydrotreated Vegetable Oils, HL=hydrolysis, OS=oxygenate synthesis, P=pyrolysis

Hydrotreated Vegetable Oil (HVO) and Pyrolysis Oil (Biocrude)

Finland and the Netherlands: Neste Oil has developed a process of hydrotreating to produce hydrotreated vegetable oils (HVO). The product is sold as drop-in fuel for road and air transport. In addition to drop-in biofuels, the Neste plants produce renewable naphtha, propane and alkanes. In Finland, Neste operates one plant with two lines of about 215 million liters each which began operations in 2007 and 2009. In 2010, Neste Oil opened up a renewable diesel plant in Singapore with an annual capacity of 910 million liters and a similar scale plant in Rotterdam in 2011. Current annual production capacity of the plant in Rotterdam is a maximum of 1,280 million liters. In 2018, 83 percent of the feedstock used by the three Neste plants consisted of waste fats and oils (76 percent in 2017). The waste and residues consist of used cooking oil (UCO), palm fatty acid distillate (PFAD), animal fats and technical corn oil.

Spain: Two companies, CEPSA and REPSOL have been producing HVO since 2011 and 2013 respectively. In 2018, Spanish HVO production increased to 482 million liters from 465 million liters in 2017. For more information see the GAIN report - *Spain's Biodiesel and Renewable Diesel Overview*, dated June 27, 2017.

Italy: In 2014, an HVO plant was opened by Eni in Venice, Italy. Since then, the plant has been able to produce approximately 325 million liters per year. Production is forecast to increase to 540 million liters in 2021 as a result of upgrades. The feedstock, currently palm oil, will include an increasing proportion of used oils, animal fats, and by-products from palm oil production. Following the model adopted specifically for Venice, Eni is converting the Gela refinery in Sicily into a renewable diesel production facility to produce 770 million liters per year. The reconversion started in April 2016 and the facility is likely to be operational by the end of 2019.

Finland: In 2015, the forest product company UPM opened an HVO plant in Lappeenranta. The capacity of the plant is about 115 million liters per year. The feedstock used is tall oil. The company is studying the possibility of opening another plant in Kotka with an expected capacity of about 550 million liters. The targeted feedstocks are mainly forest by-products, such as saw dust and branches. The plant will be able to supply biofuels to the road, marine and aviation transport sector. Another Finnish company, St1 plans to produce HVO in Gothenburg, Sweden, starting from 2021. The capacity is planned at about 125 million liters. The Finnish company Green Fuel Nordic Oy partnered with the Dutch company BTG to produce 20 million liter of pyrolysis oil as from 2020.

Sweden: In Gothenburg, the company Preem produces about 160 million liters of HVO. The feedstock used is mainly tall oil. The company recently expanded their production capacity to 220 million liters, and is reportedly planning to further expand to 1.3 billion liters in 2023. The company is currently investigating the use and sourcing of other raw materials to be able to expand production. Preem also intends to produce SAF in 2022, up to 300 million liter per year. Another potential project is planned by St1 and the forest product company SCA. They

are planning to build a HVO plant with a capacity of about 250 million liters, which is expected to be operational by 2021. One of the raw materials which will be used is biocrude oil made from tall oil. The company SunPine is planning to increase its biocrude tall oil production from about 100 million liters to 150 million liters in 2020. The Swedish company Setra is planning to produce about 30 million liter of pyrolysis oil from saw dust. The construction of the plant is scheduled to begin in 2019. The crude bio-oils of SunPine and Setra will be further refined to renewable diesel.

France: Commercial production of HVO has not yet taken off in France but several projects have been announced. In 2019, France is expected to produce 100 to 200 million liters of HVO in the new Total plant located in La Mede (southern France). The plant was put into operation in spring 2019. This plant has a maximum capacity of 640 million liters per year and feedstocks are expected to be 60 to 75 percent vegetable oils, mainly palm oil, and 25 to 40 percent waste oil such as frying oils and animal fats. French environmental activists and farm unions are opposed to this project, and as a result the percentage of vegetable oil is likely to be lower. As part of an agreement with the government in May 2018, Total has pledged to process no more than 300,000 tons of palm oil per year, less than 50% of the total volume of raw materials needed, and at least 50,000 tons of French-grown rapeseed. Current biodiesel producers have expressed concern that this project would lead to an overcapacity situation in the French biodiesel sector and to a drop in rapeseed production in France. Another project in France is the BioTFuel project, a cooperation of Avril, Axens, CEA, IFPEN, ThyssenKrupp and Total. This project aims at producing 230 million liters of advanced biodiesel and SAF fuel per year from one mmt of biomass by 2020. The demonstration-scale plant is located at Total's former Flandres refinery in Dunkerque.

Portugal: Since 2017 the company GALP has been producing HVO in their facilities in Sines. Production capacity is estimated at 40 million liters. For more information see the GAIN Report - *Portugal Biofuel Market Outlook*, dated July 3, 2017.

Biomethanol

The Netherlands: The advanced biofuel plant BioMCN, which started production in 2010 has a capacity of 250 million liters and produces bio-methanol from biogas. Biomethanol can be used as a platform chemical to produce other chemicals such as lactic acid and formaldehyde. It can also be used as transport fuel and blended with biofuels, diesel and gasoline or used for the production of bio-methyl tertiary butyl ether (bio-MTBE), bio-dimethyl ether (bio-DME). On April 11, 2017, BioMCN announced they would begin using CO_2, a byproduct of biogas production, to produce an additional volume of 19 million liters of biomethanol. In 2017, BioMCN produced 75 million liters of bio-methanol. BioMCN also produces bio-methanol in the United States which is shipped to the Netherlands and used as renewable fuel.

The Netherlands: A consortium of Enerkem, Shell, Air Liquide, Nouryon and the port of Rotterdam is planning to build a municipal solid waste to biomethanol plant in Rotterdam. The facility is expected to convert 360,000 mt of non-recyclable waste into 270 million liters of biomethanol. A final investment decision will be made in 2019.

Cellulosic Ethanol

Spain: With the sale of all Abengoa's non-core assets in 2016, the bioenergy plant in Salamanca no longer produces advanced biofuels. This was a demonstration plant completed in 2008 with an annual capacity of 5 million liters and adapted to process municipal solid waste in 2013.

Italy: In November 2017, the Beta Renewables cellulosic ethanol plant in Crescentino, Piedmont shut down. Beta Renewables was a joint venture between Biochemtex, a company of the Italian Mossi Ghisolfi Group and the U.S. fund Texas Pacific Group (TPG). Operational since 2013, the Crescentino plant had an annual production capacity of 50 million liters using 200,000 mt of biomass. The feedstock consisted of wheat straw, rice straw and husks, and Arundo donax, an energy crop grown on marginal land. On November 1, 2018, Eni's chemical subsidiary Versalis acquired the Mossi Ghisolfi Group's green portfolio. This take-over includes assets and resources related to development activities, industrialization, licensing of biochemical and biomass technologies and processes of the four companies Biochemtex, Beta Renewables, Ipb (Italian bio products) and Ipb energia. Versalis is currently in the process of defining an action plan to restart the activities of the Crescentino bioethanol plant, the connected biomass-run power plant and research center.

Finland: A cellulosic ethanol plant with an annual capacity of 10 million liters started operation in 2018. There are plans to expand production to about 50 million liters. The feedstock is saw dust. This Cellunolix® project is managed by St1 Biofuels Oy in cooperation with North European Bio Tech Oy. Another plant with a capacity of 50 million liters is scheduled to be operational in 2020. This plant will use saw dust and recycled wood as feedstock and will be located at UPM's Alholma industrial area.

Norway (outside the EU): The company Borregaard operates a plant with an annual capacity of 20 million liters. A paper mill is planned to be converted in a Cellunolix® ethanol plant in Follum, Norway. The plant will have a capacity of 50 million liters, will use forest residues as feedstock and is forecast to be operational in 2021.

More biorefinery projects have been announced for the conversion of woody biomass into cellulosic ethanol. Projects are being planned for plants in Slovakia and Romania. Both plants will have a capacity of about 65 million liters and each will use about 250,000 mt of cereal straw. The plants are anticipated to start production in 2020. Other projects focus on the conversion of sugars and lignin into high value products. An example is the cooperation of the U.S. technology provider Sweetwater Energy and the Estonian wood pellet producer Graanul to integrate their technology into existing and new plants in the Baltic States. Another project is the cooperation of the Dutch companies Avantium and Akzo Nobel to build a demonstration biorefinery in the port of Delfzijl in the Netherlands. For more information about biorefineries see the GAIN report - *Case Studies for a Biorefinery*, dated May 8, 2018.

Sustainable Aviation Fuel (SAF) and Renewable Marine Diesel

The EC forecasts the consumption of SAF will increase steadily by 2050 due to the increase in transport activity and despite improvements in efficiency. Fossil fuels remain the only fuels

used in this sector, and only after 2035 is SAF forecast to slowly start penetrating the aviation fuel mix. For more information see the publication of the EC: EU Energy, Transport and GHG Emission Trends to 2050.

In 2011, the EC, Airbus, and the aviation and biofuel producers industries, launched the European Advanced Biofuels Flightpath. This action was scheduled to achieve two million tons, about 2.5 billion liters, of sustainable biofuels used in the EU civil aviation sector by the year 2020. In 2018, the organization determined that the progress has been insufficient to achieve the two million tons target in 2020. Two main barriers for the introduction of SAF is the investment needed to expand the production to a commercial scale, and cost of the biofuel compared to fossil jet fuels. Other reasons include the lack of harmonization of EU Member State policies and the evolving political developments regarding the sustainability requirements for biofuels. As a result, the EC launched the Biofuels FlightPath to take into account recent evolutions and to tackle the current barriers identified for the production and marketing of SAF.

Currently limited volumes of SAF are produced and consumed. Global production is estimated at 15 million liters in 2018 (source: International Energy Agency). In 2018, the Finnish company Neste produced about 5 million liters of SAF. The Commercial Aviation Alternative Fuels Initiative (CAAFI) reports that commercial offtake agreements at U.S. airports (mostly at LAX) started in 2016 with 4.2 million liters that year, were 5.8 million liters in 2017, and were 4.4 million liters in 2018. In the EU, reportedly only Copenhagen Airport has a regular biofuel distribution facility for airplanes. A part of EU consumption is currently covered by imports from the United States. The company SkyNRG is planning to produce SAF in Delfzijl, a seaport in the Northern part of the Netherlands. The plant will use waste fats and oils and will have a capacity of about 125 million liters. The company reportedly has an offtake agreement to deliver 93 million liters of SAF per year to KLM over ten years with deliveries scheduled to start in 2022.

Another potential for biofuels is the marine fuel market. A recent development is the cooperation between the Finnish company Wärtsilä and the Dutch biofuel distributor GoodFuels to supply marine biofuels to the ships in the port of Rotterdam. The ship owner is aiming to use a diesel blend consisting of 30 percent biofuels and a blend of up to 100 percent biofuels in the near future.

VII. Biomass for Heat and Power

The EU market for biomass used in heat and power covers household use and industrial production. In the EU, nearly half of the renewable energy is generated from the combustion of solid biomass, not including municipal waste. The biomass is sourced from the agricultural and related food processing sector, and the forestry sector. Wood chips and pellets are increasingly used as input for renewable heat and power production. Because wood pellets rather than chips are generally traded over longer distances, this chapter is restricted to the wood pellet market.

EU Production, Supply and Demand Table

Table 15. Wood Pellets (1,000 MT)									
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018[c]**	**2019[c]**
Beg. Stocks	696	713	642	506	948	1,270	1,797	1,444	1,129
Production[a]	9,470	10,652	12,200	13,100	14,100	14,400	15,300	16,850	18,100
Imports[b]	3,115	4,367	6,096	6,547	7,163	8,095	8,692	10,355	12,200
Exports[b]	68	90	132	105	141	118	195	170	170
Consumption[b]	12,500	15,000	18,300	19,100	20,800	21,850	24,150	27,350	30,000
Ending Stocks	713	642	506	948	1,270	1,797	1,444	1,129	1,259
Production Capacity									
No. of Plants[a]		497	516			637	656		
Capacity[a]	15,000[c]	15,980	17,000[c]	18,500[c]	20,500	21,950	22,750	24,000	25,000
Cap. Use (%)	63	67	72	71	69	66	67	70	72

Source: (a) The European Biomass Association (AEBIOM), (b) GTIS, (c) FAS Post Estimates

The EU is the world's largest wood pellet market, with a consumption of about 27.4 mmt in 2018. Based on the EC mandates and MS incentives, demand is expected to expand further to about 30 mmt in 2019. Future consumption will significantly depend on a range of market factors and MS incentives and conditions.

Consumption

While the EU produces almost 50 percent of world production, EU demand represents about 75 percent of global demand. In 2017, 40 percent of total EU consumption was used for residential heating, 33 percent for commercial power, 14 percent for commercial heating and 12 percent for combined heat and power (Source: AEBIOM). The major users of wood pellets in the EU are the United Kingdom, Italy, Denmark, Germany, Sweden, France, Belgium and Austria.

Table 16. Main Pellet Consumers (1,000 MT)							
Calendar Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018[e]**
United Kingdom	1,400	3,700	4,900	6,700	7,300	7,400	8,000
Italy	2,200	2,500	3,400	3,300	3,200	3,450	3,750
Denmark	2,100	2,400	2,450	2,500	2,570	3,260	3,500
Germany	1,700	2,080	1,840	1,760	2,000	2,100	2,190
Sweden	1,700	1,860	1,650	1,650	1,605	1,530	1,785
France	550	740	900	950	1,200	1,450	1,500
Belgium	1,700	1,500	1,200	1,600	1,345	1,375	1,375
Austria	790	880	815	850	895	960	950
Spain	250	380	425	450	475	475	600
Netherlands	1,250	1,200	500	120	190	350	400
Poland	390	500	490	350	300	343	350
Total	**15,000**	**18,300**	**19,100**	**20,800**	**21,850**	**24,150**	**27,350**

Source: AEBIOM and Member State sector organisations, e = estimate EU FAS Posts

Residential Use of Pellets

Residential use for heating, about 40 percent of the total pellet market, fluctuates annually but is relatively stable compared to industrial heat and power generation. The demand depends on winter temperatures and fossil fuel prices, although medium-sized pellets for energy generation by industries or public buildings such as hospitals and swimming pools is generally less dependent on weather conditions.

In Italy, Germany, France and Austria pellets are mainly used in small-scale private residential and medium-sized industrial boilers for heating. In some EU Member States, such as Sweden, Germany, Austria, France, Spain and the Czech Republic household heating with biomass as input receives subsidies or tax deductions by the federal and local governments. In most countries, however, government funding is limited.

- Italy is the largest European market for the household use of pellets. According to the National Renewable Energy Action Plan statement, the use of pellets will increase further to 5 mmt in 2020 from about 3.8 mmt in 2018 (see Table 16). However, only 15 percent of the demand is met by domestic production, with the remaining 85 percent being covered by increasing imports. Bagged pellets represents almost the total market. The pellets are mainly distributed through retail shops, hardware stores and fossil fuel suppliers. Currently, Italy sources pellets mainly from Austria, Germany, and Croatia. Imports from the United States fell from 180,000 mt in 2014 to 40,840 mt in 2017, due to the higher price of U.S. wood pellets over European competitors. In 2018, imports from the United States recovered to 87,525 mt. Market logistics and economics indicate that in the future imports from North America are likely to expand further.
- The vast majority of wood pellets in Germany are used for heating, because the government does not financially support the use of wood for electricity generation. In 2018, the number of wood pellet based heating system units in Germany is estimated at 464,000 of which only 11,500 have a capacity exceeding 50 kW. German law mandates that all buildings erected in or after 2009 have to use a certain share of renewable energy to satisfy their heating and cooling requirements. Wood pellets are one of the options. The replacement of heating systems with wood pellet ovens is subsidized.
- Around 70 percent of total French consumption of wood pellets is used in individual residential heating systems. A minor use of wood pellets is collective residential heating. Based on incentive policies such a carbon tax, use of residential pellets is forecast to further increase.
- In Austria, wood pellets are mainly and increasingly used in household heating and receive subsidies by the federal government, the state governments and the communities. Use of pellets in industrial heating systems is also increasing.
- According to data by the Spanish pellet sector organization AVEBIOM, Spain's consumption of pellets reached 600,000 mt in 2018. Wood pellets are consumed for residential use and to a lesser extent, industrial applications. In addition to wood, the use of olive kernels or tree nut shells, is a very popular alternative in those areas where it is available.

- In the Czech Republic the use of wood pellets is relatively small but growing rapidly from 65,000 mt in 2015 to about 100,000 mt in 2018. The number of pellet heaters is still relatively low. The situation might change soon because there is a subsidy program aimed at eliminating the old heaters with high emissions. Citizens who decide to buy a new pellet heater can apply for a "heater subsidy" that can cover up to 85 percent of the price of the new heater.
- Another relatively small market with growth potential is Greece. The current pellet market is estimated at 40,000 mt. Production is forecast to increase based on the demand from the domestic market. Recently, 37 licenses were granted for producing 295 MW from biomass.

Industrial Use of Pellets

In markets such as the United Kingdom, Belgium, and the Netherlands residential use is negligible and the demand for wood pellets is dominated by large scale power plants. The governments of these countries opted to fulfill their obligations for renewable energy use in 2020 mainly by the use of biomass for the generation of electricity. As these countries lack a sufficient domestic production of pellets they are largely dependent on imports.

- The conversion of large electricity plants to fire biomass instead of coal is a key factor in the UK Government's plans to reach renewable energy targets. The main support mechanism within the UK's energy policy that has enabled the conversions is under the Levy Control Framework and called 'Contracts for Difference'. This involves the government paying a premium above the market price of the electricity generated by the biomass power plant. The largest user of pellets in the United Kingdom recently converted a fourth unit of their plant from coal to biomass combustion. Each of these four units combusts 2.3 mmt of wood pellets per year. The second largest user was scheduled to start their operations in May 2018, but this plant is not operational yet. At full capacity the power generation of this plant will utilize about 1.4 mmt of pellets. Another company is schedule to start using pellets early 2020. The expected maximum use of this plant is about 1.0 mmt. It should be noted that for power generation, these three plants use wood pellets as their main feedstock but other biomass such as elephant grass and willow also may be used. For 2019, the total use of pellets in the United Kingdom is forecast at 8.5 mmt.
- Sweden and Denmark set high targets for renewable energy use in 2020, 49 and 30 percent respectively. Both goals have already been reached, with a major part obtained from biomass. In 2018, Swedish pellet consumption picked up from a low level in 2016 and 2017. Pellet consumption increased despite rising prices for pellets. Danish consumption of pellets has increased significantly. Because the power sector is phasing out coal, several combined heat and power (CHP) plants have been converted to using pellets. A large portion of the pellets is imported. Danish pellet imports jumped from 2.0 mmt in 2016 to 3.8 mmt in 2018. The pellets were mainly sourced from the Baltic Region (1.7 mmt), but also from the United States (0.6 mmt) and Russia (0.4 mmt).

Other sources of imports that have significantly increased in the past year include Portugal, Germany and Canada. In 2019, Denmark will further replace its coal use by biomass, mainly in the form of chips. Finland has a target of 38 percent for renewable energy use in 2020. A large share is covered by the use of wood chips, but only a limited portion is wood pellets.

- Also in France, there is a potential for industrial use of pellets. The development of renewable energy power is supported by two complementary systems: feed-in tariffs and tenders. In 2016, imports of pellets from the United States were high because of a single new biomass plant. However, the objective of this plant is to use 100 percent of local pellets in 2019, and as a result, imports from the United States fell in 2017 and 2018. Local wood is favored in subsidized facilities.
- Current Belgian industrial use is estimated at about 1.3 mmt per year. Of this, some 1.2 mmt is used for electricity production to the grid, while small private units are operated in the agricultural and other industry sectors for heating purposes.
- In the Dutch Energy Accord co-firing of biomass is capped annually at about 3.5 mmt of wood pellets. In the Accord it was furthermore decided that biomass will be subject to specific sustainability criteria (for more information see *Pellet Sustainability Criteria*). During 2019, one Dutch power plant is expected to scale up, while another is forecast to start by the end of the year. Because of the resumption of co-firing, the import of wood pellets is forecast to increase to about 1.0 mmt in 2019. Important for the realization of this expansion is dependent upon the approval of the certification programs, which demonstrate sustainability. Besides co-firing projects, other biomass projects, which use solely biomass, have received funding from the Dutch Government. They include the use of a wide variety of woody biomass types such as wood chips and pellets but also non-woody biomass types. With the further upscaling of the co-firing and opening of other biomass heat and/or power plants, companies will have to source more biomass from abroad, likely in the form of pellets. For more information see the GAIN Report - *The Dutch Industrial Market for Biomass*, dated February 5, 2019.
- Besides Western Europe, in Central Europe the use of biomass for power generation is also growing. In Hungary, many previously coal-fired power and heating plants began to use renewable energy sources instead of fossil fuels. The feedstock includes a wide variety of agricultural and forestry biomass types, mostly sourced locally. This is supported by subsidies for electricity production with biomass utilization. At the same time, Hungary's National Renewable Energy Action Plan prefers more efficient and smaller heating centers that are close to biomass sources and can meet the local energy or heating demand.

Besides wood pellets, large quantities of wood chips and briquettes are used in the EU. The EU sector estimates the current EU consumption of wood chips at 15-20 mmt and expects it to grow to 28 mmt in 2020. Growth in demand is supported by increased investments in medium sized combined heat and power (CHP) plants. The main wood chips consuming EU MSs are: Germany, Finland, France, Sweden and Poland.

Production

Table 17. Main Pellet Producers (1,000 MT)							
Calendar Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018[e]**
Germany	2,200	2,250	2,100	2,000	1,950	2,250	2,415
Latvia	980	1,100	1,380	1,500	1,570	1,465	1,575
Sweden	1,340	1,310	1,490	1,550	1,665	1,680	1,845
France	680	750	1,040	950	1,150	1,300	1,450
Austria	893	962	945	1,000	1,070	1,180	1,300
Estonia	500	590	1,000	900	1,195	1,060	1,100
Poland	600	600	610	850	900	950	1,100
Spain	250	300	410	475	550	529	685
Portugal	700	800	700	700	500	500	850
Total	**10,652**	**12,200**	**13,100**	**14,100**	**14,400**	**15,300**	**16,850**

Source: IEA, AEBIOM and Member State sector organisations, e = estimate EU FAS Posts.

With a production of about 16.9 mmt in 2018, about fifty percent of global production, the EU is the world's biggest producer of wood pellets. Compared to production plants in North America, plants in the EU are mainly small or medium-sized. Most of the main pellet producing countries have a sizeable domestic market for residential heating pellets. Recent demand for pellets has supported a further increase in domestic production. Exceptions in Table 17 are Latvia, Estonia and Portugal, which are producing mainly for export for use in large scale power plants abroad.

- Germany is the third largest wood pellet producer in the world after the United States and Canada. It has currently about seventy production facilities for wood pellets with a total annual production capacity of 3.8 million mt. In 2018, production amounted to 2.4 million mt, 95 percent of which were produced from residues of the timber industry. The vast majority of the wood pellets produced in Germany are used for heating. The use for electricity production is negligible. Germany is a net-exporter of wood pellets. The vast majority of trade occurs with neighboring EU member states and Switzerland. Italy is the main market.
- Wood pellet production has expanded rapidly in the Baltic Region (Latvia, Estonia and Lithuania) during the past five years. During 2017 and 2018, Baltic production was hampered due to warm weather conditions. This is reflected in exports stagnating at about 3.2 mmt in 2018. The Baltics are producing both for the residential and industrial markets. The main markets are Denmark, the United Kingdom, Italy and Sweden.
- The third largest producer in the EU is Sweden, which has been self-sufficient since 2016. Based on the dry summer last year, a lower production of pellets was projected for 2018, but actually pellet production increased for the fifth successive year. The production numbers are based on statistics of the Swedish Pellet Association PelletsForbundet.
- There are around 60 pellet producers in France. In 2017, French production increased due to expanding domestic demand. It is expected to have increased in 2018, and anticipated to further increase in 2019.

- In 2018, Austria produced 1.3 mmt of wood pellets in 42 plants. This is ten percent more than in the previous year. For the exception of 2012 and 2014, pellet production is on a steadily rising trend. Austria is a net-exporter of wood pellets but domestic demand is also expanding. In 2018, Austria exported 781,000 MT of wood pellets of which 692,000 mt to Italy.
- Since 2014, Poland has steadily increased production and exports. The main export markets are Italy, Germany and Denmark.
- Based on information from the Spanish pellet sector organization AVEBIOM, pellet production reached 685,000 mt in 2018. According to AVEBIOM there were 83 pellet plants in Spain with an annual production capacity of nearly two million mt in 2018. About 60 pellet plants are located in shared facilities with sawmills or carpenter's workshops and 25 plants process olive kernels. Spain has traditionally being a net exporter of wood pellets. In 2018, exports reached 110,000 mt. Main destinations for Spain wood pellets include Italy, the United Kingdom, France and Denmark.
- Portugal has 3.3 million hectares of forest land that covers over 35 percent of the country's territory. The large majority of Portugal's forest land is in private hands.

According to the sector organization ANPEB, there are 25 pellet production units in Portugal. Reportedly, on average annual production is 850,000 mt of pellets and capacity is about 1 million mt. During 2016 and 2017, pellet production was negatively affected by forest fires. The majority of the pellet production is exported to EU Member States. The main markets are the United Kingdom, Denmark, Spain and Germany.

- Czech production increased from about 150,000 mt in 2010 to about 400,000 mt in 2018. About 80 percent of the production is exported with Austria and Italy as the main markets.

The major raw material for pellets has traditionally been sawdust and byproducts from sawmills. With increasing competition for sawdust resources, broader sustainable raw materials are becoming necessary. There is increased interest in forest residues, wood waste and agricultural residues, but even the volume of these additional feedstocks will not be sufficient for supplying the full demand in Western Europe. Overall, EU wood pellet production is not expected to be able to keep up with the demand from both the residential heating market and for power generation.

Trade

Table 18. Main EU Importers of Wood Pellets (1,000 MT)

	Total Imports[a]		Imports from U.S.	
Calendar Year	**2017**	**2018**	**2017**	**2018**
United Kingdom	6,833	7,829	4,266	4,880
Denmark	3,089	3,813	307	623
Italy	1,802	2,242	41	88
Belgium	1,077	1,137	578	538
Germany	432	389	1	2

Sweden	269	380	0	0
Austria	403	360	0	0
Slovenia	216	293	0	0
Netherlands	328	291	1	7
France	265	275	10	0
Total EU28	**-**	**-**	**5,205**	**6,139**

Source: GTIS (HS Code: 440131) (a) Includes EU intra-trade.

Due to their location at seaports and limited domestic production, the large power utilities in the United Kingdom and Belgium are sourcing over 75 percent of their pellet demand from non-EU suppliers. Despite their significant domestic production, the Scandinavian countries, mainly Denmark and Sweden, partly depend on imports from the Baltic Region and Russia. The port restrictions in Scandinavia are favoring the Baltic Sea supply, which generally ship with smaller vessels than used in the Atlantic trade. In Denmark, one plant is located at a deep seaport and is supplied from North America. Improved flexibility in infrastructure is expected to further increase sourcing from North America. The pellet markets in Germany, Austria and to a lesser extent France and Italy are more isolated and depend mostly on local production.

Table 19. Main Suppliers of Wood Pellets to EU (1,000 MT)

Calendar Year	2013	2014	2015	2016	2017	2018
United States	2,776	3,890	4,278	4,902	5,205	6,139
Canada	1,963	1,259	1,475	1,685	1,478	1,762
Russia	702	826	786	834	1,269	1,365
Ukraine	165	136	149	165	214	380
Belarus	116	122	158	145	212	262
Brazil	0	4	23	33	103	177
Other	374	310	294	331	211	270
Total	**6,096**	**6,547**	**7,163**	**8,095**	**8,692**	**10,355**

Source: GTIS (HS Code: 44013020 and 440131 as from 2012)

EU demand for pellets has significantly outpaced domestic production for the past ten years. This has resulted in increased imports from the United States. In 2018, U.S. exports to the EU totaled 6.1 mmt, representing a value of $1,160 million. If EU demand and trade flows remain consistent with current patterns, the United States has the potential to supply 65 percent of the import demand, which would represent a trade value of potentially US$1.6 billion in 2020. Other significant exporters of pellets to the EU are Canada and Russia. In response to the EU demand for industrial pellets, capacity has expanded in the supplying regions. These third country imports could, however, be affected by the implementation of sustainability requirements from the individual EU Member State governments.

Pellet Sustainability Criteria

A key factor to being able to capture the demand in the EU market and benefit from its growth potential is the sustainability of the supply. European traders and end-users of industrial wood pellets are calling for clear, consistent, harmonized and long term government regulations. In

the absence of EU-wide binding criteria for solid biomass, several EU Member States including Belgium, Denmark, and the Netherlands, developed their own rules in response to the growing use of imported wood pellets.

In the RED II, sustainability of biomass production will be assessed at the sourcing level, and not at the forest-holding level, as originally proposed by the EC. EU MSs may place additional sustainability requirements for biomass fuels. By December 31, 2026 the EC shall assess the impact that such additional criteria may have on the internal market to ensure harmonization of sustainability criteria for biomass fuels (for more information see the Policy Chapter of this report).

Meanwhile, the industry is actively formulating their own criteria. For *non-industrial wood pellets*, the European Pellet Council (EPC) developed sustainability criteria called ENplus, based on EN 14961-2. It includes sustainability requirements for the entire supply chain. For *industrial pellets*, the Sustainable Biomass Partnership (SBP) developed a sustainability scheme based on existing programs, such as the Forest Stewardship Council (FSC) or Program for the Endorsement of Forest Certification (PEFC). The SBP made their program compliant with the current requirements in the United Kingdom, Denmark, Belgium and the Netherlands.

In the Netherlands, the Dutch Energy Accord of September 2013 adopted strict sustainability criteria for biomass, such as forest level certification, information on greenhouse gas (GHG) emissions, carbon debt and indirect land use changes (ILUC). These strict conditions make it difficult for Dutch buyers to implement long term contracts with pellet producers. For more information see the GAIN Report – *Current Opportunities for Wood Pellets in The Netherlands*, dated May 14, 2018.

VIII. Notes on Statistical Data

Bioethanol

Production capacity, production and consumption figures are based on statistics from the European Commission, Eurostat, the European Renewable Ethanol Association (ePURE) and FAS Posts. FAS Posts based their estimates on figures from national industry organizations and government sources. Ethyl tert-butyl ether (ETBE) is not included in ethanol production, but is included in the consumption figures. ETBE is predominantly consumed in France, Spain, the Netherlands and Poland.

Bioethanol import figures are based on Global Trade Atlas (GTA) data, which are sourced from EU MS customs data, and the U.S. Bureau of Census. As the EU has no Harmonized System (HS) code for bioethanol, trade numbers are difficult to assess. The estimation of EU import figures is based on EU imports through preferential trade agreements under HS 2207, EU imports from Brazil under HS code 3824.90.97, U.S. fuel ethanol exports to the EU under HS 2207, and EU imports of HS code 29091910 (ETBE, 45 percent ethanol).

It should be noted that the latest official Eurostat fuel statistics are for 2016. In addition, the EC forecast of a lower gasoline and diesel consumption during 2016-2030 differs from the official International Energy Agency Statistics (IEA) which suggests an increase during 2016-2019. Based on IEA statistics the blending rates calculated in this report for 2016-2018 are overestimated by a maximum of 0.12 percent (absolute terms).

Feedstock and co-product figures: Official data for feedstock use is scarcely made available by industry and government sources. The figures in this report represent FAS Posts estimates and are based on the conversion and yield rates listed in Appendix II.

Biodiesel

Production and consumption figures are based on statistics from Eurostat and MS official statistics and adjusted by EU FAS Posts using additional information obtained from national industry organizations and government sources.

Trade figures are based on Global Trade Atlas (GTA) data, which are sourced from EU MS customs data, and the U.S. Bureau of Census, and adjusted for U.S. exports of biodiesel blends. A specific customs code for pure biodiesel (B100) and biodiesel blends down to B96.5 (HS 3824.90.91) was first introduced in the EU in January 2008. In January 2012 the code was changed to HS 3826.00.10 for blends containing at least 96.5 percent biodiesel, HS code 3826.00.90 (containing between 30 and 96 percent of biodiesel), and HS 2710.20.11 for blends containing at most 30 percent biodiesel. In this report it is assumed that these codes represent a blend of 99, 95, and 5 percent, respectively.

The U.S. Bureau of the Census introduced HTS export code 3824.90.40.30 in January 2011 which exclusively covers pure biodiesel (B100) and biodiesel blends above B30.

Feedstock and co-product figures: Data for feedstock use is not available. The figures in this report represent estimates by EU FAS posts and based on the conversion and yield rates listed in Appendix II.

Appendix I – Abbreviations

Biodiesel = Fatty acid methyl ester produced from agricultural feedstock (vegetable oils, animal fat, recycled cooking oils) used as transport fuel to substitute for petroleum diesel
Bioethanol = Ethanol produced from agricultural feedstock used as transport fuel
BtL = Biomass to Liquid
Bxxx = Blend of mineral diesel and biodiesel with the number indicating the percentage of biodiesel in the blend, e.g. B100 equals 100% biodiesel, while B5 equals 5% biodiesel and 95% conventional diesel.
CEN = European Committee for Standardization (Comité Européen de Normalisation)
DDG = distillers dried grains
EBB = European Biodiesel Board

EC = European Commission
Exxx = Blend of mineral gasoline and bioethanol with the number indicating the percentage of bioethanol in the blend, e.g. E10 equals 10% bioethanol and 90% conventional gasoline.
FAME = fatty acid methyl ester
GHG = greenhouse gas
GJ = Gigajoule = 1,000,000,000 Joule or 1 million KJ
Ha = Hectares, 1 hectare = 2.471 acres
HS = Harmonized System of tariff codes
HVO = Hydrotreated Vegetable Oil
KTOE = 1000 MT of oil equivalent = 41,868 GJ = 11.63 GWh
MJ = Megajoule
Mmt = Million metric tons
MS = Member State(s) of the EU
Mt = Metric ton (1,000 kg)
Mtoe = Million tons of oil equivalent
MW = Mega Watt = 1,000 Kilo Watt (KW)
MWh = Mega Watt hours= 1,000 Kilo Watt hours (KWh)
MY = Marketing Year
Nordics = Denmark, Sweden, Finland, Norway and Iceland
PME = palm oil based methyl ester biodiesel
PVO = Pure vegetable oil used as transport fuel
RED = EU Renewable Energy Directive 2009/28
RME = Rapeseed Methyl Ester
SME = Soybean Methyl Ester
TME = Tallow Methyl Ester, biodiesel made from animal fat
Toe = Tons of oil equivalent = 41,868 MJ = 11.63 MWh
UCO = Used cooking oil/recycled vegetable oil
UCOME = UCO-based methyl ester biodiesel
US$ = U.S. Dollar

Appendix II - Energy Content and Conversion Rates

1 mt Gasoline = 1,342 Liters = 1.03 toe
1 mt BtL = 1,316 Liters = 0.80 toe
1 mt of HVO = 1,282 Liters = 1.00 toe
1 mt Ethanol = 1,267 Liters = 0.64 toe
1 mt Diesel = 1,195 Liters = 1.02 toe
1 mt Biodiesel = 1,136 Liters = 0.90 toe
1 mt Pure veg Oil = 1,087 Liters = 0.83 toe

Yields Ethanol
Corn kernels: 1 mt = 402 to 417 liters (has risen since 2006)
Wheat kernels: 1 mt = 393 liters
Rye/Barley kernels: 1 mt = 241 liters
Sugar beets: 1 mt = 95 liters

Yields Biodiesel
Soybean oil, crude: 1 mt = 1,113 liters
Soybean oil, 1x refined: 1 mt = 1,128 liters
Crude palm oil (CPO): 1 mt = 1,087 liters
Animal fats/grease: 1 mt = 1,043 liters
Used cooking oil (UCO): 1 mt = 1,043 liters

Yields Ethanol Co-products (maximum theoretical yield)
Corn kernels: 1 mt = 313 kg of DDGs + up to 29 kg of corn oil
Other grain kernels: 1 mt = 313 kg of DDGs (negligible vegetable oil)

Appendix III - Related Reports from USEU Brussels and MS Posts in the EU

Country	Report Nbr	Title	Date
EU	GM19010	Biofuel Mandates in the EU by Member State in 2019	06/27/19
EU	E19012	EU Sugar Annual	04/23/19
EU	-	EU Grain and Feed Annual	04/15/19
EU	AU1904	EU Oilseeds and Products Annual	03/28/19
Netherlands	NL9001	The Dutch Industrial Market for Biomass	02/05/19
EU	E19003	EU Recognizes U.S. Soybean Industry Sustainability Scheme	02/11/19
EU	E18070	European Union Unveils Its Protein Plan	12/18/19
EU	E18058	EU Sugar Semi-Annual	09/28/18
EU	AU1804	Oilseeds and Products Update	09/12/18
EU	-	Weather Woes Mount for EU28 Grain Crop	07/27/18
EU	NL8027	EU Biofuels Annual 2018	07/03/18
EU	GM18024	Biofuel Mandates in the EU by Member State in 2018	06/22/18
EU	E18044	EU Reaches a Political Agreement on Renewable Energy	06/22/18
Netherlands	NL8017	Current Market Opportunities for Wood Pellets	05/17/18
Netherlands	NL8015	Case Studies for a Biorefinery	05/14/18
EU	E17061	EU to Cut Anti-Dumping Duties on Argentinean Biodiesel	09/20/17
Italy	IT1728	Italian Wood Pellets Overview	09/06/17
Spain	SP1724	Spain's Bioethanol Sector Overview	08/14/17
Portugal	SP1722	Portugal Biofuel Market Outlook	07/03/17
Spain	SP1723	Spain's Biodiesel and Renewable Diesel Overview	06/29/17
EU	NL7015	EU Biofuels Annual 2017	06/27/17
Romania	RO1711	Romania Biofuels Market Overview	06/23/17

The GAIN Reports can be downloaded from the following FAS website:

http://gain.fas.usda.gov/Pages/Default.aspx

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Disclaimer: This report presents the situation and outlook for biofuels in the EU. This report presents the views of the authors and does not reflect the official views of the U.S. Department of Agriculture (USDA). The data are not official USDA data. Official government statistics on biofuels are not available in many instances. This report is based on analytical assessments, not official data.