The European biofuel market is now regulated by the directive, known as ILUC, whose wording focuses on the environmental impact of first-generation biofuel development. This long-awaited clarification has arrived against the backdrop of falling oil prices and shrinking European Union biofuel consumption, which should drop by 1.7% between 2014 and 2015, according to EurObserv’ER.

- **79.4%**
  Biodiesel part in the total biofuel consumption in EU transport in 2015 (in energy content)

- **14 Mtoe**
  Total biofuel consumption in European Union transport in 2015
Biofuel consumption has developed, and varies across sectors. While bioethanol appears to have increased by 0.8%, biodiesel has remained relatively stable. The popularity of diesel engines in Europe is the main reason for biodiesel's status as the main biofuel used in transport. In 2015, the shares of the various forms of biofuel were:

- biodiesel: 79.4% (80% in 2014), i.e. 11,154 toe;
- bioethanol: 19.5% (19% in 2014) i.e. 2,743 ktoe (directly blended with petrol or previously converted into ETBE);
- biogas: 1.2% (2% in 2014) i.e. 501 ktoe.

Pure vegetable oil consumption has been amalgamated into the biodiesel consumption figure as its use as fuel is considered to be too marginal (<0.1%).

Biofuel consumption has developed by fits and starts over the last three years. After dropping in 2013 and appearing to pick up in 2014, it should slip again in 2015 (graph 1). First estimates put European Union biofuel requirements for transport at 14 Mtoe in 2015 (1.7% less than in 2014), yet in 2012 they amounted to 14.4 Mtoe. This drop (expressed in energy content rather than metric volume) can essentially be put down to the 2.4% drop in the biodiesel sector, whereas bioethanol appears to have increased by 0.8%.

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The EurObserv’ER survey also covers the consumption of biofuel certified as sustainable, and applies the criteria set by the European Renewable Energy Directive as the only biofuel to be considered sustainable.

<table>
<thead>
<tr>
<th>Country</th>
<th>Bioethanol</th>
<th>Biodiesel***</th>
<th>Biogas</th>
<th>Total consumption</th>
<th>% certified sustainable</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>414,111</td>
<td>2,541,235</td>
<td>0</td>
<td>2,955,346</td>
<td>100%</td>
</tr>
<tr>
<td>Germany</td>
<td>792,563</td>
<td>1,933,276</td>
<td>45,381</td>
<td>2,771,223</td>
<td>100%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>415,773</td>
<td>533,188</td>
<td>0</td>
<td>958,961</td>
<td>90%</td>
</tr>
<tr>
<td>France</td>
<td>69,897</td>
<td>364,636</td>
<td>1,462</td>
<td>435,995</td>
<td>100%</td>
</tr>
<tr>
<td>Belgium</td>
<td>36,502</td>
<td>373,362</td>
<td>0</td>
<td>410,864</td>
<td>100%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>128,332</td>
<td>246,561</td>
<td>0</td>
<td>374,893</td>
<td>100%</td>
</tr>
<tr>
<td>Czech Rep.</td>
<td>78,527</td>
<td>265,484</td>
<td>0</td>
<td>344,011</td>
<td>100%</td>
</tr>
<tr>
<td>Portugal</td>
<td>5,121</td>
<td>277,769</td>
<td>0</td>
<td>282,890</td>
<td>52%</td>
</tr>
<tr>
<td>Denmark*</td>
<td>0</td>
<td>238,886</td>
<td>0</td>
<td>238,886</td>
<td>100%</td>
</tr>
<tr>
<td>Hungary</td>
<td>84,480</td>
<td>130,421</td>
<td>0</td>
<td>214,901</td>
<td>100%</td>
</tr>
<tr>
<td>Romania</td>
<td>41,917</td>
<td>125,490</td>
<td>0</td>
<td>167,407</td>
<td>105%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>39,954</td>
<td>195,164</td>
<td>0</td>
<td>235,118</td>
<td>100%</td>
</tr>
<tr>
<td>Greece</td>
<td>0</td>
<td>223,001</td>
<td>0</td>
<td>223,001</td>
<td>23%</td>
</tr>
<tr>
<td>Ireland</td>
<td>27,121</td>
<td>88,330</td>
<td>0</td>
<td>116,600</td>
<td>79%</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>14,832</td>
<td>93,675</td>
<td>0</td>
<td>109,508</td>
<td>100%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>7,125</td>
<td>65,116</td>
<td>0</td>
<td>68,232</td>
<td>100%</td>
</tr>
<tr>
<td>Latvia</td>
<td>5,547</td>
<td>57,556</td>
<td>0</td>
<td>63,104</td>
<td>97%</td>
</tr>
<tr>
<td>Estonia</td>
<td>5,804</td>
<td>36,233</td>
<td>0</td>
<td>42,837</td>
<td>100%</td>
</tr>
<tr>
<td>Croatia</td>
<td>0</td>
<td>29,354</td>
<td>0</td>
<td>29,354</td>
<td>100%</td>
</tr>
<tr>
<td>Latvia</td>
<td>6,138</td>
<td>35,907</td>
<td>0</td>
<td>42,045</td>
<td>80%</td>
</tr>
<tr>
<td>Cyprus</td>
<td>0</td>
<td>13,343</td>
<td>0</td>
<td>13,343</td>
<td>100%</td>
</tr>
<tr>
<td>Malta</td>
<td>0</td>
<td>4,375</td>
<td>0</td>
<td>4,375</td>
<td>100%</td>
</tr>
<tr>
<td>Total EU 28</td>
<td>2,712,887</td>
<td>32,121,848</td>
<td>4,915</td>
<td>34,869,845</td>
<td>91%</td>
</tr>
</tbody>
</table>

* Estimate. ** For Denmark, biodiesel and bioethanol is mixed due to confidentiality, so the figure contains both bioethanol and biodiesel.
*** Vegetable oil included in the biodiesel figure. Source: EurObserv’ER 2016.
in national targets. Preliminary estimates suggest that certified consumption was about 12.9 Mtce, or 92.1% of EU biofuel consumption. This anomaly should be removed in 2016, as a Royal Decree has been passed to bring Spain's biofuel consumption in line with the Renewable Energy Directive's sustainability requirements.

**EUROPE SCALES DOWN AGRO-FUEL INCORPORATION**

For nigh on 5 years, first-generation biofuel, derived from agricultural crops, has been at the centre of heated debate about factoring in GHG emissions caused by indirect land use change (ILUC). This highly controversial issue was subject to a lengthy legal process that culminated in the adoption of a new directive shifting European biofuel policy on 9 September.

The main effect of the new directive which amends both the directive on petrol and diesel fuel quality and the Renewable Energy Directive is to limit the energy share of biofuel produced from cereal, sugar and oilseed crops on farming land to 7% by 2020 in Member States' renewable energy consumption for transport. The overall 12% renewable energy target in transport is retained, while the remaining 3% can be obtained through electric mobility (see further on) or by using biofuel produced from specific feedstocks that do not qualify for double accounting (listed in Annex IX of the directive).

The directive also stipulates that prior to 6 April 2017 every Member State must set a national target for incorporating "advanced" biofuel. The list of eligible feedstocks is given in Annex IX, part A, of the Directive and this time excludes the production of biogas fuel (generally in the form of biomethane) obtained by the anaerobic digestion process followed by purification is a somewhat special category because it can be produced both from fermentable waste and energy and food crops.

**Three generations of biofuel**

Biofuel is a liquid or gaseous fuel used for transport and produced from biomass. Three types of biofuel are generally distinguished:

- **First-generation biofuel** (said to be “conventional”) which includes bioethanol and biodiesel outputs from the conversion of food crops (rapeseed, soya, beets, cereals...). The category also includes the production of vegetable oil that can be used pure and directly by specific engines. The production of biogas fuel (generally in the form of biomethane) obtained by the anaerobic digestion process followed by purification is a somewhat special category because it can be produced both from fermentable waste and energy and food crops.

- **Second-generation biofuel** – sectors totally devoted to energy that do not rely on agricultural crops (no ILUC effect). They offer better yields and are more environmentally-friendly in terms of GHG emissions because they recover all the plant ligno-cellulose contained in the plant cells. The raw materials range from steam, green waste (free cuttings, etc.), for even fast-growing energy plants such as miscanthus. They enable alcohol to be produced and thus bioethanol. Additionally some of the processes produce biodiesel.

- **Third-generation biofuel** (which includes biofuel produced from algae (also known as algaefuel) that present the advantage of not competing with food or energy crops (plants and forestry). Recovery is through an oil sector and thus produces biodiesel.

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**Graph n°1**

Trend in biofuel (liquid and biogas) consumption for transport in the European Union (EU 28) in ktoe

The hydrogenation process has been patented and developed by Finland's Neste Oil, involving a catalytic reaction just as in the traditional process. Hydrogen rather than methanol is introduced to the oil as happens with the other types of biodiesel. The advantage of this technology is that it avoids the coproduction of glycerine, which so far has been problematic. The technology also removes all the oxygen atoms, which enhances the final product's stability. Lastly, the reaction products are essentially alkanes, which ensure that higher cetane indices are obtained than with the other types of biodiesel.

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in biodiesel consumption was sharpest (6.8% down on 2014) falling to 2 033 000 tonnes, while bioethanol consumption also dropped (6.4% down on 2014) to 1 273 000 tonnes. When the figures are expressed as energy units, the drop in German consumption was about 2.6 Mtoe, which equates to 6.3%.

The UBA also points out that the provision for the proviso- nal energy content incorporation rate for 2015 is 4.9% as opposed to 5.3% in 2014. In volume terms, the drop in bioetha- nol use (from 293 628 to 282 389 tonnes) was offset by the rise in biodiesel use from 875 436 to 892 430 tonnes. As for energy content, consumption reached 976 518 toe (8% more than in 2014).

In 2015, Spain failed to meet the Renewable Energy Directive line on sustainability criteria. In March 2015, the European Commission formally demanded that Spain conform to the directive, which it conceded by adopting a new Royal Decree on 30 April 2015, establishing their application from January 2016 onwards. Another Royal Decree dated 12 December 2015 set out the biofuel incorporation roadmap through to 2020. The decree, which abandons sector-specific targets, imposes a 2.3% minimum energy content incorporation rate for biofuels in 2016. This rate will gradually rise to 5% in 2017 and 8.5% in 2020.

Legal problems rein in Belgian biodiesel consumption

Biodiesel consumption in Belgium fell dramatically in 2015 from 222 452 to 259 611 tonnes because of a Constitutional Court order dated 8 May 2015 that annulled article 7 of the Act dated 27 July 2013 on biofuel incorporation in fossil fuel volumes. The result was the absence of any legislative framework for setting a sustainable biofuel incorporation rate in diesel. The Neste Oil petroleum group and producer of HVO biodiesel (hydro-treated vegetable oil) brought this appeal to the Constitutional Court on the grounds of discrimination by the Act. The Court ruled the difference in the law’s treatment in the area of incorporation between producers of FAME (fatty acid methyl ester) and the other forms of sustainable biofuel as anti-constitutional. Early in December 2015 a draft bill was approved removing this difference between FAME and HVO biodiesel to provide legal certainty and achieve European renewable energy tar- gets for transport.

Bioethanol consumption remained stable, and rose from 56 621 tonnes in 2014 to 58 447 tonnes in 2015 (i.e. 3.7% increase). A significant rise is expected from the beginning of 2017, because of a Belgian government decision taken in February 2016 to raise the bioethanol incorporation rate in petrol from 4 to 8.5% as of 2 January 2017. Thus, E2 petrol, which may contain up to 10% bioethanol (6% for biodiesel), will be launched and eventually replace the current 95-98 octane Super grade of petrol, once the European Commission has given its assent.

Conditions for Europe’s first-generation biofuel industry worsen

The year 2015 was tough for Europe’s biofuel industry players. The European Union wide drop in fuel consumption was compounded by a number of countries’ refusals to increase their incorporation targets, and this limits market opportu- nities for the sector.

The situation is partly due to the price of ethanol which was held down at an extreme- ly low level throughout the year and thus eroded profits. Nonetheless business picked up early in 2016, which improved the results of groups whose financial year runs from April to March. The price of etha- nol (FOB Rotterdam) rose from its March 2015 level of € 430/m3 to € 511/m3 at the end of February 2016, with peaks of more than € 600/m3 at the end of 2015, when the supply position was somewhat tense. CropEnergies, Germany’s top biofuel manufacturer saw its 2014/2015 sales drop from 832 720 to 782 6 million euros between 2015 and 2016. Yet its opera- ting result improved (86.7 million euros in 2015/2016 compared to -11.2 million euros in 2014/2015) which gave it a positive net profit of 47.2 million euros. Yet this improve- ment will be short-lived. The tempo- rary closure of the Wilton plant in the United Kingdom, will reduce the group’s output from 1 056 000 m3 in 2015/2016 to 900 000 m3 in 2016/2017, and cause sales to drop by about 625-700 million euros in 2016/2017. In the bioethanol market...
The end of 2015 and start of 2016 were also marked by turmoil at Abengoa caused by poor financial management. The group started insolvency proceedings on 25 November 2015, posting a 9 billion euro debt at the time. A few months later, the loss for FY 2015 was put at 12.5 billion euros. The creditors and the group reached an agreement on 9 March 2016 to avoid bankruptcy, whose terms approved by the Board on 1 July 2016. The plan has yet to be endorsed by at least 75% of the group’s shareholders. The Avril group’s situation gives all the more reason for concern as the petroleum giant Total intends to convert its La Mède (Bouches-du-Rhône) refinery into a biodiesel production plant by spring 2017, which will push its annual output of HVO from 10 000 to 50 000 tonnes - which equates to a little less than a quarter of the French market volume.

Key
- Green Plains
- Abengoa
- Avril
- Total
- Neste
- Cosan
- Biobrija
- Green Plains
- Abengoa
- Avril
- Total
- Neste
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- Biobrija

Biofuel consumption for transport in the European Union in 2015* (ktoe) with respective shares of each sector
In 2014, the group posted an overall profit of 7.55 billion euros, including 7.1 billion euros from renewable energies (i.e. 26% of the total). In 2013, 70% of its sales of renewable products went to Europe and Asia and 30% to America.

**Second-generation Biofuel Depends on Regulatory Developments**

In this unsettled situation, “second-generation” (2G) biofuel types, produced from residue or lignocellulose matter of forest and farming origin are experiencing an upswing. To produce 2G biofuels, the biomass is converted by biochemical, thermo-chemical or hybrid methods. Regulatory developments will govern the development of 2G biofuels but they appear to be on track. As 2015 was marked by the inauguration of commercial production plants all over the world. According to the IFP Energies Nouvelles Panorama 2015, total annual production capacity of these biofuel companies at the end of 2014 was 320,000 tonnes and 254,000 tonnes of production capacity were under construction.

In Europe, there many pilot projects developing 2G, some of which were interrupted between 2014 and 2015. In France, the Futuroail project, started in 2008, should soon bear fruit. It aims to develop and market a comprehensive cellulosic ethanol production solution. This ambitious project, partly funded by Bpifrance that involves 13 partners (including Tereos and Total) is structured around three stages: setting up a pilot site with annual production capacity of 280,000 litres, developing it into a prototype (1,900,000 litres per year) and since 2015 into an industrial plant (1,100,000 litres per year). Aixen will market the process.

As explained in last year’s barometer, the USA’s 2G biofuel market has taken off faster than Europe’s, with a number of commercially viable plants that have recently started up. A case in point is the DuPont (Iowa) plant which was commissioned at the end of October 2015. This bio refinery is described as the world’s largest cellulosic ethanol production plant, with annual production capacity of 124 million litres. Feedstock will mainly be sourced from farming land close to the plant while most of its output will be distributed in California because the State has an ambitious GHG reduction policy.

Moreover, the site will be used as a showcase to garner international investors keen to import these technologies. In fact DuPont has entered into a licence agreement with New Tianlong Industry in July 2015 to co-construct a cellulosic ethanol production plant in China.

**The Future Awaits Definition at Member State Level**

The European Council has clarified European Union’s stance on biofuels for 2020, by penning a new directive in September 2015. Many of the key Member States have clarified their roadmaps to 2020 and are set to achieve their 10% renewable energy targets for transport.

However, the United Kingdom’s departure from the European Union will affect EurObserv’ER’s biofuel consumption forecasts that are based on an effective biofuel incorporation rate of about 8% (graph 3). The UK actually accounts for about 13% of fuel consumption in European Union transport (39.5 Mtoe of the 325.1 Mtoe in 2014).

While, from a regulatory stance, the issue of biofuel use in transport is regulated through to 2020, uncertainties remain for the post-2020 period and their significance through to 2030. The European Commission intends to present a new renewable energy directive for 2020-2030 to address this by the end of 2016, with a new common invariable European Union target of 27% right across the Member States.

However the text will no longer mention targets for transport. During a European Parliament seminar held on 3 May, Marie Donnelly, Director for new and renewable sources of energy of the European Commission’s Directorate General for Energy said: “The continuation of the sub-target for the transport sector is something that has not been accepted and will not be continued in our proposal at the end of this year” Abandoning a specific target in transport for after 2020 has drawn sharp criticism from biofuel industry representatives. In the absence of consensus between the Member States, each one will be free to apply a national ceiling in line with its energy policy and national interests. The draft directive should also clarify the framework (or otherwise) of the ILUC effect and the method used to calculate it.

This decision will determine which type of biofuel will be furthered. The future of the 7% cap on biofuel from subsistence farming is a key element of the new post-2020 policy framework.

The European Commission is aware that the biofuel sector needs greater stability, as Marie Donnelly emphasized: “It is important, I believe, that the legislative framework delivers a clear message that gives clarity to that sector… For the moment we are in dialogue. We will continue with our modelling regarding the costs and implications (of dropping the 10% target)”.

Sources: Umweltbundesamt UBA (Germany), ENEA (Italy), ECOFYS (Netherlands), DG ENV (Luxembourg), DG Energy (Spain), Vattenfall (Sweden), ENS (Denmark), NSO (Estonia), Ministry of Agriculture, Food and Fisheries (Iceland), Ministry of the Environment and Energy (Malta), Eurostat.

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