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Biofuels Annual

EU Biofuels Annual 2017

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Report Highlights:
Approaching the 2020 mandates laid down in the Renewable Energy Directive (RED), EU bioethanol and biodiesel consumption is forecast to grow in 2017 and 2018. On November 30, 2016, the European Commission (EC) published a new legislative proposal (RED II) for the period 2021-2030. The RED II progressively caps the use of food-based biofuels. The blending rates for advanced biofuels are stepwise increased between 2020 and 2030, which aims to boost the market for these non-food based biofuels. The RED II also includes additional harmonized sustainability criteria for products from biofuels to biomass. The proposed sustainability requirements are a potential trade barrier for the import of wood pellets.

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I. Executive Summary

Policy and Programs

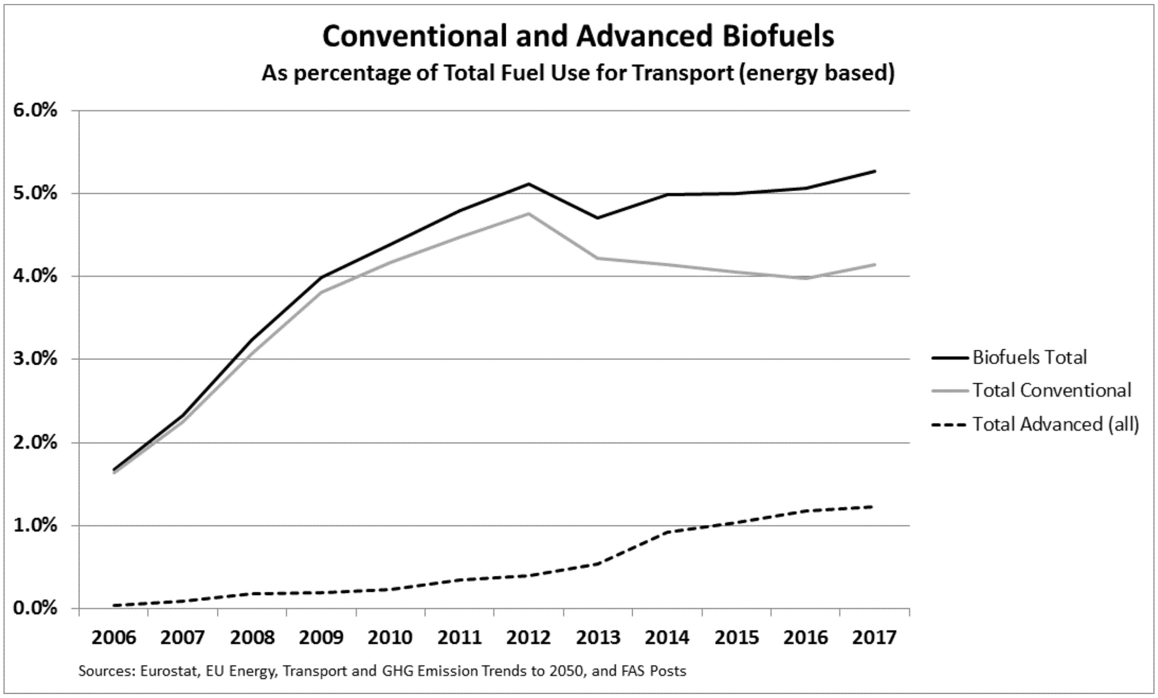
The current EU policy for renewable energy is laid down in the EU Energy and Climate Change Package (CCP) and the Fuel Quality Directive (FQD). The Package includes the "20/20/20" mandatory goals for 2020, one of which is a 20 percent share for renewable energy, and a 10 percent blending target for transport biofuels. In the Renewable Energy Directive (RED), which is part of the CCP, specific sustainability requirements are defined for liquid biofuels. On October 5, 2015, the RED was amended by Directive (EU) 2015/2013. The main elements of the legislative change are a seven percent cap on the share of food crop-based (conventional) biofuels, and a non-binding national target for non-food based (advanced) biofuels of 0.5 percent.

On November 30, 2016, the European Commission (EC) published the RED II as a legislative proposal for the period 2021-2030. The RED II seeks to ensure that the EU will produce at least 27 percent of its energy from renewable sources by 2030. In addition, the RED II sets a cap on conventional biofuels starting at seven percent in 2021 and going down gradually to 3.8 percent in 2030. The RED II supports the use of advanced biofuels with a minimum share of 1.5 percent in 2021 to 6.8 percent by 2030. Furthermore, the RED II extends the existing biomass sustainability criteria for biofuels.

Conventional and Advanced Biofuels

In 2016, the blending of bioethanol and biodiesel in transport fuels was respectively 3.3 and 5.8 percent (energy basis), and thus well below the 10 percent target for 2020. This can partly be explained by the double counting of advanced biofuels. The blending of conventional biofuels in transport fuels is estimated at 4.0 percent, still well below the seven percent cap (see graph below). With the potential outlook of capping the use of conventional biofuels after 2020, the market conditions appear to be dim for these types of food based biofuels.

The blending of advanced biofuels in transport fuels is about 1.2 percent (see graph below), and thus already surpassing the non-binding 2020 target of 0.5 percent. Since 2011, hydrogenated vegetable oil (HVO) production has taken off in the EU. HVO is produced from predominantly non-food feedstocks. In 2016, production is estimated at 2.4 billion liters, and is expected to increase to about 2.6 billion liters in 2017. The current capacity of cellulosic ethanol is about 60 million liters, and could possibly increase to about 200 million liters in 2021. Based on the proposed maximum blending rates for conventional and minimum blending rates for advanced biofuels in the RED II, the consumption of advanced biofuels must increase significantly from 2020.



Biomass for heat and power

Wood Pellets

The EC expects the share of biofuels to be roughly 12 percent of the renewable energy use in 2020. While heat and power consumption from solid biomass is estimated to account for approximately 45 percent. With a consumption of about 22.2 MMT of pellets in 2016, the EU is the world's largest wood pellet market. Based on the EC mandates and Member State (MS) incentives, the demand is expected to expand further to 25 MMT in 2018. The United States has the potential to supply at least half of the import demand, which would represent a trade value of potentially over US$1 billion in 2020.

Biogas

The biogas sector is very diverse across Europe. Depending on national priorities, countries have structured their financial incentives to favor different feedstocks. Germany and the United Kingdom are the two largest biogas producers in the EU. Germany generates 93 percent of its biogas from agricultural crops, predominantly corn silage. The United Kingdom relies almost entirely on landfill and sewage sludge gas. The production of landfill and sewage sludge biogas is expected to stagnate, while production of biogas from agricultural feedstocks is forecast to expand during 2017 and 2018.

II. Policy and Programs

The Renewable Energy Directive

The EU Energy and Climate Change Package (CCP) was adopted by the European Council on April 6, 2009. The Renewable Energy Directive (RED), which is part of the CCP package, entered into force on June 25, 2009. Directive (EU) 2015/1513 (Indirect Land Use Chance or ILUC Directive) entered into force on October 5, 2015, and amends both the RED and the Fuel Quality Directive (FQD). The goal of the RED, as amended by the ILUC Directive, is to ensure that all MSs will contribute to reaching the 20 percent renewables goal by 2020. The RED also includes a 10 percent target for each MS for the share of renewable energy in the transportation sector by 2020. The implementation of the RED, including the design of the support schemes promoting the development of renewable energy, is the responsibility of the MS.

The ILUC Directive includes the following key elements:

1. Fuel suppliers are required to include ILUC emissions in their reports.
2. A seven percent cap on the contribution of first-generation biofuels to the transportation sector's 10 percent target for renewable energy in transport by 2020. MSs are free to set lower caps.
3. Multiplication factor of 5 towards the 10 percent target for electricity from renewable sources used for electric road vehicles and of 2.5 for renewable electricity used in rail transport.
4. A non-binding national target for advanced biofuels [1], taking as a reference value 0.5 percent share of the renewable energy consumed by transport in 2020. MSs may set up lower targets on certain grounds: a) limited potential for production, b) technical or climatic features of the national market for transport fuels, c) national policies putting particular emphasis on incentivizing energy efficiency and renewable electricity in transport.
5. Double counting of the contribution of advanced biofuels towards the 10 percent target.
6. Members States will be required to respect the hierarchy principle when incentivizing biofuel production, preventing food and feed grade feedstocks to be used for fuel.

The EU has set a goal of 10 percent of energy used in the transportation sector to come from biofuels by 2020 as the transportation sector represents the fastest growing increases in greenhouse gas (GHG) emissions. The wider target is for clean energy to make up 20 percent of fuel used in transport, power stations, heating stations, and cooling stations combined. National targets will be set for each country's contribution to the overall goals.

Transposition of the RED
All MSs were required to transpose the RED into national legislation by December 5, 2010.

In April 2016, the EU issued an "Urge to Comply" message to Portugal. The Government of Portugal issued Decree Law 69/2016 in response to the EU's compliance request, which eliminated the preference for domestically produced biofuels, and revoked the special treatment to domestic raw materials in terms of double counting eligibility.

In May 2016, the European Commission (EC) announced that Poland would be referred to the EU Court of Justice (ECJ) for establishing restrictions in Polish law against certain imported biofuels and raw materials for biofuel. However, according to the Polish Ministry of Energy, the EC did not submit the case to the EU Court of Justice until May 2017.

Follow this link to find infringement procedures by the EC on EU energy law. For information on previous failure to transpose cases see the EU Biofuels Annual 2016 – GAIN NL6021.

MS Mandates and Tax Incentives
Each MS is responsible for developing policy and tools to implement the provisions outlined by the RED. A full listing of the mandates from each MS is available in a separate GAIN report. Additionally, each MS is responsible for incentivizing the renewable energy sector. Prior to 2014, subsidies for renewable energy were only available in the form of state aid that was controlled by

the EC. In April 2014, the EC released guidelines for MS to modernize their individual systems in order to attempt to reduce distortions in energy markets that had caused high energy prices across Europe.

National Renewable Energy Action Plans (NREAPs)

The RED required MSs to submit National Renewable Energy Action Plans (NREAPs) by June 30, 2010. The NREAPs provided detailed roadmaps of how each MS expects 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. The report gives an overview of renewable energy policy developments in each EU Member States. On February 2017, the EC published its most recent and fourth Renewable Energy Progress Report. This report concludes that the EU as a whole achieved a 16% share of renewable energy in 2014 and an estimated 16.4% share in 2015 and the vast majority of EU MSs are well on track to reach their 2020 binding targets for renewable energy.

RED and Sustainability Criteria

The RED establishes two sets of criteria to promote sustainability of biofuels production: 1) GHG emissions savings must meet a 50 percent threshold in 2017; 2) biodiesel must be certified as having been produced sustainably on land that has not been converted from high carbon density conditions such as rainforest. In order to receive public support or count towards mandatory sustainability targets, biofuels and bioliquids used in the EU must comply with the EU's sustainability criteria as featured in the RED and FQD as amended by the ILUC Directive. The EU has defined a set of sustainability criteria to ensure that the use of biofuels (used in transport) and bioliquids (used for electricity and heating) is done in a way that guarantees carbon savings and protects diversity.

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 GHG savings, appropriate land use, and monitoring requirements for any potentially adverse effects.

In order to demonstrate compliance with the EU sustainability criteria, biofuels need to be validated by either national verification systems or by one of 20 voluntary schemes approved by the EC and valid in the EU. Sustainability criteria must be met by all biofuels, whether produced within the EU or imported, and must meet a 50 percent GHG emission savings requirement compared to fossil fuels. As of 2018, the threshold is set to rise to 60 percent, for new installations.

Environmental sustainability criteria covering biodiverse and high-carbon-stock lands are also laid out in the RED. The biodiversity criteria apply 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 forest and other wooded land, biodiverse grasslands, or areas designated for nature protection purposes. Biofuels also cannot 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). Other sustainability requirements cover environmental criteria for soil, water, and air quality, as well as social criteria, which focus on food price impact and adherence to International Labor Organization conventions.

MS competent authorities are responsible for ensuring that biofuels counted towards targets, mandates, and tax credits fulfill the EU's sustainability criteria. MSs are not allowed to have higher or lower sustainability criteria than those set by the EC, and must accept all certification systems recognized by the EC. However, with each MS having different checklists, there could be 28 different national certification schemes that must be registered and approved by the EC. The United Kingdom has proposed amendments to their mandate scheme that could be stricter than the EU's limit on crop-based biofuels and on the definitions of waste.

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 60 percent reduction 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.

GHG Emissions
GHG emissions for biofuels and bioliquids 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. Emissions 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 A: Typical and default values for biofuels if produced with no net carbon emissions from land-use change

	Typical GHG[1] savings	**Default GHG[2] 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 mill)	62%	56%
Corn ethanol, Community produced (natural gas as process fuel in CHP 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-Directive 2009/28/EC
(1) 'Typical' implies an estimate of the representative GHG emission savings for a particular biofuel production pathway.
(2) 'Default' implies a value derived from a typical value by the application of pre-determined factors and that may, in circumstances specified in RED, be used in place of an actual value.

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. Recognition by the EC is granted for up to a period of five years. The EC has approved 20 voluntary schemes that can certify biofuels for all MSs.

In May 2016, the EC approved the Austrian Agricultural Certification Scheme as compliant with the sustainability criteria under the FQD and RED as amended by the ILUC Directive.

The EC approved voluntary schemes are:

(1) ISCC (International Sustainability and Carbon Certification)
(2) Bonsucro EU
(3) RTRS EU RED (Round Table on Responsible Soy EU RED) expired on 08/09/2016
(4) RSB EU RED (Round Table of Sustainable Biofuels EU RED)
(5) 2BSvs (Biomass & biofuels voluntary scheme)
(6) RBSA (Abengoa RED Bioenergy Sustainability Assurance) expired on 08/09/2016
(7) Greenergy (Brazilian bioethanol verification program) expired on 08/09/2016
(8) Ensus (Voluntary scheme under RED for Ensus bioethanol production)
(9) Red Tractor (Farm Assurance Combinable Crops & Sugar Beet Scheme)
(10) SQC (Scottish Quality Farm Assured Combinable Crops scheme)
(11) Red Cert
(12) NTA 8080
(13) RSPO RED (Roundtable on Sustainable Palm Oil RED)
(14) Biograce (GHG calculation tool)
(15) HVO Renewable Diesel Scheme
(16) Gafta Trade Assurance Scheme
(17) KZR INIG
(18) Trade Assurance Scheme for Combinable Crops
(19) Universal Feed Assurance Scheme
(20) Austrian Agricultural Certification Scheme (National biofuel sustainability scheme recognized by the EC for agricultural feedstock and vegetable oils)

In April 2015, the U.S. Soybean Export Council (USSEC) submitted an application for recognition of their U.S. Sustainable Soy Assurance Protocol (SSAP) under the RED to DG Energy. USSEC developed a RED specific protocol entitled SSAP/RED. The SSAP/RED met the Dutch Feed Industry Association's (NEVEDI) requirements for sustainable feedstuffs. In March of 2016, SSAP was positively benchmarked against the European Feed Manufacturers' Federation's (FEFAC) Soy Sourcing Guidelines through the International Trade Centre's (ITC) customized benchmark tool. USSEC sees this as a significant step towards meeting the EU's sustainability criteria. Archer Daniels Midland Co.'s (ADM) sustainability scheme, The Responsible Soy Standard, had also met FEFAC and ITC Soy Sourcing Guidelines as of November 2015.

Biomass Sustainability for Heat and Power
While the current RED sets clear sustainability criteria guidelines for liquid biofuels, the EC has deferred setting mandatory sustainability criteria for pellets and other forms of solid biomass. In the absence of EU-wide binding criteria, several MSs including the United Kingdom, Belgium, Denmark, and the Netherlands, have 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.

Commission Communication on 2030 Climate and Energy Goals

On October 24, 2014, European Heads of State and Government confirmed the EC's proposal by reaching an agreement on the 2030 Framework for Climate and Energy in an effort to maintain what the EU sees as its global leadership on climate change. According to the Conclusions, the 2030 framework will be based on three targets:

- Reducing greenhouse gas emissions by 40 percent;
- Increasing the share of renewable energy to 27 percent of consumption;
- Improving energy efficiency by 27 percent.

These targets also fall in line with the EU's 2050 low-carbon economy, 2050 energy strategy, and the White Paper 2011 (the long term vision for fueling the EU's transportation sector).

The Renewable Energy Directive 2021-2030 (RED II)

The EC's legislative proposal on the revision of the Renewable Energy Directive, RED II, was published on November 30, 2016 as part of the comprehensive "Clean Energy for All Europeans" package that included initiatives on energy efficiency, the electricity market, the security of electricity supply, and governance rules for the EU Energy market. The document was accompanied by an impact assessment of the proposed legislation and technical specifications, which according to the EC were taken into consideration by the EC in its preparatory work.

This legislative proposal revises the RED for the period 2021-2030 and sets out a new framework for the promotion of energy from renewable sources by setting a binding 27 percent EU target for the overall share of energy from renewable sources by 2030. This target is expected to be achieved through the collective effort of all MSs. Unlike the current RED, it does not establish binding national targets; however the 2020 national targets remain in RED II as a baseline. The proposal also lays down rules on financial support to electricity produced from renewable sources, consumption of renewable electricity and renewable energy use in heating and cooling and transport sectors, and regional cooperation between MSs and with third countries.

For the transportation sector, the EC deletes the existing requirement for a 10 percent share of biofuels and reduces the maximum contribution of food crop-based biofuels from seven percent by 2021 to 3.8 percent by 2030. The proposal calls for a gradual reduction of 0.3 percentage points annually from 2021 through 2025 and 0.4 percentage points annually from 2026 to 2030; this caps the use of first generation biofuels each year. For example, the cap for 2025 is 5.8 percent. The EC's proposal also includes a required minimum share of energy from advanced biofuels which will grow from 1.5 percent by 2021 to 6.8 percent by 2030. On July 2016, the EC presented a European Strategy for low-emission mobility, which sets the course for the development of EU-wide measures on low and zero-emission vehicles and alternative low-emissions fuels.

The EC lists acceptable feedstocks for the production of advanced biofuels in Annex IX of the proposal. The list includes: algae, biomass fraction of industrial waste and mixed municipal waste, bio-waste, straw, animal manure and sewage sludge, palm oil mill effluent and empty palm fruit bunches, tall oil and tall oil pitch, crude glycerin, bagasse, grape marcs and wine lees, nut shell, husks, cobs cleaned of kernels of corn, biomass fraction of waste and residues from forestry and forest-based industries, used cooking oil, certain animal fats and molasses as a by-product from of refining sugarcane or sugar beets.

Advanced alternative fuels used for aviation and maritime can be counted 1.2 times toward the 6.8% renewable energy mandate as an additional incentive to develop and apply biofuels in these sectors. The RED II proposes a sub-target (from 0.5% by 2021 to 3.6% by 2030) for advanced biofuels listed in part A, Annex IX. This sub-mandate for advanced feedstocks is intended to promote emerging technologies for biofuel production, such as cellulose hydrolysis and pyrolysis in order to avoid the excessive use of used cooking oil, animal fats and molasses in the share of advanced biofuels. The legislative proposal gives MSs complete flexibility on the mix of food crop-based fuels (ethanol versus biodiesel versus renewable diesel) consumed and feedstock (sugar beets, grains, and oilseeds) used to meet renewable energy goals up to the aggregate limit proposed.

Sustainability Criteria

In Article 26 of the proposal, the EC also lays down, a set of sustainability criteria for liquid biofuels, biogas and other biomass fuels (like energy pellets) when used in installations with a fuel capacity equal or exceeding 20 MW for solid biomass fuels and 0.5 MW for gaseous biomass fuels. As in the current RED, in order to be considered sustainable, biofuels, bioliquids, and biomass produced from agriculture should not be made from raw material obtained from land either with high biodiversity value or with high carbon stock or land that was peatland in January 2008.

Biofuels and Bioliquids Sustainability

For biofuels and bioliquids, the GHG emissions savings should be at least 50 percent for installations in operation before October, 5, 2015; 60% for those starting operation from October, 5, 2015, and 70 percent for those starting after January, 1, 2021. The GHG saving from biomass fuels shall be at least 80 percent when used in installations that started operating after January, 1, 2021 and 85 percent for installations starting operation after January 2026.

Biomass Sustainability

The RED II introduces EU wide sustainability criteria for biomass. More precisely, biofuels, bioliquids, and biomass from forest should meet the following requirements:

(1a) The country in which forest biomass was harvested has national and/or sub-national laws applicable to the area of harvest, as well as monitoring and enforcement systems in place.

(1b) If 1a is not available, at forest holding level it has to be demonstrated that: (i) the forest biomass has been harvested according to a legal permit; (ii) forest generation of harvested areas takes place; (iii) areas of high conservation value, including peatlands and wetlands, are identified and protected; (iv) impacts of forest harvesting on soil quality and biodiversity are minimized; (v) harvesting does not exceed the long-term production capacity of the forest;

(2a) The country in which forest biomass was harvested has ratified the Paris agreement, has submitted a Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) and has a national system in place for reporting emissions and removals from agriculture, forestry and land use.

(2b) If the country does not meet 2a, at forest holding level a system is needed to ensure that carbon stocks and sinks levels in the forest are maintained.

Additionally, a high efficient cogeneration technology is required for installations over 20 MW capacity which start operations three years from date of the adoption of the Directive. Moreover, the EC withdraws the possibility to conclude bilateral or multilateral agreements with third countries covering sustainability certification included in Article 18 (4) of the current RED.

Stakeholders' Reactions
The EU Agricultural Organizations and Cooperatives Association (Copa-Cogeca), which has been battling to keep the first generation biofuel cap at seven percent until 2030, described the targets set for advanced biofuels as "unrealistic" as they are not yet commercially viable. "We oppose the Commission proposal to replace conventional biofuels with advanced biofuels. Conventional and advanced biofuels are part of the solution to ensure a more climate-friendly transportation sector as well as a sustainable EU agriculture sector, growth and jobs in EU rural areas" commented Copa & Cogeca Secretary-General Pekka Pesonen in a press release.

Farmers views are echoed by the bioethanol industry (ePURE), The European Biodiesel Board (EBB), the EU Vegetable Oil and Protein Meal Industry (FEDIOL) and the European Oilseed Alliance (EOA), stating that the proposed exclusion of conventional biofuels from the incorporation of obligations of fuel suppliers is unacceptable and it would mean a likely increase of fossil fuels in the transportation sector due to the lack of availability of advanced biofuels.

In a joint letter to the EC, the European Association of Sugar Manufacturers (CEFS), the European Confederation of Maize Production (CEPM), the International Confederation of European Beet Growers (CIBE), and ePURE warned that phasing out conventional ethanol produced from crops is not scientifically justified, and claimed that it would rob the transportation sector of a credible green alternative, and cost European cereal and beet farmers at least €2.1 billion in lost revenue annually. The European Biomass Association (AEBIOM) welcomed the harmonization of the biomass regulation proposed by the EC, but regretted giving flexibility to MSs in defining additional sustainability rules.

NGOs such as Birdlife, Transport & Environment (T&E) and World Wildlife Fund (WWF) said that the EC did not go far enough and should have proposed a zero target for first generation biofuels. Birdlife also declared in a press release that "the new sustainability criteria for forest biomass only require minimal national forestry legislation to be in place. Signing up to international climate commitments by countries is not enough to ensure bioenergy really reduces emissions and doesn't lead to overexploitation of forests."

Next Steps
The EC release of the RED II proposal starts the legislative process for review, input, and possibly amendments by the European Parliament (EP) and the Council (MS' Ministers) for examination and discussion. At the EP, the lead committee responsible for dealing with the file will be the Industry, Research and Energy (ITRE) Committee with Environment, Public Health and Food Safety (ENVI) and Agriculture and Rural Development (AGRI) Committees likely involved in delivering an opinion. The legislative process will take at least 18 months. A final proposal is expected in the second half of 2018 in order to implement the new directive on January, 1, 2021.

Palm Oil

The European Parliament (EP) voted to call on the EU to phase-out the use of palm oil in biofuels by 2020, on April 2017. Members of the European Parliament (MEPs) noted that 46 percent of imported palm oil is used to produce biofuels, requiring the use of about one million hectares of tropical soils. MEPs called on the EC to introduce sustainability criteria for palm oil and products containing palm oil entering the EU market. Although the report is not binding, it comes at the beginning of the negotiations on the proposed RED II, which includes a 3.8 percent cap on the contribution of crop-based biofuels. Environmental NGOs welcomed the EP's vote and asked for a total phase-out of crop-based biofuels.

Duty Rates

In 2012, the EC published a customs regulation which changed the HS code for ethanol used for fuel to HS/CN code 2207. Ethanol and gasoline blends with an ethanol content of 70 percent or more are classified as denatured ethanol under code 22.07.20.00, and charged with an import tariff of €10.20 per hectoliter. Previously, ethanol was imported under code 3824, at an import duty of 6.5 percent. There seems to still be some uncertainties where blends between E30 and E70 would be classified.

For biodiesel, a code that covers fatty-acid mono-alkyl esters (FAMAE) was introduced in January 2008, and changed in January 2012. However, other forms of biodiesel could still enter under other codes depending on the chemical composition. Diesel with a biodiesel component of less than 30 percent can enter the EU under chapter 27.10.20 at a tariff rate of 3.5 percent.

Table B: Duty Rates for Fuels

HS Code	Description	Duty Rate
3826001	FAMAE 96.5-100%	6.5% (plus AD and CV duties for U.S. and most Canadian
		companies)
38260090	FAMAE below 96.5%	6.5% (plus AD and CV duties for U.S. and most Canadian
		companies)
271020	B30 and below	3,5%
220710	Undenatured	€19.2/hl
	ethanol	
220720	Denatured ethanol	€10.2/hl

Bioethanol
On February 23, 2013, the EC adopted Council Regulation (157/2013) imposing a definitive anti-dumping (AD) duty on imports of bioethanol originating in the United States (for more information see the EU Biofuels Annual 2016 – GAIN NL6021). In June of 2016, the EU General Court ruled against the duties created by the 2013 regulations. They found that applying a weighted average duty to all U.S. bioethanol producers as a whole instead of separate duties for each sampled producer was not in keeping with EU law or WTO rules. The European Council on July 18, 2016 voted in favor of appealing the European Court of Justice's (ECJ) decision to annul the definitive AD duty on imports of bioethanol from the United States. Regardless of the final outcome of the AD case, the United States and other non-preferential trade agreement EU suppliers will continue to face hurdles that place them at a competitive disadvantage.

Biodiesel
In March 2009, the EC published Regulation 193/2009 and Regulation 194/2009, containing provisional anti-dumping (AD) and countervailing (CV) duty measures on imports of biodiesel from the United States containing 20 percent or more of biofuels. Both regulations were imposed by the EC on July 7, 2009 (see Council Regulation 598/2009 and 599/2009) and were due to expire in July 2014. However, the European Biodiesel Board (EBB) lodged a request for a review of the duties on April 9, 2014, based on the grounds that an expiry of the measures would result in recurrence of subsidized imports offered at dumping prices. On July 10, 2014, the EC decided to undertake an investigation and as of September 2015, the EU moved extended the duties against U.S. biodiesel an additional five years to September of 2020.

In May 2011, the EC published a Council Decision which extended the definitive AD and CV on biodiesel blends of 20 percent or less originating from the United States. The measures adopted by the EC were retroactive and extended to August 13, 2012. For U.S. companies that were investigated in 2009, the combined duties will apply €213.8 – €409.2 per metric ton (MT). Other U.S. companies will be subject to the highest combined duty of €409.2 per MT, based on the biodiesel content in the blend. The different duties have drastically reduced imports of biodiesel from the United States. On October 2014, the U.S. National Biodiesel Board (NBB) filed comments with the EC, challenging the import duties that were introduced in 2009. The NBB urged the EC to allow duties to expire that year, citing evidence that global trade for biodiesel had changed since the duties were imposed and that continuing the duties was protectionist and unnecessary. With the renewal of the U.S. tax credit on biodiesel not expected to expire until 2016, the EU's response was to extend the duty imposed on U.S. produced biodiesel until September of 2020 in a move to put European based biodiesel on equal footing with U.S. made fuel.

In May 2013, the EC published regulation 490/2013 imposing a provisional AD duty on imports of biodiesel originating in Argentina and Indonesia. The provisional tariffs were effective beginning May 29, and range between 6.8-10.6 percent on imports from Argentina, and between 0-9.6 percent on biodiesel originating in Indonesia. During the investigation period (July 1, 2011- June 30, 2012) all imports from Argentina were found to be dumped, while a low level (two-six percent) of the Indonesian biodiesel was found not to be dumped. The Argentine and Indonesian biodiesel sectors filed a complaint with the WTO regarding the EU biofuels quota and tax systems. In November 2013, the AD duties were made permanent, see Regulation 1194/2013. The Indonesian case is still pending, however, in March 2016, the WTO ruled that while the core of the EU regulations do not violate WTO standards, specific portions of the EU's definition of dumping violated the General Agreement on Tariffs and Trade (GATT) as well as the Anti-Dumping Agreement. Both the EU and Argentina filed appeal claims in May of 2016 which will be heard by the WTO's Appellate court.

On December 20, 2016, the EC published a notice of initiation regarding the AD measures in force on imports of biodiesel originating in Argentina and Indonesia, following the recommendations and rulings adopted by the WTO/DSB and asserting that the aim of the investigation is to bring its AD measures in line with recent rulings and recommendations from a WTO panel. A report adopted by the WTO's dispute settlements body (DSB) in October 2016 found that EU measures imposed on biodiesel from Argentina were inconsistent with several provisions of the organization's Anti-Dumping Agreement. The EC says its review will also cover biodiesel from Indonesia given that this is subject to a pending WTO dispute where similar issues are covered. The EC has notified the WTO that it plans to implement the WTO recommendations and rulings by August 10, 2017.

III. Gasoline and Diesel Pools

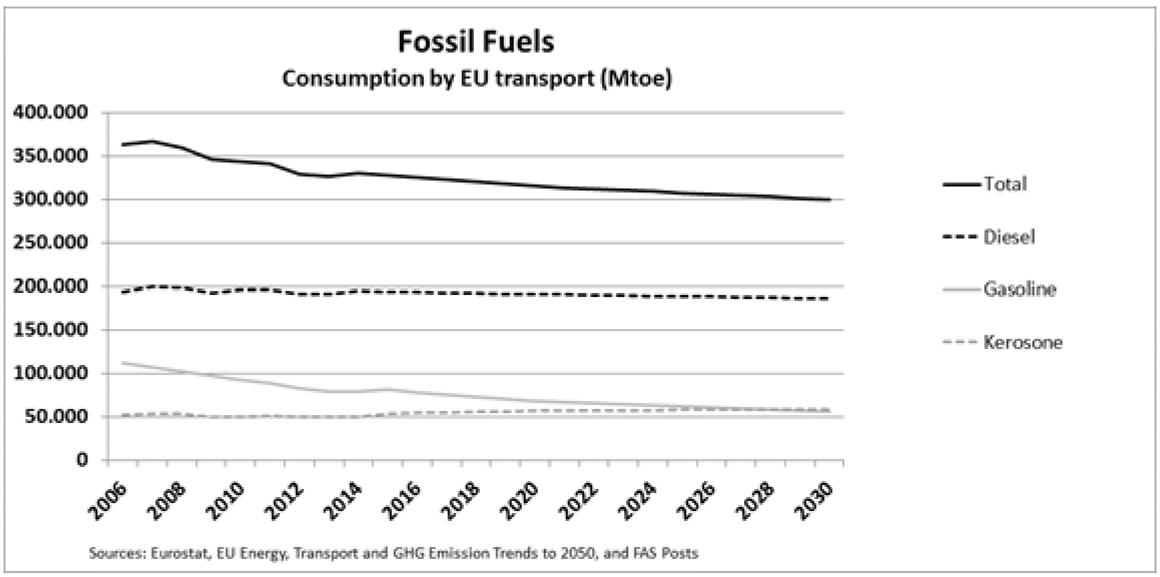
Table 1. Fuel Use Projections (Million liters)

Calendar Year	2011	2012	2013	2014	2015[e]	2016[e]	2017[e]	2018[e]
Gasoline Total	114,708	106,928	103,307	103,014	105,170	101,670	98,170	94,670
Diesel Total	245,886	241,789	240,734	241,047	248,510	252,000	254,350	256,700
On-road	192,540	189,002	189,077	193,992	199,370	200,000	200,640	201,200
Agriculture	11,715	11,193	11,281	11,059	11,260	11,400	11,500	11,600
Constr./mining	2,733	2,670	2,765	2,790	2,930	3,000	3,050	3,100
Shipping/rail	6,107	6,076	5,202	4,824	5,075	5,200	5,300	5,400

Industry	6,147	6,069	5,204	4,891	5,255	5,400	5,500	5,600
Heating	26,644	26,779	27,204	23,490	24,630	25,000	25,000	25,000
Jet Fuel Total	57,508	56,067	55,825	56,333	61,030	61,710	62,390	63,065
Total Fuel	418,102	404,784	399,865	400,393	414,710	415,380	414,900	414,430

Source: Eurostat Estimates based on: EU Reference Scenario 2016 - Energy, transport and GHG emissions Trends to 2050

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 transportation 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 use of gasoline significantly by 2030. The use of diesel is expected to remain relatively stable and continues to be the primary fuel for heavy duty vehicles. Regarding international shipping, fossil fuels continue to be by far the dominant energy source. Air transportation is projected to be the highest growing sector of all passenger transportation modes. Consumption of jet fuels in aviation increases steadily to 2050 due to the increase in transportation activity and despite improvements in efficiency. Use of energy by agriculture, construction and mining, and by other industries heavily depends on the economic outlook in the European Union. 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 2. Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)								
Calendar Year	**2011**	**2012[r]**	**2013[r]**	**2014[r]**	**2015[e]**	**2016[e]**	**2017[f]**	**2018[f]**
Beginning Stocks	445	321	90	254	312	256	224	224
Fuel Begin Stocks	407	282	55	217	274	209	178	191
Production	5,170	5,348	5,741	6,022	6,258	6,080	6,289	6,333
Fuel Production	4,392	4,658	5,000	5,253	5,316	5,165	5,340	5,380
-of which cellulosic (a)	0	0	0	50	50	50	55	60
Imports	1,935	1,536	1,245	1,068	878	878	840	840
Fuel Imports	1,285	886	595	418	228	228	190	190
-of which ETBE (b)	261	188	197	109	107	31	30	30
Exports	149	145	113	284	234	221	215	215
Fuel Exports	99	95	63	234	184	171	165	165
Consumption	7,080	6,970	6,708	6,747	6,958	6,770	6,899	6,982
Fuel Consumption	5,703	5,676	5,370	5,380	5,425	5,250	5,355	5,445
Ending Stocks	321	90	254	312	256	224	238	201
Fuel Ending Stocks	282	55	217	274	209	178	191	153
Production Capacity, First Generation								
Number of Refineries	68	70	71	71	71	71	71	71
Capacity	7,759	8,468	8,480	8,600	8,480	8,230	8,230	8,290
Capacity Use (%)	67	63	68	69	73	73	76	76
Production Capacity, Cellulosic Ethanol								
Number of Refineries	0	0	0	1	1	1	2	2
Capacity	0	0	0	50	50	50	55	60
Co-product Production(c) (1,000 MT)								
DDG	2,932	2,962	3,223	3,457	3,569	3,535	3,617	3,648
Corn Oil	86	136	148	157	163	158	165	168
Feedstock Use (1,000 MT)								
Wheat	4,458	3,285	3,200	3,596	3,734	3,998	3,855	3,874
Corn	2,965	4,687	5,092	5,397	5,634	5,433	5,679	5,789
Barley	735	400	647	537	528	514	492	487
Rye	692	367	790	831	775	631	786	771
Triticale	517	725	567	683	729	718	744	734
Sugar Beet	9,477	10,588	11,694	11,142	10,059	8,820	9,787	9,717
Cellulosic Biomass	0	0	0	200	200	200	220	240
Market Penetration (million liters)								
Fuel Ethanol	5,703	5,676	5,370	5,380	5,425	5,253	5,354	5,443
Gasoline	114,708	106,928	103,307	103,014	105,170	101,669	98,168	94,667
Blend Rate (%)	5.0	5.3	5.2	5.2	5.2	5.2	5.5	5.7

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 production and exports 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 in million liters of ethanol. HS code 29091910, ETBE contains 45 percent ethanol. (c) Data is not available, the figures above represent estimates by EU FAS posts. Calculated co-product production (theoretical maximum) based on estimated feedstock use in fuel ethanol production.

Production & Production Capacity

In 2014, the sector benefitted from low feedstock prices and restrictive measures on bioethanol imports, and as a result EU bioethanol production rose to about 5.3 billion liters. In 2016, EU bioethanol production dipped due to financial problems within the sector but is forecast to recover to nearly 5.4 billion liters.

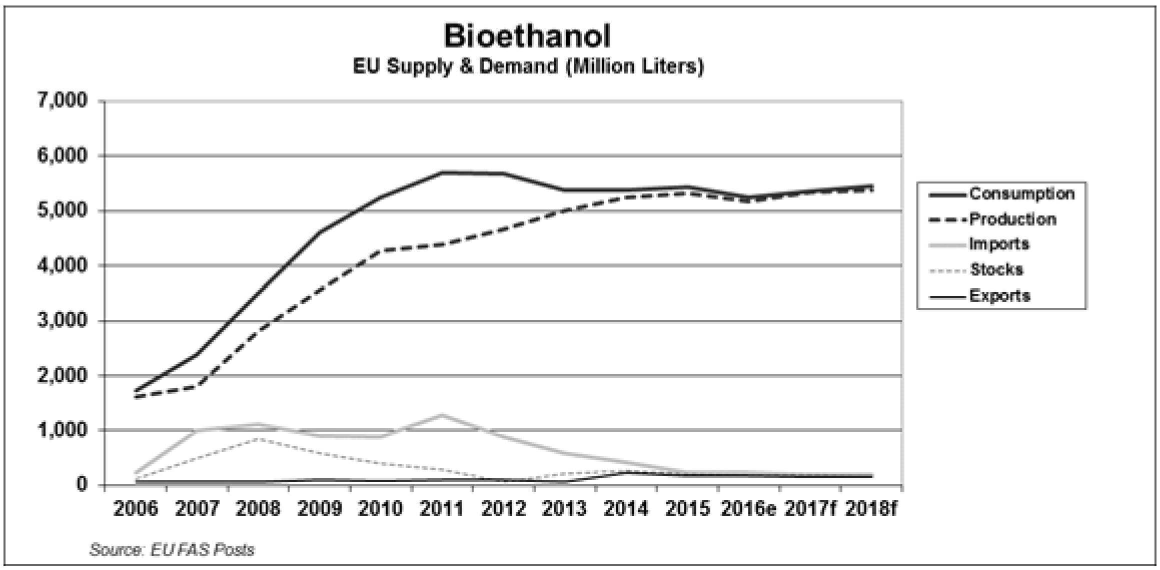


Table 3. Fuel Ethanol Production Main Producers (million liters)								
Calendar Year	**2011[r]**	**2012[r]**	**2013[r]**	**2014[r]**	**2015 e**	**2016 e**	**2017[f]**	**2018[f]**
France	846	829	995	1,018	1,039	1,040	1,040	1,040
Germany	730	776	851	920	937	935	950	950
United Kingdom	89	215	278	329	538	660	815	885
Hungary	190	291	392	456	589	590	590	595
Belgium	400	410	451	557	557	570	570	570
Netherlands	275	451	524	520	563	445	530	565
Spain	464	381	442	455	494	328	280	280
Poland	174	218	242	181	220	240	255	265
Austria	216	216	223	230	223	230	230	230
Total	**4,392**	**4,658**	**5,000**	**5,253**	**5,316**	**5,165**	**5,340**	**5,380**

r = revised / e = estimate / f = forecast; source: EU FAS Posts

EU bioethanol production is forecast to slightly increase in 2017 and 2018. This anticipated expansion is mainly based on increased use of existing capacity and growing demand by MSs as they attempt to reach their 2020 targets. MSs that are increasing production include mainly Germany, the United Kingdom, the Netherlands, Hungary, and Poland.

- As of January 1, 2015, Germany switched its biofuel mandates from being energy to greenhouse gas (GHG) based. On January 1, 2017, the mandate increased from 3.5 to 4 percent GHG savings. This is expected to result in a small increase in biofuels use. The increased demand is expected to equally benefit domestic produced and imported bioethanol.
- In the United Kingdom production is increasing solely due to increased use of existing capacity of two plants. During 2011–2014, the United Kingdom was deficient of about 600 million liters of bioethanol. This shortage is anticipated to shrink to only 100 million liters this year.
- In Hungary, both capacity and production expanded significantly during the past five years. In 2017 and 2018, the operational capacity is expected to increase by another 25 million liters. Hungarian bioethanol production is fully corn-based. About 80 percent of the bioethanol production is exported. Investments in second generation bioethanol production are not yet foreseen.
- In Poland, capacity in bioethanol production is below 30 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 in France, Belgium and Austria stabilized and is expected to remain flat this and next year. A significant reduction is forecast in Spain and Romanian.

- Spanish production declined significantly during 2016 as the largest plant halted production in April 2016. Currently only the port facilities are running at full capacity. Due to the lack of capital of the Spanish producer, its bioethanol plant in the Netherlands temporarily stopped production. In July, 2016 this plant was taken over by a Belgian company and reportedly resumed production a few months later.
- Financial problems are also negatively affecting production in Romania. The single bioethanol plant in Romania is forecast to produce only at five to twenty percent of its total capacity of about 125 million liters in 2017 and 2018.

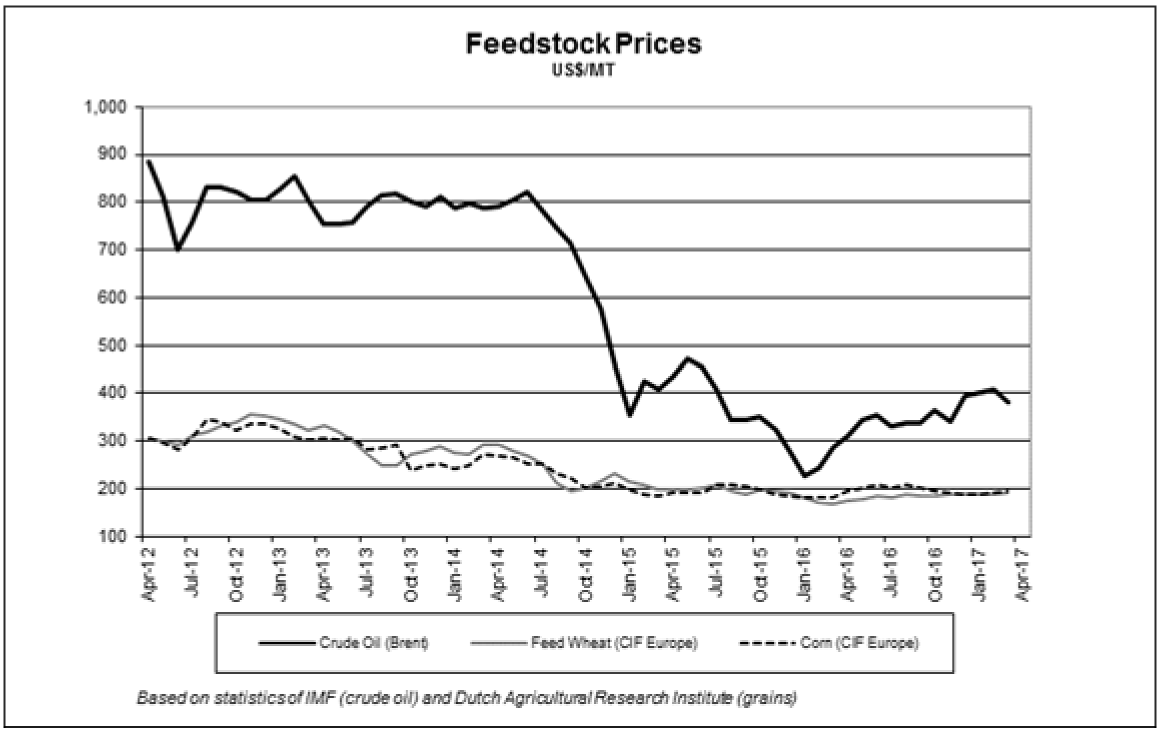
Total EU ethanol production capacity, for fuel, industrial and food uses, is estimated at about 8.9 billion liters. Further expansion of first generation bioethanol is expected to be limited. Expansion of cellulosic bioethanol production is restrained due to the lack of certainty in the EU policy making process (see Policy and Advanced Biofuels Chapter).

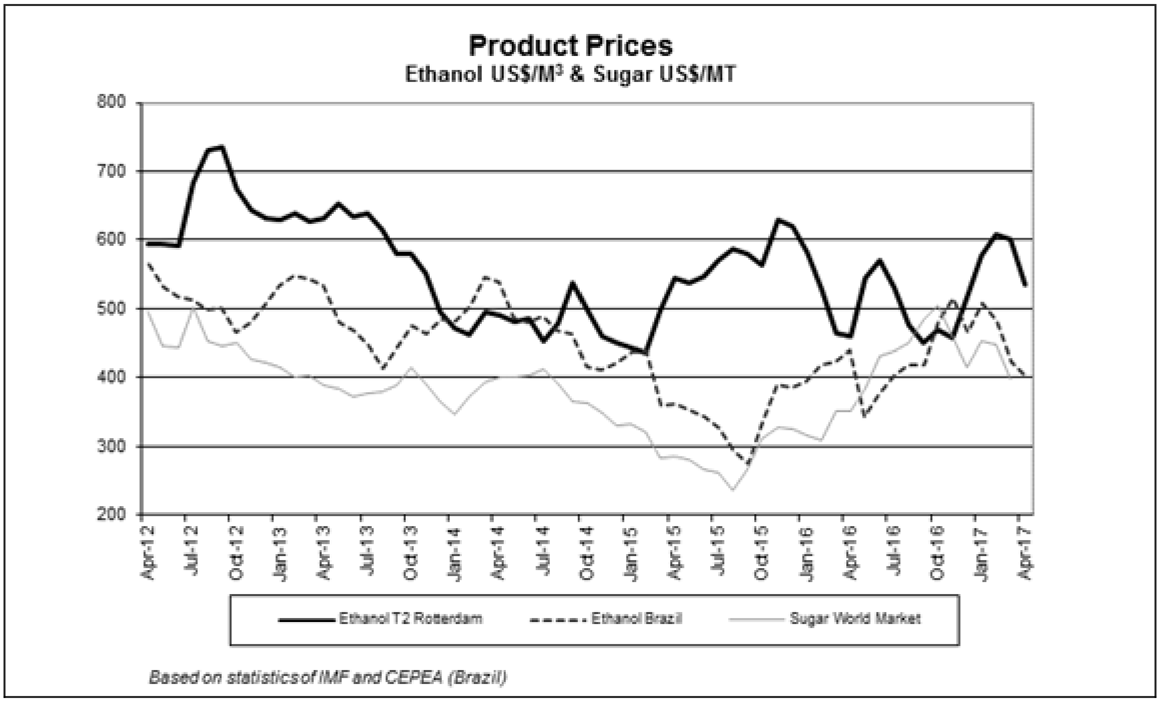
Fuel Ethanol Feedstock Use and Co-products Production

In the EU, bioethanol is mainly 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 in Hungary. But corn is also the preferred grain in the Netherlands and Spain, where the majority of the ethanol plants are located at sea ports, and the corn is predominantly sourced from the Ukraine. This is partly because of its non-genetically modified (non-GM) content. Producers in northwestern Europe prefer to market their distillers dried grains (DDG) as non-GM to the domestic feed market.

In France, Germany, the United Kingdom, the Czech Republic, and Belgium sugar beets are also used for the production of bioethanol. Bioethanol produced from sugar beets faced tough competition from decreasing grain prices (see graph below), and as a result fell during 2013-2016. From October 2017, the EU sugar market will be liberalized. The beet acreage is expected to expand in 2017, with elevated sugar volumes produced in marketing year 2017/2018. Despite the relatively high sugar prices (see graph below), use of beets for ethanol production is expected to recover from 8.8 MMT in 2016 to 9.7–9.8 MMT during 2017 and 2018 (see [FAS EU Sugar Annual](#)).

In the EU, the required feedstock for 2017 production (5,340 million liters of bioethanol) is estimated at 11.6 MMT of cereals and 9.8 MMT of sugar beets. This is about 3.8 percent of total EU cereal production and nearly 9 percent of total sugar beet production. Co-products of the bioethanol production are DDG (Distillers Dried Grains), wheat gluten and yeast concentrates. In 2017, the maximum theoretical production of co-products is forecast to reach 3.6 MMT. This is about 2.1 percent of total EU feed grain consumption.





Based on statistics of IMF and CEPEA (Brazil)

Fuel Ethanol Consumption

Table 4. Fuel Ethanol Consumption Main Consumers (million liters)								
Calendar Year	**2011**	**2012**	**2013[r]**	**2014[r]**	**2015[r]**	**2016 e**	**2017[f]**	**2018[f]**
Germany	1,568	1,581	1,532	1,557	1,485	1,485	1,545	1,545
United Kingdom	823	981	1,038	1,041	997	960	950	935
France	768	790	778	797	803	825	840	855
Poland	319	275	286	261	302	330	330	335
Netherlands	292	244	246	254	281	305	325	330
Italy	480	463	362	267	281	285	285	285
Spain	443	395	337	371	375	253	260	260
Sweden	399	406	354	327	320	230	220	220
Total	**5,703**	**5,676**	**5,370**	**5,380**	**5,425**	**5,250**	**5,355**	**5,445**

r = revised / e = estimate / f = forecast; source: EU FAS Posts

While EU bioethanol production has stagnated since 2015, consumption has been on the decline since 2011. This trend can mainly be explained by lower gasoline use and the adjustment of national blending mandates. Another factor is the blending of biofuels which count double towards the mandate. The reduction of fossil fuel prices did not have a significant effect on biofuel consumption in the markets which are regulated by mandates and consumption of biofuels is fixed. Price increases have been tempered by the weakening of the Euro against the US$. Sales of the higher ethanol blends have been significantly affected by the low gasoline prices. In 2016, bioethanol consumption is estimated at close to 5.3 billion liters and is anticipated to gradually increase to over 5.4 billion liters in 2018.

The forecast recovery of consumption is supported by increased blending in mainly Germany, France, Poland, the Netherlands and Spain.

- In Germany, bioethanol consumption remained stable in 2016, as a higher use of ethyl tert-butyl ether (ETBE) compensated for a small reduction in ethanol blending. For 2017, bioethanol consumption is expected to increase by four percent as a result of the adjustment of the greenhouse gas (GHG) reduction mandate from 3.5 to 4 percent. This is anticipated to result in a relatively small increase of bioethanol use. Germany switched its biofuel mandates from being energy to GHG based from January 1, 2015. Blenders are obliged to establish a minimum GHG reduction of total fuel sales (including biofuels) compared to only the emissions from fossil fuels. Based on GHG savings, the new system creates a preference for hydrogenated vegetable oil (HVO) above bioethanol and conventional biodiesel.
- In France, bioethanol consumption is growing due to an increase in the number of gas stations that sell E10 and E85. Currently, more than half of French gas stations sell E10, and about 8 percent sell E85. In 2016, consumption of E10 and E85 increased respectively by 2.3 percent to 3.5 billion liters, and 11 percent to 96 million liters. Other reasons for higher consumption included an increase in gasoline consumption in 2015 and 2016 and the lower price of E10 and E85 compared to gasoline. In January 2016, the French tax for energy products (TICPE) was reduced for E10 and increased for gasoline. As a result, on average, a liter of E10 is around four to five cents cheaper than a liter of gasoline in gas stations. Since the beginning of 2016, a new fuel called ED95 (95 percent ethanol) has been commercialized. It contains 95 percent bioethanol and five percent additives. It is exclusively consumed by buses and trucks with specific motors that can use this fuel.
- Polish consumption of bioethanol is expected to increase during 2016 and 2017 as mandates gradually rise, and a limited share is fulfilled through double counting.
- In the Netherlands, consumption in 2016 is forecast to increase only slightly as a result of higher mandates and increased taxes on diesel cars. In April, 2017, The Dutch Government announced their intention to introduce E10 before 2020. A detailed plan of this market introduction has not been made public.
- In both Spain and Portugal, the elimination of the bioethanol specific targets in 2016 reduced marketing opportunities for bioethanol producers. Blenders are anticipated to meet mandates with biodiesel and HVO produced from waste feedstocks, which don’t count against the seven percent cap on crop-based biofuels (see Policy Chapter), but are eligible for mandate compliance. However, despite the preference for biodiesel and HVO, the higher overall mandate in Spain would allow for slightly higher bioethanol consumption levels.

Bioethanol consumption is forecast to decline in the United Kingdom, Sweden, Portugal and the Czech Republic:

- In the United Kingdom, the gasoline market is on the decline, and with an unchanged biofuels mandate, bioethanol consumption is forecast to slightly fall.
- In Sweden, E85 sales are plummeting as gasoline prices decline and new government energy taxes and taxes for flex fuel cars disadvantaged the use of E85. In 2016, Swedish E85 consumption halved to 45 million liters.
- In Portugal, the elimination of the bioethanol specific targets in 2016 reduced marketing opportunities for bioethanol producers. Blenders are anticipated to meet mandates with just biodiesel and HVO.
- In the Czech Republic the consumption of biofuels is on the decline due to an increase in the excise tax on biofuels starting from January 2016. Because of this situation it is uncertain if

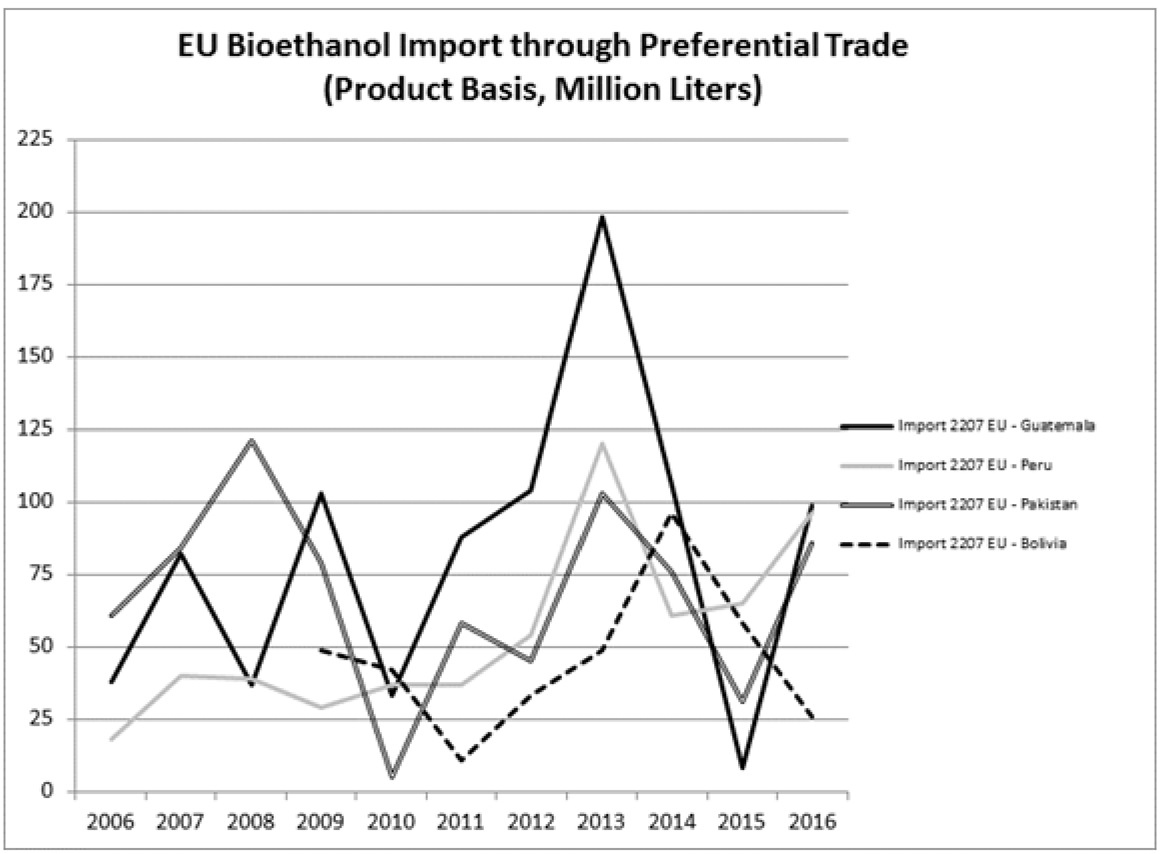
the Czech Republic will be able to meet its goals in GHG savings in 2017.

A surplus of bioethanol will be available in Hungary, Belgium, the Netherlands and France. Germany and Italy are expected to remain the main deficit markets in 2017 and 2018.

With the cap of seven percent for conventional biofuels and the potential outlook of lifting EU wide mandates after 2020, the market conditions appear to be dim for bioethanol. Conventional biofuels will likely be out competed with fossil fuels unless Member States will implement national policies to support feedstock and biofuels production. A more cost effective approach to further green the transportation sector would be to introduce higher blends such as E10, and open the market for foreign produced biofuels. But both the imports of bioethanol and biodiesel have been cut off by high import and antidumping duties.

Trade

In 2016, of the total 230 million liters of imported bioethanol, about 170 million liters were imported through zero duty quotas, about 30 million liters were imported from the United States, and about 30 million liters were imported as ETBE.

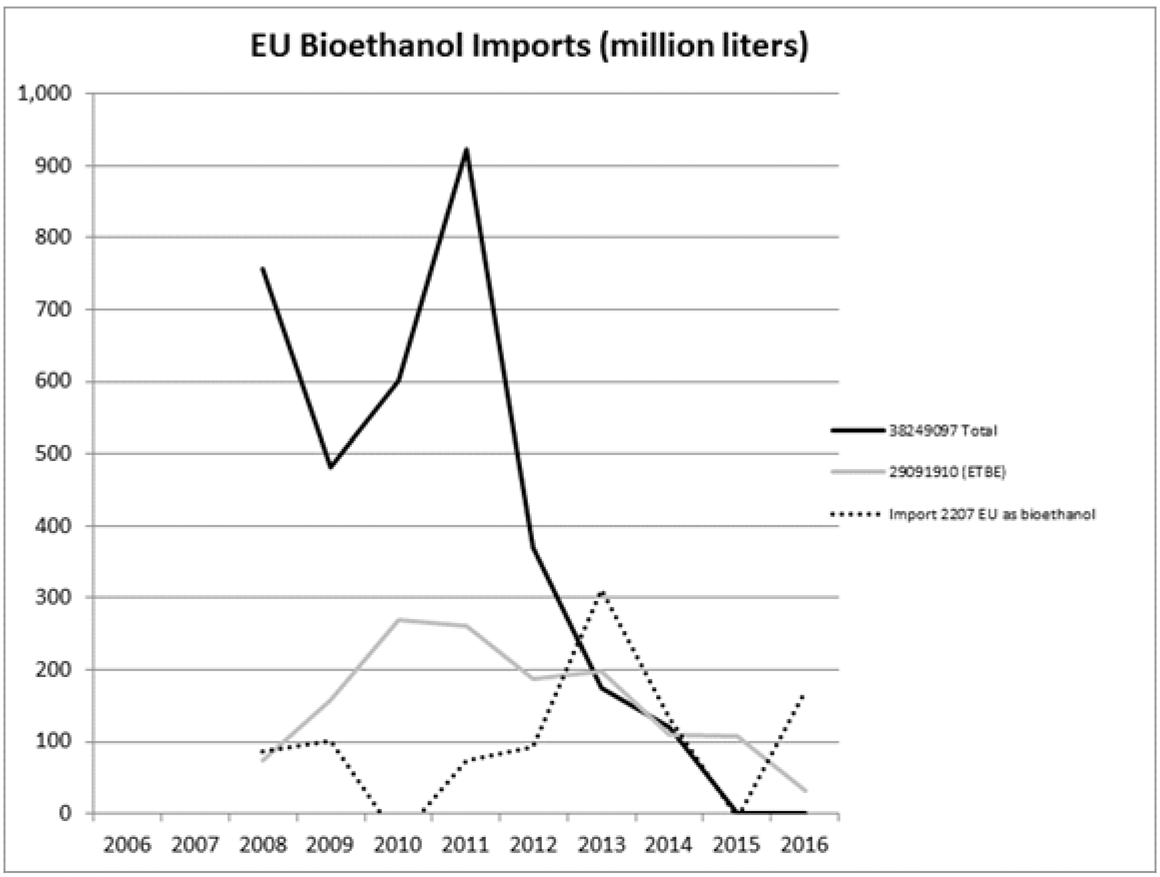


The EC imposed an anti-dumping duty on the bioethanol imports from the United States. On February 23, 2013, the duty was set at €49.20 per 1,000 liters for the coming five years (see the Policy Chapter). Adding up to the already imposed import tariff of €102 per 1,000 liters, a volume of 1,000 liters of ethanol from the United States is charged with €151.2. This rate significantly cut

U.S. exports of bioethanol to the EU. On June 9, 2016, the EU General Court ruled that the EC violated EU legislation by issuing a country-wide duty rather than imposing specific duties for each of the exporters. But even if the duty of €49.20 per 1,000 liters is dropped entirely in late 2017 or early 2018, U.S. suppliers face several challenges in the EU market.

In 2017 and 2018, a slight increase in U.S. corn ethanol production is expected in response to continued stronger demand for gasoline due to low prices. Total U.S. exportable surplus remains slightly above 4 million liters per year in the near-term, allocated among several markets. But EU imports of U.S. ethanol will still be charged the duty rate of €102 per 1,000 liters and have to compete with duty free imports. Currently EU domestic ethanol prices are too low to attract significant volumes of duty free ethanol from foreign markets. Another barrier is the minimum greenhouse gas savings criteria, which is increased from 35 to 50 percent in 2017. Given these constraints it is not expected that even after full abolishment of the antidumping duty, U.S. exports will increase significantly in 2017 or 2018.

In the longer run, a projected long-term decline in EU gasoline use and the FAS outlook for emerging post-2020 EU policy on biofuels used in the transport sector suggests that the sales growth opportunity for all ethanol suppliers is flat to declining.



V. Biodiesel / Renewable Diesel

Unless mentioned otherwise in this chapter the term biodiesel includes traditional first generation biodiesel (FAME) and hydrogenated vegetable oil (HVO).

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 eighty percent of the total transport biofuels market. Biodiesel was the first biofuel developed and used in the EU in 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 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 5. Biodiesel & Renewable Diesel (HVO) (Million Liters)

Calendar Year	2011^r	2012^r	2013^r	2014^r	2015^r	2016^e	2017^f	2018^f
Beginning Stocks	530	575	600	540	590	590	595	620
Production	11,344	11,829	12,417	14,316	14,436	14,724	15,295	16,120
>HVO Production	278	800	1,444	2,151	2,313	2,442	2,570	3,470
Imports	3,164	3,293	1,393	632	541	579	570	570
Exports	100	116	416	182	245	408	450	450
Consumption	14,363	14,981	13,454	14,716	14,732	14,890	15,390	16,210
Ending Stocks	575	600	540	590	590	595	620	650
Production Capacity, FAME (Million Liters)								
Number of Biorefineries	265	263	244	218	205	202	201	193
Nameplate Capacity	24,900	25,160	24,670	22,260	21,615	21,140	21,150	20,320
Capacity Use (%)	44.4%	43.8%	44.5%	54.6%	56.1%	58.1%	60.1%	59.7%
Production Capacity, Renewable Diesel (HVO) (Million Liters)								
Number of Biorefineries	4	4	5	10	11	11	12	14
Nameplate Capacity	1,700	1,700	1,830	2,830	3,395	3,395	3,450	5,300
Capacity Use (%)	16.4%	47.1%	78.9%	76.0%	68.1%	71.9%	74.5%	65.5%
Feedstock Use for FAME Biodiesel + Renewable Diesel (HVO) (1,000 MT)								
Rapeseed oil	6,700	6,750	5,900	6,400	6,380	6,140	6,160	6,150
Palm oil	940	1,470	2,360	2,300	2,600	2,400	2,610	2,720
UCO	680	760	1,100	1,910	2,270	2,440	2,510	2,950
Animal fats	340	350	410	940	965	1,110	1,140	1,220
Soybean oil	950	810	890	850	430	590	620	710
Other (pine oil, tall oil, fatty acids)	50	90	180	170	185	350	355	375
Sunflower oil	10	0	0	0	15	5	5	5
Other virgin veg oil	280	320	310	330	210	250	160	170
Market Penetration, FAME Biodiesel + Renewable Diesel (HVO) (Million Liters)								
Biodiesel+HVO, on-road use	13,717	14,541	13,087	14,445	14,448	14,500	15,100	15,700
Diesel, on-road use	192,540	189,002	189,077	193,992	199,368	200,000	200,635	201,200
Blend Rate (%)	7.1%	7.7%	6.9%	7.4%	7.2%	7.4%	7.3%	7.3%
Diesel, total use	245,886	241,789	240,734	241,047	248,509	252,000	254,350	256,700

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 and 1,282 liters for HVO. Production capacity as of December 31 of year stated. Diesel use 2009-2015: Eurostat; all other: FAS Posts. Trade data: Global Trade Atlas (GTA); HVO trade is assumed to be happening under a biodiesel customs code as no separate trade code for HVO exists. 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, data for stocks is based on the assumption that average stocks amount to the equivalent of two weeks supply of consumption.

Production and Production Capacity

In 2016, EU biodiesel (FAME) and HVO production benefitted from higher exports and higher domestic consumption. As a result, biodiesel/FAME production increased by 1.3 percent, mainly due to expansion in Spain, Germany, Austria, and Hungary. HVO production increased by 5.6 percent in 2016, almost solely driven by elevated Spanish production. In 2017 and 2018, combined biodiesel and HVO production is forecast to increase further by 3.9 and 5.4 percent, respectively. In both years, the increase is supported by Spanish raised consumption mandates. In 2018, the projected increase is based on new HVO plants going into production in France and Italy.

Table 6. EU FAME
Main Producers (Million Liters)

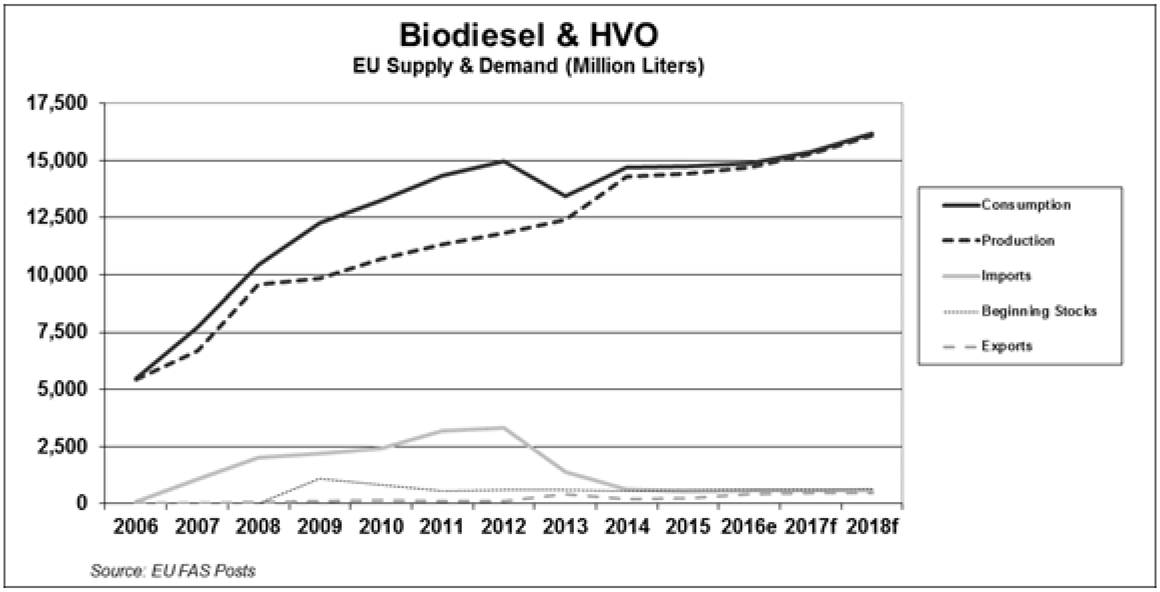
Calendar Year	2011[r]	2012[r]	2013[r]	2014[r]	2015[r]	2016[e]	2017[f]	2018[f]
Germany	3,408	3,106	3,307	3,808	3,505	3,522	3,520	3,520
France	2,090	2,516	2,476	2,681	2,556	2,522	2,410	2,400
Spain	787	538	659	1,017	1,103	1,122	1,420	1,480
Netherlands	558	974	790	1,056	1,056	909	910	910
Poland	414	673	736	786	795	784	795	795
United Kingdom	261	364	648	648	625	625	625	625
Italy	704	326	521	452	625	625	625	570
Belgium/Luxemburg	536	568	568	568	568	568	570	570
Austria	352	301	247	332	386	398	410	410
Portugal	419	356	329	349	386	333	355	406
Other	1,536	1,308	693	468	519	874	1,085	965
Total	11,066	11,029	10,973	12,165	12,124	12,281	12,725	12,650

Ranked by production in 2017 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 = 1136 liters.

Table 7. EU HVO Production (Million Liters)

Calendar Year	2009[r]	2010[r]	2011[r]	2012[r]	2013[r]	2014[r]	2015r	2016[e]	2017[f]	2018[f]
Netherlands	-	-	-	410	872	1,013	1,192	1,154	1,220	1,220
Finland	281	365	250	317	392	438	536	545	545	545
Spain	-	-	28	73	179	377	262	420	430	450
Italy	-	-	-	-	-	323	323	323	323	1,090*
Portugal	-	-	-	-	-	-	-	-	50	50
France	-	-	-	-	-	-	-	-	-	115
Total	**281**	**365**	**278**	**800**	**1,443**	**2,151**	**2,313**	**2,442**	**2,566**	**3,469**

Ranked by production in 2017 r = revised / e = estimate / f = forecast.
Source: FAS EU Posts based on information in MT and converted to liters (conversion rate of 1 MT = 1282 liters).
*Capacity



The structure of the EU biodiesel sector is very diverse and 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. EU biodiesel/HVO production capacity is expected to marginally increase in 2017 to 24.6 billion liters. A larger 4.1 percent increase to 25.6 billion liters is forecast for 2018, when new HVO facilities in France and Italy are expected to start production. Biodiesel (FAME) production facilities exist in every EU member state with the exception of Finland, Luxemburg, and Malta. In contrast, HVO production is concentrated in only six countries (see table above). The majority of HVO capacity consists of dedicated HVO plants, while in Spain HVO is co-processed with conventional fuel in oil refineries. EU HVO production capacity stands currently at 3.4 million liters and is forecast to increase to 5 million liters in 2018, when two new facilities will start production in Italy and France.

Feedstock Use

Rapeseed oil is still the dominant biodiesel feedstock in the EU accounting for 46 percent of total production in 2016. However its share in the feedstock mix has considerably decreased compared to the 72 percent share in 2008 mostly due to higher use of recycled vegetable oil, used cooking oil (UCO) and palm oil.

Palm oil was the second-most important feedstock in 2016. Its use has further increased mainly because of its use for HVO production. Currently palm oil is mainly used in the Spain, the Netherlands, Finland, Italy, and France, and to a much lesser extent in Germany, Portugal, Romania, and Poland.

UCO came in third place in terms of feedstock use in 2016. The use of UCO has received a push after some MSs (Austria, Belgium, Croatia, France, Hungary, Ireland, the Netherlands, Poland, Portugal, Slovenia, and the United Kingdom) introduced double-counting (for details see Policy section). The largest EU producers of UCO-Methyl Ester UCOME were the Netherlands, Germany, and the United Kingdom.

Animal fats benefitted far less from double-counting 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 its production is exported to other MSs. Increases of animal fat use are a result of new plants rather than a function of feedstock price as using animal fat requires changes to the technical equipment. In 2016, the Netherlands was by far the largest user of animal fat for biodiesel production followed by the United Kingdom, France, Germany, Denmark, and Austria.

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, Germany, France, and Italy. Smaller amounts are being used in Portugal, Bulgaria, Romania, and the Netherlands.

Sunflower oil only comprised two percent of the total biodiesel feedstock and is mainly used in France and Greece; together accounting for 83 percent of EU sunflower oil based biodiesel production. The category "other" includes pine oil and wood (Sweden), fatty acids (Finland and Germany), tall oil (Finland), algae (Italy), and cottonseed oil (Greece).

The majority of palm oil is imported while a large share of soybean oil is crushed from imported soybeans. In contrast, the majority of rapeseed oil is of domestic origin. The 6.2 MMT of rapeseed oil feedstock projected for 2017 is equivalent to about 15.4 MMT of rapeseed. This also generates about 9.2 MMT of rapeseed meal as byproduct most of which is used for animal feed. Similarly the 0.6 MMT soybean oil will have to be crushed from 3.1 MMT of soybeans. This will generate about 2.4 MMT soybean meal (see also FAS EU Oilseeds Annual).

Consumption

Biodiesel (FAME & HVO) consumption is driven almost exclusively by MS mandates and to a lesser extent by tax incentives. 2012 marked the end of years of rapid biodiesel use increases in the EU and 2013 saw consumption decline by ten percent. The decline was largely a result of two factors: double-counting and reduced mandates. Double-counting of certain biofuels was applied in Germany (2011-2014), the Netherlands, Belgium, the United Kingdom, Portugal, Austria, Italy (2012 until early 2014). Double-counting diminishes the physical demand even if the blending mandates remain unchanged. In addition, Spain reduced its consumption mandates from 7 percent down to 4.1 percent at the beginning of 2013.

From 2014 through 2016, biodiesel use fluctuated as mandate increases in some MSs were off-set by changes to the domestic quota allocation in Portugal as well as Germany transitioning from an energy-based use mandate to a minimum greenhouse gas (GHG) reduction mandate. The latter means that companies are inclined to calculate actual GHG values rather than using the default values of the RED because fuel companies favor biofuels with a better GHG reduction value. This reduces the physical amount of fuel needed to meet the mandate. In addition, in the Czech Republic an increase in the excise tax for biofuels made biodiesel more expensive compared to fossil diesel.

For 2017 and 2018, EU biodiesel consumption is expected to increase by 3.4 and 5.3 percent, respectively, as a result of mandate increases in a number of MSs. In 2016, France, Germany, Italy, Spain, and Sweden were the largest biodiesel consumers in the EU accounting for 63 percent of the total EU biodiesel consumption (see table). Projections for the following years indicate that the top two countries will remain the same; while Italy and Spain will trade places in 2017 and back in 2018. The United Kingdom will pass Sweden and become number five in 2018.

Table 8. EU Biodiesel/HVO Consumption Main Consumers (million liters)								
Calendar Year	**2011[r]**	**2012[r]**	**2013[r]**	**2014[r]**	**2015[r]**	**2016[e]**	**2017[f]**	**2018[f]**
France	2,624	2,914	2,971	3,232	3,249	3,272	3,270	3,290
Germany	2,756	2,874	2,581	2,678	2,465	2,467	2,640	2,640
Spain	1,921	2,563	941	1,036	1,091	1,293	1,460	1,530
Italy	1,654	1,623	1,404	1,371	1,321	1,322	1,320	1,890
United Kingdom	1,034	636	977	954	909	966	1,020	1,080
Sweden	289	415	569	909	1,022	1,022	1,020	1,020
Poland	1,079	837	843	730	738	738	740	740
Austria	576	567	575	708	710	716	720	720
Finland	137	131	195	460	460	454	450	450
Belgium	344	354	364	375	454	454	450	450
Portugal	476	356	332	351	399	327	380	385
Others	1,473	1,711	1,703	1,911	1,913	1,858	1,920	1,925
Total	**14,363**	**14,981**	**13,454**	**14,716**	**14,732**	**14,890**	**15,390**	**16,120**

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.

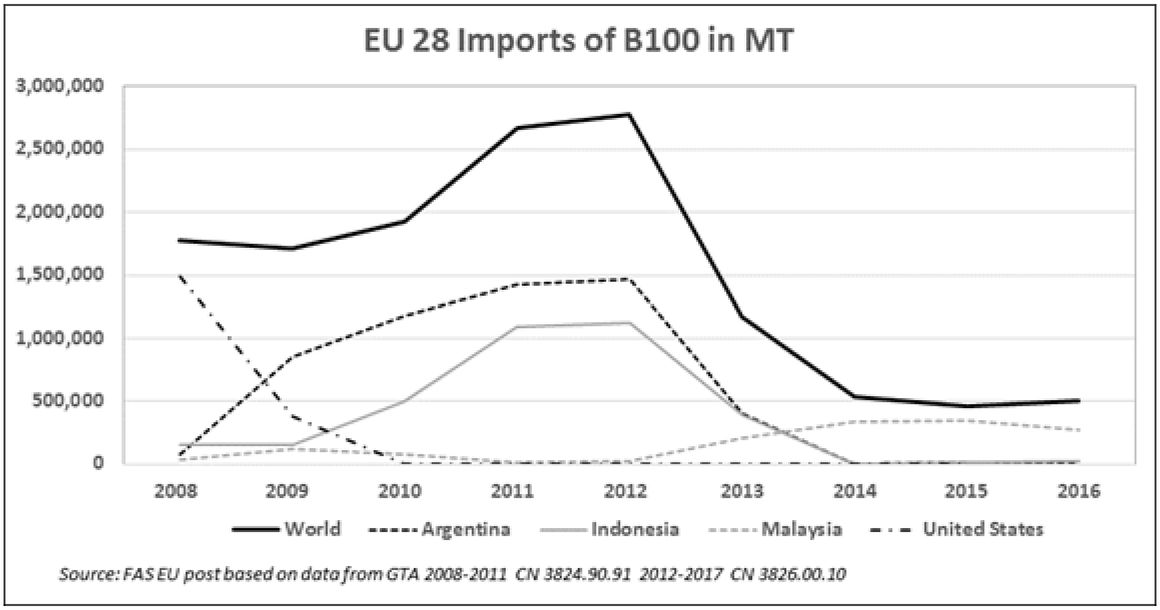
Trade

In 2016, most biodiesel, about 570 million liters, was imported under HS/CN code 3826.00.10 containing at least 96.5 percent biodiesel. The equivalent of 3 million liters and 6.6 million liters was imported as blend under HS/CN code 3826.00.90 (containing between 30 and 96 percent of biodiesel) and 2710.20.11 (containing at most 30 percent biodiesel), respectively. 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.

Currently, the EU does not have a separate customs code for HVO. Thus HVO could enter the EU under a variety of CN codes and imports are potentially underestimated.

In 2016, the dominant supplier of biodiesel to the EU was Malaysia with 54 percent of EU biodiesel imports originating there, followed by China, Norway, Indonesia, and India with 8, 7, 6, and 6 percent, respectively.

EU biodiesel exports to destinations outside the bloc are marginal and normally only amount to around one percent of production and are thus not discussed in this report.



VI. Advanced Biofuels

As biofuels replace fossil fuels in the transportation sector and generally have lower greenhouse gas (GHG) emissions, they are considered an important product of the bio-economy. In particular advanced or second generation biofuels, fuels produced from non-fossil, non-food materials, have lower GHG emissions than fossil fuels. Because hydrogenated vegetable oils (HVO) can supply specific fuel markets such as aviation, and can fully replace fossil fuels in a mix (drop-in fuels) they are considered advanced biofuels in this report, but are not necessarily produced from non-food feedstocks.

On October 5, 2015, the ILUC (Indirect Land Use Change) Directive (EU) 2015/2013 entered into force. The ILUC Directive amended the Renewable Energy Directive (RED) with the goal to support the market for advanced biofuels. On November 30, 2016, the EC published its legislative proposal on the further revision of the RED (RED II). The RED II sets a target to produce at least 27 percent of its energy from renewable sources by 2030.

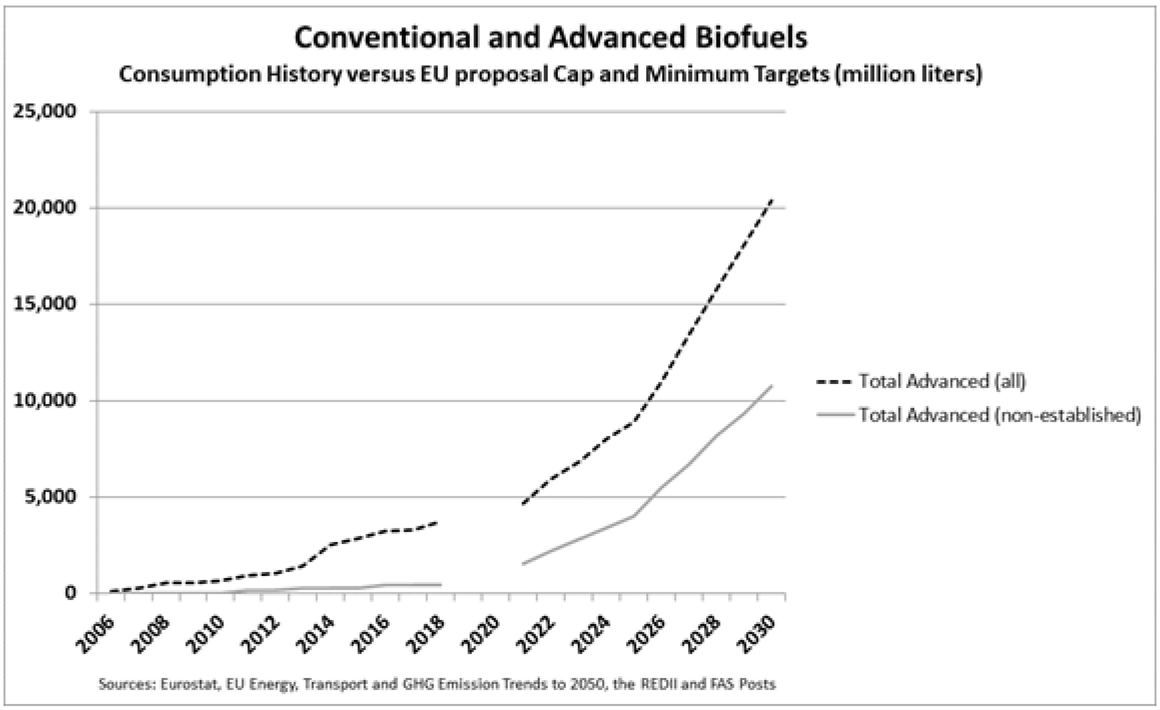
The RED II supports the marketing of advanced biofuels with the following elements:

- A declining cap of food crop-based biofuels from 7 percent in 2021 to 3.8 percent in 2030.
- A minimum share of energy from advanced biofuels from 1.5 percent in 2021 to 6.8 percent by 2030. In Annex IX Part A and B of the proposal, the EC lists the acceptable feedstock for the production of advanced biofuels.
- A sub-target from 0.5 percent in 2021 to 3.6 percent by 2030 for advanced biofuels produced with feedstocks listed in part A, Annex IX. Agricultural and forestry feedstocks listed are: palm oil mill effluent, tall oil, bagasse, grape residues, nut shells, husks, corn cobs, straw, energy crops, forest residues and biomass sourced from forests except saw logs and veneer. Part B of Annex IX lists: used cooking oil, animal fats not suitable for feeding, and molasses.
- Advanced alternative fuels used for aviation and maritime can be counted 1.2 times toward the 6.8 percent renewable energy mandate (see the Policy section for more information).

Table 9. EC proposal for biofuel blending targets in the RED II										
	2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Maximum Conventional	7.0%	6.7%	6.4%	6.1%	5.8%	5.4%	5.0%	4.6%	4.2%	3.8%
Minimum Advanced[a]	1.5%	1.9%	2.2%	2.6%	2.9%	3.6%	4.4%	5.2%	6.0%	6.8%
Minimum Advanced Non-Established[b]	0.5%	0.7%	0.9%	1.1%	1.3%	1.8%	2.2%	2.7%	3.1%	3.6%

(a) Annex IX of the RED II, (b) Part A of Annex IX

Based on historical Eurostat transport fuel statistics and EC projections for transport fuel use (EU Energy, Transport and GHG Emission Trends to 2050) combined with the proposed maximum blending rates for conventional and minimum blending rates for advanced biofuels in the RED II, the consumption of advanced biofuels must increase significantly as from 2020 (see graph below).



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 biorefinery, 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 Bio-Based Industries Joint Undertaking 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.

An example of a project funded by the Bio-Based Industries Joint Undertaking (BBI-JU) is the Bioforever project. On September 1, 2016, a consortium of fourteen companies including the Rotterdam Port Authority announced the start of a demonstration project for the conversion of woody biomass into value-adding chemical building blocks. The project is 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 companies are located in the Netherlands, Germany, France, Norway, Finland, the United Kingdom and Greece. The demonstration project starts in September 2016 and will run for 3 years. The overall budget is €16.2 million with a €9.9 million contribution from the EC.

Production of Advanced Biofuels

In the past six years, the production of hydrogenated vegetable oils (HVO) has taken off in the EU. HVO can be produced from waste oils and fats and can fully substitute petroleum fuels, such as kerosene. In 2016, HVO production is estimated at 2.4 billion liters, and is expected to increase to about 2.6 billion liters in 2017. With new plants in Italy and France, production could further expand to about 4 billion liters in 2020. 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. Expansion of capacity has been announced in Finland (100 million liters in 2020) and, in Europe but outside the EU, in Norway (50 million liters in 2021). It is anticipated that the capacity for cellulosic ethanol production could possibly increase to a maximum of about 200 million liters in 2021.

Specific mandates are important for the further commercialization of advanced biofuels. Italy was the first EU Member State to mandate the use of advanced biofuels. The Decree requires gasoline and diesel contain at least 1.2 percent of advanced biofuel made of waste and non-food feedstocks as of January 2018 and 2019, rising to 1.6 percent in 2020 and 2021, and 2 percent by 2022. Denmark also 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 and animal fats.

Below table 10 with the operational or close to operational advanced biofuel plants at commercial scale in the EU.

Table 10. Advanced Biofuels Plants in the EU

Country	Process	Biofuel	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	Oils and fats	945 (7 plants)	2011
The Netherlands	H	HVO	Oils and fats	1,280	2011
Italy	H	HVO	Palm Oil	465	2014
Finland	H	HVO	Tall Oil	115	2015
Italy	H	HVO	Oils and	680	2017

			fats		
France	H	HVO	Oils and fats	570	2018
Biochemical					
Italy	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=hydrogenation, HVO=Hydrogenated Vegetable Oils, HL=hydrolysis, OS=oxygenate synthesis, P=pyrolysis

Hydrogenated Vegetable Oil (HVO)

Finland and the Netherlands: Neste Oil has developed a process of hydrogenation to produce hydrogenated vegetable oils (HVO) with the product name NExBTL. The product is sold as drop-in fuel for road transportation and is used by commercial airlines. In addition to drop-in biofuels, the Neste plants also produce renewable naphtha, propane and alkanes. In Finland, Neste operates one plant with two lines of about 215 million liters each. 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. During 2016, all HVO plants operated at full or nearly full capacity with the exception of an outage of the plant in Rotterdam. In 2016, 78 percent of the feedstock consisted of waste fats and oils (68 in 2015), and 19 percent crude palm oil (31 in 2015). The waste and residues consist of mainly palm fatty acid distillate (PFAD), animal fats and unused cooking oil (UCO). During the second half of 2017, Neste is planning to use a biodiesel plant in the Netherlands as pre-treatment plant for processing wastes into suitable feedstocks for HVO production.

Spain: In July 2011, the company CEPSA started producing HVO at two refineries and since 2013, the company REPSOL started producing HVO at one refinery. Spanish HVO production increased from 270 million liters in 2011 to 945 million liters in 2016, when a total of seven refineries have HVO co-processing capacity. For more information see GAIN Report SP1321 - Spain's Bioethanol Standing Report.

Italy: In 2014, an HVO plant was opened by Energy Group Eni SpA in Venice, Italy. In 2017, the refinery is expected to produce approximately 325 million liters per year. Production is forecast to increase to 540 million liters in 2018. The feedstock, currently palm oil, will then include also animal fats, used oil, oils from algae, and various types of biological waste. Following the model adopted for Venice, Eni is converting the Gela refinery in Sicily into a renewable diesel production facility to produce 680 million liters per year. The reconversion started in April 2016 and the facility is likely to be operational in 2018. Used oil, animal fats, oils from algae, and various types of biological waste will be used as feedstock. For more information see GAIN Report IT15110 - Biofuels Overview – Italy.

Finland: In 2015, the forest product company UPM opened a HVO plant in Lappeenranta. The capacity of the plant is about 115 million liters per year. The feedstock used is tall oil, a residue of pulp production.

France: Commercial production of HVO has not yet taken off in France but several projects have been announced. The French group Total stated that it will convert its refinery site in La Mede (southern France) into a HVO plant with a capacity of 570 million liters. The new biorefinery would be put into operation by the end of 2017 or the beginning of 2018. The biorefinery is planning to produce around 40 percent of the HVO out of waste oil, and to import vegetable oils, mainly palm oil. Current biodiesel producers have expressed concern that this project could 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 bio-jet fuel per year from one MMT of biomass by 2020. The demonstration-scale plant is located at Total's former Flandres refinery in Dunkerque.

Biomethanol

The Netherlands: In June 2010, the advanced biofuel plant BioMCN started production. The plant has a capacity of 250 million liters and produces biomethanol from biogas. Biomethanol can be blended with gasoline or used for the production of bio-methyl tertiary butyl ether (bio-MTBE), bio-dimethyl ether (bio-DME), or synthetic biofuels. On April 11, 2017, BioMCN announced to use CO_2, as byproduct of biogas production, to produce an additional volume of 19 million liters of biomethanol.

Cellulosic Ethanol

Spain: In 2008, Abengoa Bioenergy completed a demonstration plant with an annual capacity of 5 million liter in Babilafuente (Salamanca). The sale of all Abengoa's non-core assets as part of a debt-restructuring plan affected advanced bioethanol development and production in Spain. Reportedly the plant in Salamanca is closed.

Italy: In 2013, Beta Renewables started the commercial production of cellulosic ethanol. Beta Renewables is a joint venture between Biochemtex, a company of the Italian Mossi Ghisolfi Group and the U.S. fund Texas Pacific Group (TPG). The Crescentino plant has an annual production capacity of 50 million liters using 200,000 MT of biomass. The feedstock consists of wheat straw, rice straw and husks, and Arundo donax, an energy crop grown on marginal land. Wood waste from the forest industry and lignin from the ethanol plant are used as feedstock at the attached power plant, which is a critical source of revenue for the plant.

Finland: A cellulosic ethanol plant with an annual capacity of 10 million liters is anticipated to be operational in 2017. 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): 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.

Advanced Biofuels for Aviation

The EC forecast the consumption of jet fuels in aviation to increase steadily by 2050 due to the increase in transport activity and despite improvements in efficiency. Fossil fuels continue to dominate, and only after 2035 bio-kerosene is 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 is scheduled to achieve two MMT of sustainable biofuels used in the EU civil aviation sector by the year 2020. Since 2008, the aviation sector has been conducting test flights with biofuels. The project is planning to make 2 MMT of aviation biofuels in 2020, about 2.5 billion liters.

VII. Biomass for Heat and Power

This Chapter describes the EU market for biomass intended for the production of heat or power, which is either generated through direct combustion or through the production of biogas. Forestry products, such as chips and pellets are the main feedstock for direct combustion, while a wide range of inputs are used for the production of biogas.

A. Wood Pellets

EU Production, Supply and Demand Table

Table 11. Wood Pellets (1,000 MT)

Calendar Year	2010	2011	2012	2013	2014	2015[c]	2016[c]	2017[c]	2018[c]
Beginning Stocks	467	696	713	642	506	948	1,279	1,761	1,661
Production[a]	9,186	9,470	10,652	12,200	13,100	14,100	14,800	15,100	15,600
Imports[b]	2,515	3,115	4,367	6,096	6,547	7,172	8,000	8,500	9,000
Exports[b]	72	68	90	132	105	141	118	200	200
Consumption[c]	11,400	12,500	15,000	18,300	19,100	20,800	22,200	23,500	25,000
Ending Stocks	696	713	642	506	948	1,279	1,761	1,661	1,061
Production Capacity									
No. of Plants[a]			497	516					
Capacity[a]	14,845	15,000[c]	15,980	17,000[c]	18,500[c]	19,000	19,500	20,000	20,500
Cap. Use (%)	62%	63%	67%	72%	71%	74%	76%	76%	76%

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

Production

The EU is the world's largest wood pellet market, with consumption of about 22.2 MMT of pellets in 2016 (see table). Based on the EC mandates and MS incentives, the demand is expected to expand further to about 25 MMT in 2018. Future consumption will significantly depend on a range of market factors and in particular MS incentives and conditions.

Table 12. Main Pellet Producers (1,000 MT)

Calendar Year	2011	2012	2013	2014[e]	2015[e]	2016[e]	2017[e]
Germany	1,880	2,200	2,250	2,100	2,000	1,950	2,300

Latvia	713	979	1,200	1,350	1,500	1,600	1,650
Sweden	1,340	1,340	1,310	1,490	1,550	1,550	1,550
Austria	940	893	962	945	1,000	1,050	1,100
France	550	680	750	1,040	950	1,000	1,000
Estonia	50	400	600	600	850	900	925
Poland	600	600	600	600	600	600	600
Portugal	675	700	800	700	700	500	500
Spain	240	250	300	350	475	550	550
Total	**9,470**	**10,652**	**12,200**	**13,100**	**14,100**	**14,800**	**15,100**

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

With a production of about 14.8 MMT in 2016, 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 growing demand for pellets has supported a further increase in domestic production. Exceptions in table 12 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 3.5 MMT. In 2016, production amounted to 2.0 MMT, 90 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.
- Wood pellet production has expanded rapidly in the Baltic Region (Latvia, Lithuania and Estonia) during the past five years. In 2016, however, expansion of production and exports has been limited to about 125,000 MT compared to 2015. With about 1.6 MMT, Latvia is the main producer in this region. 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. Depending on domestic use, Swedish self-sufficiency fluctuates between 70 and 90 percent. In years of high demand, Sweden imports from Russia and the Baltics.
- French wood pellet production has stabilized during the past three years. In 2015, French production decreased after two warm winters and a decrease in the price of fossil fuels.
- Austrian pellet production followed a moderate growth rate during the past three years. This expansion is based on an increasing domestic as well as foreign demand, mainly in Italy and Germany.
- Another growing pellet producer is the Czech Republic. Czech production increased from about 150,000 MT in 2010 to 300,000 MT in 2016. About half of this production expansion is exported, mainly to Italy and Austria.
- There is an excess of capacity present in most MSs, but particularly in Spain. Only about forty percent of the Spanish production is being used.

The major raw material for pellets has traditionally been sawdust and byproducts from sawmills. With increasing competition for sawdust resources, a broader sustainable raw material is 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.

Consumption

While the EU produces about fifty percent of world production, EU demand represents about 75 percent of the market. In 2016, total EU consumption was 22.2 MMT of which about 65 percent was used for heating and 35 percent for power. The major users of wood pellets in the EU are the United Kingdom, Italy, Denmark, Germany, Sweden, Belgium, France and Austria.

Table 13. Main Pellet Consumers (1,000 MT)

Calendar Year	**2011**	**2012**	**2013**	**2014^e**	**2015^e**	**2016^e**	**2017^e**
UK	1,000	1,400	3,700	4,900	6,700	7,300	7,800
Italy	1,950	2,200	2,500	3,400	3,300	3,400	3,400
Denmark	1,600	2,100	2,400	2,100	2,100	2,100	2,300
Germany	1,400	1,700	2,000	1,800	1,850	2,000	2,200
Sweden	1,880	1,700	1,860	1,650	1,650	1,605	1,600
Belgium	1,200	1,700	1,500	900	1,250	1,250	1,100
France	450	550	640	1,040	860	1,005	1,030
Austria	720	790	880	950	975	1,000	1,000
Spain	200	250	380	700	700	475	475
Netherlands	1,000	1,250	1,200	500	100	100	300
Total	**12,500**	**15,000**	**18,300**	**19,100**	**20,800**	**22,200**	**23,500**

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

Residential Use of Pellets

Residential use for heating, about 40 percent of the total pellet market, is a relatively stable market compared to industrial heat and power generation. However, the past four winters have been relatively mild and coupled with the low prices for fossil inputs, tempered the use of pellets for residential heating.

In Italy, Germany, France and Austria pellets are mainly used in small-scale private residential and medium-sized industrial boilers for heating. In some MSs, such as Sweden, Germany, Austria, France and Spain, 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 forecast to be 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. However, only 15 percent of the demand is met by domestic production, with the remaining 85 percent being covered by increasing imports. Currently, Italy sources pellets mainly from Austria, Croatia and Germany. Since 2015, imports from the United States have fallen significantly, due in part to a warm winter and the higher price of U.S. wood pellets over European competitors. But market logistics and economics indicate that in the close future imports from North America will recover.

Industrial Use of Pellets

Use of pellets for energy generation by medium-sized industries or public buildings such as hospitals and swimming pools is generally less dependent on weather conditions. Demand for industrial pellets depends primarily on EU MS mandates and incentives.

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

- The UK Government enforced the EU Industrial Emissions Directive, by requiring major electricity suppliers to convert from coal to renewable feedstock by 2015. This boosted consumption from 1.4 MMT in 2012 to 7.3 MMT in 2016 (see GAIN Report UK Wood Pellet Market). The market will continue to increase for wood pellets in the near-term. The conversion of an additional large electricity generator capable of using 1.5 MMT of wood pellets in the place of coal is set to be completed by the end of 2017. Existing capacity is expected to reach full operation in the next year. Another plant with a capacity of 1.0 MMT is expected to be operational in 2019.
- Sweden and Denmark have a high target 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 Sweden pellet consumption declined during the past four years. Explanations are relatively warm winters and the declining prices of fossil inputs. During 2012 – 2016, Danish consumption of pellets stagnated around 2.1 MMT but as another CHP plant has been converted to using pellets, use is expected to grow in 2017.
- 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.
- Current Belgian industrial use is estimated at about 1 MMT to 1.3 MMT per year. However, the closing of a power plant in Ghent scheduled for 2018 would imply a reduction in imports into Belgium of between 500,000 MT and 600,000 MT annually. A recovery of pellet consumption is unlikely as the Belgian government retracted funding for two new plants. In addition, the license of a power plant in Wallonia, which uses between 400,000 MT and 500,000 MT of wood pellets annually, will expire in 2017.
- In the Netherlands, demand for industrial pellets has been uncertain due to stringent Dutch sustainability requirements. 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. It is still uncertain what the implications of this will be for the sourcing of pellets (for more information see *Pellet Sustainability Criteria*). Apart from the Dutch power sector, the Dutch chemical sector is planning to use wood pellets on the longer term. The Dutch use of pellets is expected to gradually increase as of mid-2017.
- Also in France, there is a potential for industrial use of pellets. There is pressure from the local forest sectors to use local wood, but demand is gradually outpacing domestic supply. Some new bioenergy projects are located close to harbors and are already using imported pellets.

Besides wood pellets, large quantities of wood chips and briquettes are used. 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. Most chips are sourced locally, but Scandinavia is regarded as a potential growth market for imports from non-EU destinations.

Trade

Table 14. Main EU Importers of Wood Pellets (1,000 MT)

	Total Imports[a]		Imports from U.S.	
Calendar Year	**2015**	**2016**	**2015**	**2016**
United Kingdom	6,519	7,069	3,528	4,128
Denmark	2,059	2,189	28	94
Italy	1,654	1,664	48	19
Belgium	986	906	629	533
Sweden	355	268	0	0
Germany	446	425	2	0
Austria	369	379	0	0
France	156	245	13	95
Netherlands	141	144	38	22
Total EU28	**-**		**4,287**	**4,902**

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

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 the infrastructure is expected to further increase the sourcing from North America. The markets for pellets in Germany, Austria and lesser extent France and Italy is more isolated and depend mostly on the production in this region itself.

Table 15. Main Suppliers of Wood Pellets to EU (1,000 MT)

Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
United States	1,001	1,764	2,776	3,890	4,287	4,902
Canada	1,160	1,346	1,963	1,259	1,475	1,685
Russia	477	645	702	826	786	842
Ukraine	150	217	165	136	149	165
Belarus	101	112	116	122	158	145
Other	226	283	374	314	317	364
Total	**3,115**	**4,367**	**6,096**	**6,547**	**7,172**	**8,103**

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 2016, U.S. exports to the EU totaled 4.9 MMT, representing a value of U$920 million. If trade flows remain consistent with current patterns, the United States has the potential to supply at least half of the import demand, which would represent a trade value of potentially over US$1 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 by the individual MS 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 MSs including Belgium, Denmark, and the Netherlands, developed their own rules in response to the growing use of imported wood pellets.

On November 30, 2016, the legislative proposal of the European Commission (EC) on the revision of the Renewable Energy Directive (RED II) was published. The RED II introduces EU wide sustainability criteria for biomass. In the RED II, the EC withdraws the possibility to conclude bilateral or multilateral agreements with third countries covering sustainability certification included in Article 18 (4) of the current RED (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, and Belgium.

In the Netherlands, the Dutch Energy Accord of September 2013 adopted to 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 may make it impossible for Dutch buyers to implement long term contracts with pellet producers.

B. Biogas

The EU biogas sector is very diverse. Depending on national priorities, i.e. whether biogas production is primarily seen as a means of waste management, as a means of generating renewable energy, or a combination of the two. Countries have structured their financial incentives (or the lack thereof) to favor different feedstocks. Germany and the United Kingdom, the two largest biogas producers in the EU, represent the two ends of the scale according to the latest Eurostat data (2015). Germany generates 93 percent of its biogas from the fermentation of agricultural crops and residue while the United Kingdom, along with Estonia, Greece, Ireland, Portugal, and Spain, relies on landfill and sewage sludge gas for over 80 percent of its biogas. All other countries use a variety of feedstock combinations.

Table 16. Biogas (Ktoe)

Calendar Year	2011	2012	2013	2014	2015	2016[e]	2017[f]	2018[f]
Landfill	2,739	2,744	2,817	2,755	2,682	2,650	2,630	2,610
Sewage Sludge	1,169	1,195	1,373	1,365	1,372	1,375	1,375	1,375
Field Crops/ Manure/ Agro-food industry waste	6,509	8,248	9,709	10,795	11,489	12,000	12,500	13,000
Total	10,416	12,187	13,898	14,915	15,543	16,025	16,505	16,985

Sources: 2009-2015 Eurostat table nrg_109, downloaded on May 2, 2017; 2016-2018: e, f = Estimate/Forecast EU FAS Posts

Germany is the leader in biogas production from biomass accounting for 64 percent of total EU production in 2015. Italy, the Czech Republic, and the United Kingdom followed with a production share of 13, 5, and 4 percent, respectively.

- Due to changes to the German renewable energy law (EEG), the attractiveness of investing in new biogas plants is limited. Instead, investments are focused on rejuvenating existing plants. Farmers receive an incentive to invest in biogas digesters through a guaranteed feed-in price, which is considerably higher than that of electricity generated from other sources.

- Biogas production is increasing in the Czech Republic (driven by feed-in tariffs) and Denmark (driven by the goal to use 50 percent of livestock manure for biogas production in 2020).
- In France, the government seeks to increase the number of biogas facilities by means of investment support through its 2016 Multi-Year Energy Plan. However, administrative burdens are slowing down the development of biogas projects in France.
- According to its National Renewable Energy Action Plan (NAP), Hungary wants to increase its biogas production capacity to 100 MW by 2020. However, the increase is stifled by problems with the green energy feed-in system and low electricity purchase prices, which make further investments into biogas facilities economically unattractive.
- In the Netherlands, high corn prices in combination with low electricity prices have led to a decline in biogas production. On June 13, 2017, the Dutch Government made a subsidy of €150 million available for manure digestion facilities to reduce the oversupply of diary manure and increase the production of renewable energy.

Biogas is mainly used to generate electricity and/or heat. The trend is toward the so-called cogeneration plants which produce electricity and capture the process heat at the same time (Germany, France, the Netherlands, Austria, Czech Republic, and Poland). The heat can be supplied to nearby buildings or sold to district heating systems. A growing number of large scale operations are purifying the biogas (50-75 percent methane) to bio-methane (99 percent methane) and then subsequently entering it into the natural gas grid (Germany, Austria, France).

The use of purified biogas as transportation fuel is still marginal in most EU countries with the exception of Sweden and Germany. In 2015, the EU, according to Eurostat, consumed 127.5 TOE of biogas for transportation uses: 97 TOE in Sweden, 30 TOE in Germany, and 0.5 TOE in Austria.

Table 17. Overview of the EU-28 Biogas Sector by Member State

Country	**No. of biogas plants**	**Total capacity in MW**	**Biogas production in TOE** (Eurostat 2015)	**Electricity production GWh**	**Feedstock**
Austria (2016)	392	116.2	300.1	559 from biogas plus 19 from sewage and landfill gas (CY2014)	Corn silage, manure, agricultural and food waste, sewage gas, landfill gas
Belgium (2012)	39		227		Manure, corn silage, agricultural and food waste
Czech Republic (2015) – no newer data available yet	507	358	613	2,614 (2015)	Corn silage, hay, industrial and municipal waste
Croatia			36		
Denmark (2015)	21		152		Manure

Estonia (2013)		4	13	16	Landfill gas, sewage sludge, manure
Finland (2010)	70		103		Municipal waste
France (2016)	478 (2016)	385 (2016)	539	2,128 electricity 1,419 heat (2015)	Municipal waste, sewage sludge, industrial waste, farm waste
Germany (2015)	8,861	4,018	7,854	30,110 for electricity 18,980 for heat 530 for fuel	Corn and rye silage, grains, manure, waste, sugar beets
Greece (2016)	19	49	91		Manure and agricultural waste
Hungary (2015)	74	69.5	80	275 for electricity	Manure (867,000 MT), corn silage (165,000 MT), sugar beet slices (200,000 MT) (together 47 plants); sewage sludge (11 plants); landfill gas (16 plants)
Italy (2016)	> 1,500	1,200	1,872	7,400	Manure, agro-industry waste, OFSUW
Latvia (2013)		45	88	222	Manure, municipal and food processing waste, waste water treatment sludge
Lithuania (2013)	9	15	23	42	Agricultural crops, food industry waste, sludge, energy crops
Netherlands (2015)	97		327	550	Manure, corn silage (30,000 MT), agricultural and food waste
Poland (2015)	78	67 electricity 68 heat	229	429 for electricity 225 for heat	Sewage sludge, landfill gas, energy crops, plant and animal waste
Portugal (2011)	100	42	83	140	Manure Landfill gas, OFSUW
Slovakia (2015)	111	103	149	810	Corn silage, manure, agricultural waste
Slovenia (2010)	21	21	30	n/a	Manure, agricultural crops, waste water, landfill gas
Spain (2015)	145	223	441	1,174 (163 ktoe)	Landfill collections (70 plants); agro-industrial waste (39 plants); sewage sludge (15 plants); OFSUW (15 plants), industrial waste(6 plants)
Sweden (2011)	230		167	1,400	waste materials, manure, crops
United Kingdom (2010)	184 Agri 177 Waste	1,500	2,252	8,670	Food waste, brewery waste, OFSUW, animal slurry & manure

OFSUW = organic fraction of solid urban waste MW = Mega watt GWh = Giga watt hours
Sources: Eurostat table nrg_109 (column biogas production in TOE), downloaded on May 2, 2017; EU FAS Posts (all other)

VIII. Notes on Statistical Data

Bioethanol

Production capacity, production and consumption figures are based on statistics of the European Commission, Eurostat, the European Renewable Ethanol Association (ePURE) and FAS Posts. FAS Posts based their estimates on figures of 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 during 2006-2009 are based on estimates of ePURE. Other 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. As the EU has no Harmonized System (HS) code for bioethanol, trade numbers are difficult to assess. The estimation of the EU import figures after 2009 is based on EU imports through preferential trade under HS 2207, EU imports from Brazil under HS code 3824.90.97, U.S. exports to the EU under HS 2207, and EU imports of HS code 29091910 (ETBE, 45 percent ethanol).

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 of 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 = Hydrogenated 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
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

<u>Yields Ethanol</u>
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
Soyoil, crude: 1 MT = 1,113 liters
Soyoil, 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	GM1717	Biofuel Mandates in the EU by Member State	06/07/17
EU	E17030	EU Sugar Annual	04/24/17
EU	-	EU Grain and Feed Annual	04/06/17
EU	AU1704	EU Oilseeds and Products Annual	04/05/17
Italy	IT1636	The Italian Wood Pellet Market	08/16/16
Czech R.	EZ1607	Biofuels Annual - Czech Republic	08/02/16
Estonia	-	Biofuels Annual - Estonia	07/12/16
Latvia	-	Biofuels Annual - Latvia	07/11/16
Lithuania	-	Biofuels Annual - Lithuania	07/06/16
Poland	-	Biofuels Market Outlook in Poland	07/05/16
EU	NL6021	EU Biofuels Annual 2016	07/04/16
EU	E16025	EU Rules Against Anti-Dumping Duty on U.S. Ethanol	06/17/16
Italy	IT5104	Biofuels Overview – Italy	01/06/16

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.

[1] The European Industrial Bioenergy Initiative (EIBI) defines advanced biofuels in the following manner: those (1) produced from lignocellulosic feedstocks (i.e. agricultural and forestry residues, e.g. wheat straw/corn stover/bagasse, wood based biomass), non-food crops (i.e. grasses, miscanthus, algae), or industrial waste and residue streams, (2) having low CO_2 emission or high GHG reduction, and (3) reaching zero or low ILUC impact.