EUROPEAN RENEWABLE ETHANOL

Enabling Innovation and Sustainable Development
State of the industry 2015
Data for renewable ethanol production, production capacity, consumption, feedstock use, and co-products is reported from ePURE members, who make up 90% of total European ethanol production. ePURE does not accept liability for any inaccuracy or incompleteness of data in this report.
The European ethanol industry has faced a difficult year, characterised by policy uncertainty and low market prices, but there are reasons to be optimistic that the situation will improve. The instability in Europe’s biofuel policy has been central to the problems faced by our industry over the past 12 months. Ending this policy instability is essential in order to retain and boost investment in the renewable ethanol sector up to 2020, and beyond.

With Brussels having taken five years to decide on how to legislate for indirect land use change (ILUC), the resulting policy stasis and uncertainty has harmed biofuels growth in the EU and negatively impacted our companies. This has created a depressed EU biofuel market, causing an oversupply of ethanol and low ethanol prices, which subsequently led to the shutdown of several ethanol plants. On average, ethanol prices have dropped by 30% since 2013. It is hoped that the recent agreement on ILUC will encourage Member States to reinvigorate their implementation of national targets and recommit to achieving them. This will help provide certainty and stability for our sector. Ethanol, as a sustainable biofuel with high greenhouse gas (GHG) savings, must be promoted as an essential part of the EU fuel mix if Europe is to be able to meet its ambitious 2030 climate and energy targets.

European companies are world leaders in developing innovative technologies for the production of renewable ethanol. This leadership needs to be harnessed and incentivized so that investments in Europe can be increased and not sent elsewhere. Such ‘technology leakage’ to other regions, such as the US and Brazil, negatively impacts and undermines Europe’s overall competitiveness and economic growth leading to a loss of jobs.

Our industry is ready and willing to invest. We look forward to seeing an end to EU policy uncertainty and the establishment of a consistent, stable and forward-looking policy framework in the EU. On this basis we can all work together to meet the EU’s commitments to delivering a sustainable climate and energy package for 2030. ePURE looks forward to playing a constructive role in this joint effort.

Jérôme Bignon, President

Robert Wright, Secretary-General

2015 is all about the future. The challenge to EU policy makers is clear: with transport emissions now a fifth of Europe’s total emissions, European transport needs to reduce its greenhouse gas emissions. As the EU now focuses on meeting its 2020 and 2030 commitments, sustainable biofuels are the only cost-effective and practical means of enabling net cuts to Europe’s transport emissions. European ethanol is an excellent example of a good biofuel that achieves on average 61% GHG savings compared to petrol and has low ILUC impacts. Europe must capitalise on the benefits of this sustainable and readily available alternative fuel.

Our sector is ready to help deliver Europe’s 2030 commitments: to reduce greenhouse gas emissions by 40% and to ensure at least 27% of Europe’s energy is made up of renewables. But to help us do this, the EU needs to support the most sustainable, low-ILUC biofuels. Europe’s ‘Better Regulation’ agenda will also require the development of a reliable, secure and forward-looking policy that promotes the best-performing biofuels, such as conventional and advanced ethanol, even further.

Following the recent political agreement on ILUC, and once the amended Directives have been formally adopted, it is now up to the European Commission and Member States to ensure a full and complete transposition of the new Fuel Quality and Renewable Energy Directives. Words without action are meaningless. Our industry wants to see a tangible outcome from the discussions on ILUC. Member States must follow through and commit to the agreements made. The Commission should also be proactive in its enforcement of the new legislation, especially the fulfillment of the targets set down by both Directives.

In particular, we look forward to the publication of criteria to define low-ILUC biofuels and a certification methodology for these biofuels by the Commission. In the meantime, EU Member States should seek to increase and replicate the roll-out of E10, as is already being done by France, Germany and Finland. The roll-out of E10 will help reduce GHGs by 15 million tonnes and oil use in transport by 50 million barrels, while improving Europe’s growing air quality problems. These are essential first steps on the bigger path to meeting the EU’s 2030 commitments.
Last year ePURE members produced 6.6 billion litres of renewable ethanol, representing a production increase of 13% from 2013. Of this production 86% was fuel ethanol. Maize was the main feedstock used, accounting for 42% of feedstock use.

Production capacity

In 2014, our members had a total production capacity of 7.8 billion litres, representing 90% of an estimated production capacity in Europe of 8.8 billion litres. There were commercial-scale ethanol production plants in 20 EU Member States, with France and Germany being the largest ethanol producing countries. Together they account for 40% of the total installed production capacity in the EU. France has the highest number of individual production plants, followed by Poland and Germany.

Actual production

In 2014, ePURE member companies produced 6.6 billion litres of ethanol, compared to 5.8 billion litres in 2013, a production increase of approximately 13%. Of this production 86% (5.6 billion litres) was fuel ethanol while 14% (1 billion litres) was for traditional markets, with an equal share between beverages and industrial applications. The rate of ethanol production growth slowed as our companies struggled with poor market conditions and underlying policy instability across EU Member States.

EU renewable ethanol production by end-use

<table>
<thead>
<tr>
<th>Year</th>
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<th>Industrial</th>
<th>Food &amp; Beverages</th>
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<tbody>
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</tr>
<tr>
<td>2013</td>
<td>4.9</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>2014</td>
<td>5.6</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
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Source: ePURE
Noteworthy developments have not only taken place in the structure of the overall market, but also in terms of the raw materials used to produce ethanol in the EU. In Europe, ethanol is made from a variety of agricultural feedstocks, but in recent years maize in particular has grown in popularity as a feedstock due to its competitive price and higher ethanol yields. Most of the production capacity that has been added in the EU in recent years relies on maize, while some existing plants have been refitted to process maize in place of other cereals.

In 2014, the feedstocks used to produce ethanol in Europe were: maize (42%), wheat (33%), sugar beet (18%), and other cereals (7%). A total 10.5 million tonnes of cereals and 2.21 million tonnes of out-of-quota sugar (white sugar equivalent) were used to produce ethanol, the equivalent of 2% of Europe’s cereals and 8% of sugar supply in 2014.

Consumption

Although the EU ethanol market tripled in size between 2004 and 2009, growth rates have substantially slowed down in recent years. Since 2009, the ethanol market has only grown an estimated 8%. In 2014 Europe consumed an estimated 7.7 billion litres of ethanol (F.O. Lichts), with the fuel market accounting for well over 80% of total consumption.

While the European ethanol market is expected to continue to grow in the coming years, anticipated demand for fuel ethanol in transport by 2020 has halved from an initial estimate of 14 billion litres to a current estimate of 7 billion litres (European Commision, DG JRC, 2014). This has been a major cause for concern to our companies, who made long term investments on the basis of Member States indicating in their NREAPs an expected total collective consumption of 14 billion litres.

Feedstocks

Noteworthy developments have not only taken place in the structure of the overall market, but also in terms of the raw materials used to produce ethanol in the EU. In Europe, ethanol is made from a variety of agricultural feedstocks, but in recent years maize in particular has grown in popularity as a feedstock due to its competitive price and higher ethanol yields. Most of the production capacity that has been added in the EU in recent years relies on maize, while some existing plants have been refitted to process maize in place of other cereals.

In 2014, the feedstocks used to produce ethanol in Europe were: maize (42%), wheat (33%), sugar beet (18%), and other cereals (7%). A total 10.5 million tonnes of cereals and 2.21 million tonnes of out-of-quota sugar (white sugar equivalent) were used to produce ethanol, the equivalent of 2% of Europe’s cereals and 8% of sugar supply in 2014.
In the past year, EU ethanol producers faced a challenging market environment, with ethanol prices in Europe dropping by 30%, making it increasingly difficult to achieve sustainable profit margins. This was coupled with increasing amounts of duty free ethanol imports to Europe.

European producers facing difficult market conditions

Despite relatively low feedstock prices, the EU ethanol industry is facing difficult times. European producers are under increasing pressure as a result of a combination of strong global competition, which benefits from stronger forms of support from their respective governments, a growing number of bilateral free trade agreements which have encouraged duty-free ethanol imports to Europe and regressed demand in the EU biofuels market. These factors have put severe downward pressure on domestic ethanol prices, which has damaged our companies and stifled further growth and investments in the European ethanol industry. On average ethanol prices in Europe have dropped 30% since 2013.

Europe is a relatively small player on the global ethanol scene

Globally, 90.5 billion litres of renewable ethanol were produced in 2014. Only about 10% of this production was traded internationally. Most of it was consumed domestically as a renewable transport fuel. The United States is by far the largest ethanol producer followed by Brazil. EU ethanol production has grown significantly since 2003, but while Europe is today the third largest producer in the world, it remains a relatively modest player, accounting for just over 7% of global ethanol production in 2014.
The European ethanol market is increasingly exposed to duty-free imports

In 2014, Europe imported 600 million litres of ethanol from third countries. This represents less than 10% of total EU consumption. By contrast, between 2009 and 2013, imports represented above 20% of EU ethanol consumption. Close to 80% of all imports came from countries that have duty-free access to the EU market, through Free Trade Agreements or other trade preferences. The top five countries of origin were Guatemala, Bolivia, Pakistan, Peru and Costa Rica. Together they accounted for 60% of all EU ethanol imports.

<table>
<thead>
<tr>
<th>Year</th>
<th>Duty-free</th>
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<tbody>
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<td>66%</td>
<td>34%</td>
</tr>
<tr>
<td>2013</td>
<td>34%</td>
<td>66%</td>
</tr>
<tr>
<td>2014</td>
<td>22%</td>
<td>78%</td>
</tr>
</tbody>
</table>

2014 at a glance

- ePURE members produced 6.6 billion litres of ethanol, a total production increase of 13% from 2013.
- 86% of renewable ethanol produced in 2014 was for fuel use.
- 42% of the feedstock used to produce renewable ethanol was maize.
- 22% of all ethanol imports to EU paid any import duties.
- European ethanol prices dropped 30% from 2013 levels.

POLICY RECOMMENDATION

- Ethanol should be treated as a sensitive agricultural product in all EU trade negotiations.
- Policy makers need to ensure a level-playing field vis-à-vis a globally subsidised competition that enjoys much stronger government support than EU ethanol producers.
- Tariffs are a legitimate tool to counter such unfair competition.
In 2014, our transport fuel achieved 61% GHG savings compared to petrol, thereby reducing Europe’s annual GHGs emissions by 5 million tonnes, the equivalent to taking 3 million cars off Europe’s roads for a year.

Europe’s transport emissions have increased by 36% since 1990 and account for 26% of total EU GHG emissions. Transport is the second biggest source of GHG emissions in the EU and is the only sector in Europe whose GHG emissions have continued to rise compared to 1990 levels. Solutions are urgently needed to address this. Biofuels are proven to be one of the most commercially viable carbon abatement solutions for transport in the short to medium term.

**European renewable ethanol has high GHG savings**

Renewable ethanol, which can be mixed with petrol and sold as a transport fuel, is a cost-effective and readily available means of decarbonising transport. In 2014, European ethanol achieved 61% average GHG savings compared to petrol, saving 5 million tonnes of GHGs, the equivalent to taking 3 million cars or 1.3% of Europe’s total car fleet off the road for a year. Ethanol still has substantial net GHG savings even after taking into account any potential ILUC emissions. Furthermore, the use of ethanol makes petrol’s combustion more efficient thereby improving fuel efficiency. However, the structure of the European fuels market is complex and limits the amount of GHG emission savings that can be achieved in transport. With the right regulations in place, Europe can achieve substantial cuts in GHG emissions. The EU-wide roll-out of E10 (a petrol-ethanol fuel blend containing up to 10% ethanol) would reduce Europe’s transport emissions by 15 million tonnes, the equivalent to taking 9 million cars or 4% of Europe’s total car fleet off the road for a year.

**Europe’s air quality is in decline**

In 2014, 17 EU Member States were found to be in breach of their air quality targets. Poor air quality is a major cause of increased respiratory disease and therefore has a major negative impact on human health for many thousands of people across Europe, particularly in urban areas. Over reliance on diesel as a transport fuel in cities is a key source for this worsening air pollution in urban areas. Policy makers therefore need to act in order to meet their EU air quality legal obligations. Greater use of petrol blended with renewable ethanol, such as E10, will lessen air quality problems associated with diesel use and at the same time reduce the GHG emissions associated with petrol use.
Ethanol-petrol blends are a solution

Petrol blended with higher levels of ethanol has lower levels of emissions than diesel or non-blended petrol fuels. This is because ethanol contains more than one third oxygen, which, when added to petrol, leads to a more complete combustion of fuel in the engine, resulting in fewer toxic particulate emissions and making it safer for humans to breathe.

Many additives commonly used in petrol to increase octane levels contain carcinogens, such as benzene, which are highly toxic and harmful to humans. Renewable ethanol is a high-octane fuel additive, which improves engine efficiency and is a substitute for benzene, while also being virtually sulphur-free.

POLICY RECOMMENDATIONS

• European Member States should introduce or strengthen existing targets for the use of ethanol in petrol.

• European Member States should introduce E10 fuel immediately, and prepare for the introduction of E20 fuel.
Contributing to Europe’s energy security

In 2014, our industry produced enough green fuel to displace 4.8% of Europe’s petrol volumes, saving €1.5 billion to the EU oil bill.

European transport is too reliant on foreign oil

Over-reliance on energy imports hampers EU competitiveness by leaving its economy at the mercy of oil prices and supply volatilities beyond its control. In 2014, the EU’s oil import bill topped €272bn, which is nearly the size of the entire debt of Greece, and contributed to a significant deficit in the EU trade balance of 2.5% of EU GDP. Europe’s oil bill would have been much larger but for the past year’s collapsing oil prices.

The recent crisis in Ukraine brought home the fact that Europe is over-reliant on foreign oil. In 2014, the EU imported over 90% of its crude oil needs, 27.5% of which came from Russia. Most of these oil imports came from politically unstable regions. Europe’s oil dependency has now increased by around 10% since 2009. The transport sector is especially vulnerable, with 95% of its energy coming from oil products.

Domestically produced ethanol helps increase Europe’s energy security

Investing in domestically produced renewable ethanol can help Europe reduce its dependence on foreign energy imports and thereby increase its energy independence and security. In 2014, European renewable ethanol displaced 4.8% of Europe’s petrol volumes, saving €1.5 billion to the EU oil bill. Increased ethanol use, via a shift to E10 fuel, would further strengthen the benefits of ethanol use, and reduce oil use by 50 million barrels, thereby saving €4bn for the European economy based on 2014 oil prices.

Current policy conditions are inhibiting ethanol’s contribution to energy security

In 2014, biodiesel accounted for 80% of the EU market in biofuels. Renewable ethanol made up the other 20%. Renewable ethanol’s contribution to Europe’s energy security is currently being hampered by the lack of a level playing field between energy products. The existing energy taxation regime in Europe favours diesel over petrol and is one of the reasons behind Europe’s over-reliance on diesel fuel. This over-reliance has meant that, the diesel market has now grown to 70% of Europe’s transport fuel market, while petrol has declined to 30%. The declining petrol demand has meant that Europe has an increasing surplus of petrol because it produces more petrol than it needs. Europe exports its excess petrol to markets such as the US or Africa. However, changes in US energy policy, including the increased use of ethanol in the US petrol market, mean that the opportunities for EU petrol exports to the US are in decline. This has left Europe with a large surplus of petrol that it is having difficulty selling to its traditional export markets. Europe should focus on retaining more of its petrol exports and reducing its diesel imports. As such, a rebalancing of the taxation on petrol and diesel fuels, in favour of petrol, is urgently needed.
POLICY RECOMMENDATIONS

- European Member States must rebalance their fuel markets by taxing fuels based on their energy content and CO₂ performance. Such a tax regime would allow the market to price the most efficient fuels and set a more level playing field between fossil fuels and renewable fuels (and also between the various renewable fuels).

- The European Commission should incorporate the benefits of ethanol into its Energy Union strategy to ensure that the transport fuel market reduces its dependence on foreign oil.
Using land responsibly and in support of food production

Europe’s ethanol sector uses feedstocks grown on less than 1% of Europe’s agricultural land and has a high potential for further production with low indirect land use change (ILUC) impacts. In 2014 our companies produced enough animal feed co-product to feed 10% of Europe’s dairy herd. This ensures that ethanol production supports food production and increases food security.

Responsible land use for ethanol production does not impact the amount of food available for human consumption and has a minimal impact on global land conversion. The crops used to produce ethanol in Europe meet the highest environmental sustainability standards in the world. In addition, by generating high-protein animal feed as a co-product of ethanol, our companies reduce the need for European farmers to use imported animal feed, such as soya, which requires large amounts of land outside of Europe.

EUROPE’S SUSTAINABILITY CRITERIA FOR BIOFUELS

- Emissions-savings of at least 35% compared to fossil fuels, rising to at least 50% in 2018 and 60% for new installations.
- Land use: raw materials must not be grown on land with high carbon stocks or high biodiversity value.
- Crops used to produce biofuels in the EU must meet the minimum requirements for ‘good agricultural and environmental condition’ as part of the Common Agricultural Policy (CAP).

Improving sustainability by producing food and fuel

The overwhelming majority of agricultural crops used to produce ethanol are low-grade and are not suitable for direct human consumption. For every tonne of cereals used by our industry as much animal feed is produced as ethanol. In 2014 our companies produced 5.2 million tonnes of co-products, of which 63% was highly valuable animal feed. This 3.3 million tonnes of animal feed was enough protein to feed 2.1 million dairy cows, 10% of the EU dairy herd.

To qualify for use towards Europe’s 2020 targets – the 10% target for renewable energy use in transport and the 6% reduction target for the GHG intensity of transport fuels – the biofuels our companies produce must comply with strict sustainability criteria. In addition, the European Commission reports on the impact of ethanol production on food availability, compliance with land use rights and international labour conventions.

It also displaced nearly 10% of Europe’s soybean and soybean meal imports by volume. Reducing imports of animal feed improves Europe’s environmental footprint and helps reduce land conversion and GHG emissions resulting from agricultural land use outside of Europe. Reducing animal feed imports is also strategically important, as Europe is 70% dependent on feed imports to meet its ever-growing livestock demand.
Using land even more responsibly

In 2014, our industry used crops that were grown on less than 1% of Europe’s agricultural land. But recent concerns over the risk of land displacement for food production caused by the production of feedstocks for biofuels, means our industry is ready to assess how best to strengthen its commitment to sustainable land use. In Europe, farmland that has low agricultural productivity or has been abandoned can provide suitable locations to grow crops for renewable ethanol production. A 2014 study by the University of Utrecht found that ILUC-risks can be mitigated through agricultural yield increases and when unused land is used to grow crops for biofuels production. Ethanol produced on these types of farmland has low-ILUC impacts and strengthens our sector’s contribution to environmental sustainability even further.

In harmony with food production

Historically, ethanol production in Europe uses a very small amount of cereals, and in 2014 only 2%, or 10.5 million tonnes, of EU cereals supply were used— not enough to reduce cereals supply to food markets or have any significant effect on food price increases. 2014 was a record year for European cereals production, increasing by 22 million tonnes from 2013 - an increase that is more than twice the size of the amount of cereals that were used for ethanol production during that period. So in 2014, the amount of cereals used to produce ethanol in Europe was more than offset by cereals production increases, meaning there was no competition between ethanol and food production. The European Commission’s Cereals Balance clearly shows that over the last decade, the demand for cereals for ethanol production has not taken away from food markets. A 2014 UN FAO report, The State of Food Insecurity in the World, confirms that even after accounting for the cereals used for ethanol, more grain is available for feed and food use today than at any time in history. As a result, global hunger has fallen 21% since 1992.

Q: So what is really driving food prices?
A: Oil prices!

World food and oil prices (2005–2014)

POLICY RECOMMENDATIONS

• The European Commission should compile and publish regular, transparent data on animal feed consumption and protein imports in Europe.

• European policy makers should encourage the production of low-ILUC risk biofuels by identifying criteria and a certification methodology for these biofuels and incentivising their use towards the existing and future EU climate and energy targets.
Renewable ethanol is a versatile product and our industry is a vital asset in Europe’s quest to decarbonize transport, boost growth and jobs, and achieve greater resource efficiency by utilising a range of feedstocks, such as waste and residues. By 2030 biofuels made from these feedstocks could create up to 300,000 jobs.

The ethanol sector is constantly innovating

European ethanol plants are true biorefineries, converting multiple inputs into multiple outputs, not limited to renewable ethanol and animal feed. The sector is also constantly innovating at different stages of the conversion processes. For example, new enzymes and yeasts have been developed in order to maximize the amount of ethanol produced from the feedstock used, improving resource efficiency. New outputs have also been developed, such as oil extracted from maize and wheat. Similarly, the spread of best practice and constant innovation allow for the minimisation of waste. In many cases our plants pursue closed-loop production systems using, for example, waste biomass to generate green electricity for use in ethanol production plants. Water use is also kept to a minimum, recycled and/or treated before discharge, allowing some plants to be water neutral or even to return water to the rivers cleaner than when it was extracted.

The potential of advanced biofuels is within reach

Advanced ethanol, such as cellulosic ethanol, is a renewable fuel that further optimises resource efficiency by using waste and residue material, such as straw. In Europe, cellulosic ethanol can also be produced from dedicated energy crops such as miscanthus and switch grass.

Cellulosic ethanol has the potential to achieve even higher GHG emissions savings, up to 90% compared to fossil fuels, but its benefits go beyond this:

- A 2014 report by the European Climate Foundation found that by 2030, some 220 million tonnes of cellulosic material (from agricultural residues, municipal solid waste and forestry residues) could be made available sustainably in the EU for energy production, and up to 300,000 jobs created in Europe – mostly in high-tech areas – as a direct result.
- Cellulosic ethanol production will incentivise the collection of agricultural residues, which will diversify farmers’ income and generate additional European revenues of up to €15bn annually. Advanced production technologies have the potential to process new, dedicated energy crops grown on degraded or marginal land that currently lies fallow.

Processing these feedstocks to extract sugars requires high-tech facilities, pioneering enzyme and yeast extraction technologies, as well as highly-skilled people. Europe enjoys easy access to these resources, thanks inter alia to traditional financing in the first stages of R&D up to the point of pilot and demonstration plants. Europe now needs to maximize the use of these resources and harvest the benefits of cellulosic ethanol by supporting fully integrated commercial-scale biorefineries.
POLICY RECOMMENDATIONS

• Member States should introduce a dedicated but realistic sub-target for advanced biofuels, together with clear definitions of eligible feedstocks. Establishing binding targets is a crucial step in stimulating commercial-scale investment in advanced biofuels before and after 2020.

• Such binding targets, combined with a longer-term perspective of the EU’s climate policy, and meaningful financial support for upfront investments, would provide investors and innovators with clarity and a predictable market.