Biofuels update: growth in national and international markets

As the only direct substitute for fossil fuels, biofuels continue to grow in importance, despite a significant slowdown in investment. International trade remains active, with dynamic growth from the major exporting countries. However, current production technologies will very soon come up against the limits of resource availability, raising important questions regarding the ability to meet incorporation targets for 2020, especially in Europe and the USA. Current markets are therefore expected to maintain their current levels whilst waiting for the emergence of new biofuel technologies from 2015 onwards.

Biofuels are currently the only form of renewable energy usable by the transport industry. As a direct substitute for oil, gas and coal, biomass should enable the production of fuels low in greenhouse gases emissions (GHG). Used essentially in blends with conventional fuels (concentrations of up to 10% are possible without engine modification), they can also be used pure or in higher concentrations (B30[1] or E85[2]) by specially adapted vehicles.

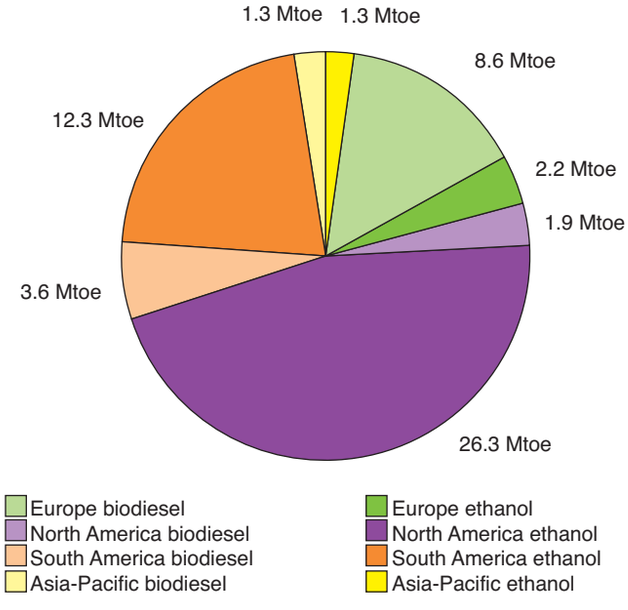
In 2010, global consumption of biofuels represented 3% of total fuel consumption (i.e. 55 million tons oil equivalent – Mtoe). This total figure for biofuels breaks down into 73% bioethanol (produced by fermenting sugar and usable in gasoline-powered engines) and 27% biodiesel (produced from vegetable oils and usable in diesel-powered engines).

The major production and consumption regions

The USA has been the world's leading producer and consumer of biofuels since 2007. Then come South America and Europe, with slightly lower consumption levels, but with a strong predominance of biodiesel in Europe and ethanol in Brazil.

After a significant slowdown in growth between 2008 and 2009, consumption of biofuels worldwide returned to growth in 2010 (Figure 1). Although the European Union shows relatively stable consumption of biodiesel, South America has seen its consumption double, whilst that of the USA has fallen by nearly 50%. Ethanol consumption is growing at 20% in Europe and North America, whilst the situation remains stable or possibly declines slightly in South America.

Fig. 1 – Breakdown of biodiesel and ethanol production by major region in 2010



Source: IFP Energies nouvelles (IFPEN) derived from multiple sources

(1) Bx: diesel fuel containing x% of biodiesel by volume, with the remainder being conventional diesel
(2) E85: fuel containing 85% by volume of ethanol and 15% of gasoline

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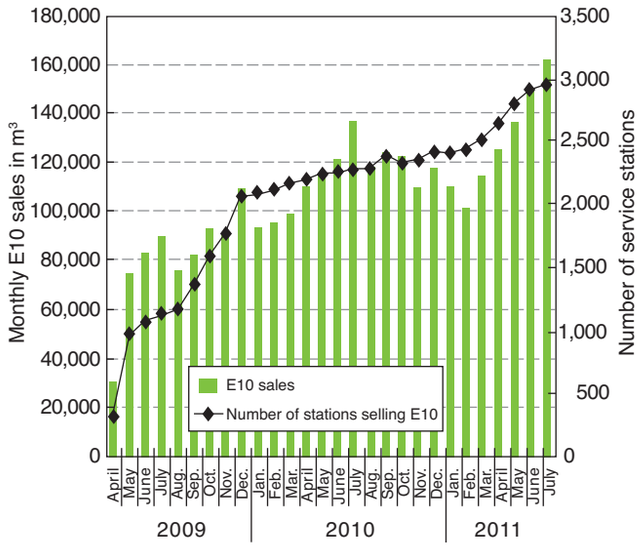
Fig. 2 – Trend in E10 sales and service station outlets in France



Source: CPDP

These trends can be explained by a series of different factors (changes in public policy, raw materials prices, etc.), which will be analysed in the following paragraphs.

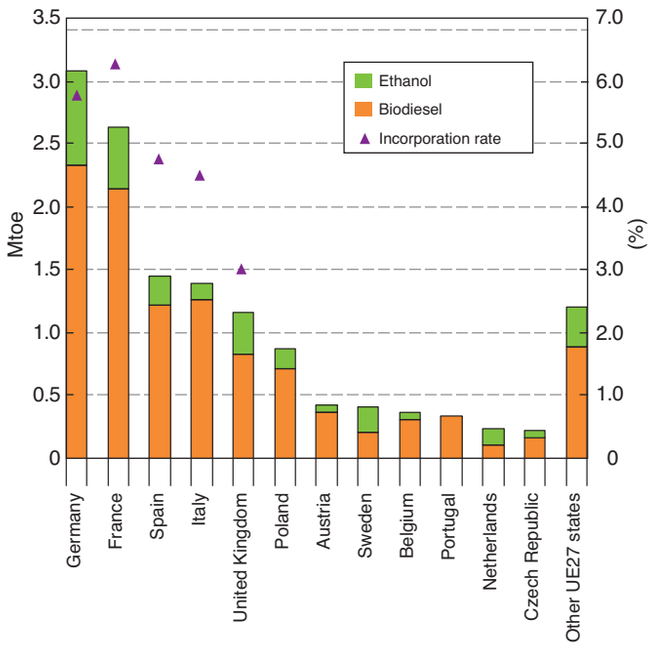
Europe

The historic growth in consumption observed in the European Union slowed overall in 2010 (+1.7 Mtoe, compared with +2.7 Mtoe in 2009). In addition to persistent negative economic factors, some countries are waiting for the European Commission to complete its detailed definition of sustainability criteria before developing their markets.

In 2010, ethanol grew more strongly than biodiesel, largely as a result of the marketing in a number of countries of E10, a fuel containing 90% unleaded gasoline and 10% bioethanol (by volume), sales of which require the installation of dedicated pumps. France was the first European country to develop this fuel, which has been marketed since 2009 under the name of SP95-E10. In July 2011, it accounted for 16.5% of gasoline fuel sales. The European Commission is planning to standardise E10 as the leading gasoline fuel for all member states by 2013 (Figure 2).

Bioethanol is also incorporated into conventional unleaded fuels in Europe (up to a maximum of 5% by volume), with no reference to this inclusion indicated at the pump. It is also consumed under the names of superethanol and E85 by dedicated FlexFuel vehicles. E85 is marketed in France, Austria, Sweden, Hungary, Poland and the Czech Republic in compliance with national standards. A European standard is currently at the implementation stage.

Fig. 3 – Breakdown of European Union biodiesel and ethanol consumption in 2010



Source: IFPEN, Eurobserv'ER

Vegetable Oil Methyl Ester (VOME) biodiesel is still the most commonly-consumed biofuel in Europe (77% of total consumption, compared with 21% for ethanol, 1.3% for pure vegetable oil and 0.4% for biogas in dedicated vehicles, essentially in Sweden). Up to 7% by volume of this fuel may be incorporated into conventional diesel blends without this fact being specifically indicated at the pump. The use of B10 is currently being researched, whilst B30 is used in captive fleets, such as buses, waste collection vehicles, government-owned vehicle fleets, etc.

Figure 3 shows data for biodiesel and bioethanol production in the leading states of the European Union and their rate of incorporation (in terms of energy) into the pool of road transport fuels.

Although only the second-largest consumer of biofuels in Europe, France has the highest incorporation rate (approaching 7%) and — like all European Union member states — has set a target of around 10% incorporation (in terms of energy) by 2020.

Germany is the leading consumer and producer, as well as being a major importer of finished products. The incorporation rate is currently below the quota originally set, as a result of the less favourable tax treatment applied to biodiesel. The introduction of E10 has also raised a number of issues following problematic communication regarding the compatibility of this fuel with vehicles already in the market.

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Countries like Spain and Italy have active market development policies, but are lagging behind their targets. In Spain, operators are hampered by delays in introducing national blending standards compatible with current engine specifications. Italy is highly dependent on imports. Rising raw materials prices are impacting negatively on market growth at present, despite the high level of gasoline prices. Added to the reduction in public subsidies, these economic factors are reducing the rate at which European biodiesel industry capacity is employed, which was 44% during the first half of 2011.

USA

The US market for biofuels is based principally on ethanol consumption by the national fleet of gasoline-powered vehicles. Ethanol production in the USA has grown continuously since the end of the 1990s. Higher demand has driven a rapid increase in the number of ethanol production plants: from fewer than 50 plants in 17 states producing approximately 1.4 billion gallons (2.7 Mtoe) in 1998, to 204 installations in 29 states producing more than 13.2 billion gallons (26 Mtoe) in 2010 (Figure 4).

Today, more than 90% of gasoline consumed in the USA contains up to 10% bioethanol. Nevertheless, to achieve the biofuel incorporation targets set out in the RFS2 (Renewable Fuel Standard of 2009), it appears that widespread introduction of E15 will be required. Already adopted in some states, E15 is not yet authorised for use in vehicles manufactured before 2001, or in motorcycles.

The US biodiesel industry is younger, and produces much lower volumes than its ethanol industry (Figure 5). It started up at the beginning of the 2000s and, until 2004, production was limited, usage was purely domestic and there was no external market. Between 2005 and 2008, production increased significantly to meet strong growth in exports. Exports fell back significantly after 2009, following regulations introduced by the European Commission to counter excessively advantageous taxation in the USA (see following chapter).

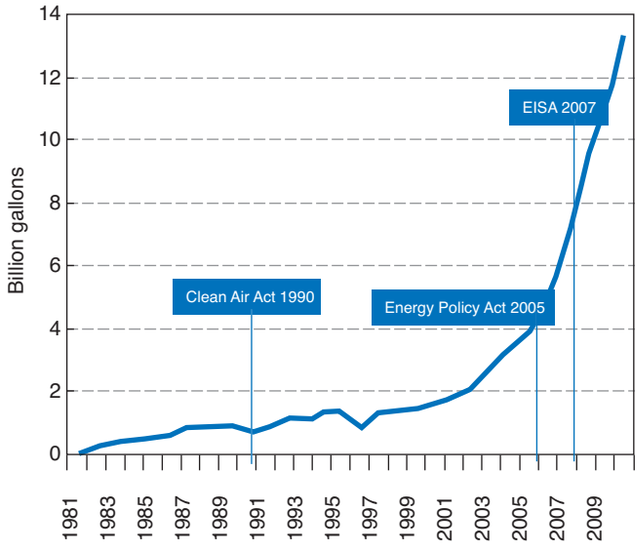
The fact that the annual incorporation obligations specific to biodiesel (RFS2) were not introduced in regulatory form until March 2010 resulted in falling consumption of biodiesel between 2008 and 2010. Future production levels should henceforth achieve the government target of 2.3 Mtoe (800 million gallons) in 2011.

Although the USA is putting significant effort behind the deployment of new fuel technologies (the so-called second-generation lignocellulosic processes), the sectors already in operation, like corn-based ethanol and soya-based biodiesel, also continue to be well supported by investment programmes and government subsidies. The (RFS2) consumption targets set for corn-based ethanol require an eventual contribution of 15 billion gallons (28 Mtoe), compared with current production capacity of 13.5 billion gallons (26 Mtoe).

Brazil

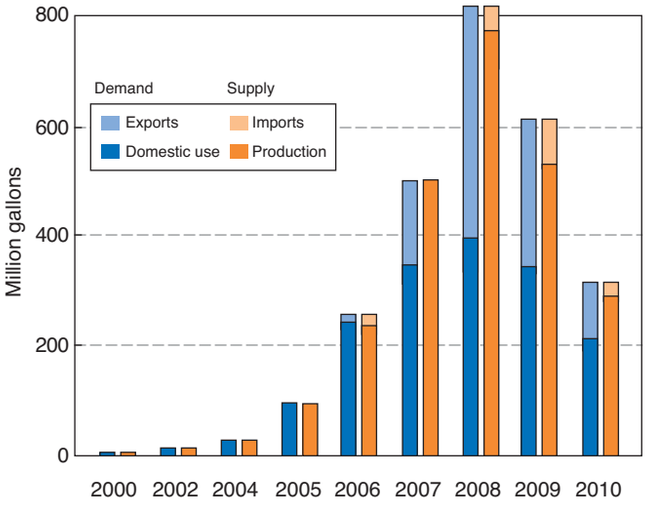
As the world's leading user of biofuels, Brazil's consumption of fuels derived from renewable sources already accounts for 19% of its total consumption. The majority is bioethanol made from sugar cane, which is used either in anhydrous form blended with conventional gasoline, or pure in its hydrated form for dedicated

Fig. 4 – Trend in US bioethanol production between 1981 and 2010



Source: Department of Commerce, US Census Bureau, Foreign Trade Statistics

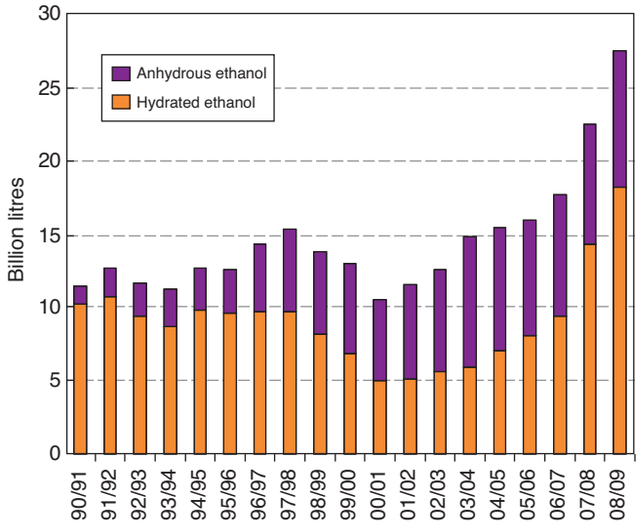
Fig. 5 – Trend in US biodiesel supply and demand



Source: USDA, International agricultural trade report 2011

vehicles and those using FlexFuel technologies. Despite strong growth since the beginning of the 2000s following widespread introduction of FlexFuel vehicles, the internal and external markets are now slowing down. This slowdown results from the combination of increased demand for food-grade sugar and a particularly bad sugar cane production season in 2011, in which both cane and sugar yields fell (Figure 6).

Fig. 6 – Trend in Brazilian ethanol production



Source: UNICA

In responding to this situation, the Ministry of Energy has reduced the minimum anhydrous ethanol content to be incorporated into gasoline (from 25% to 20% by volume in October 2011, and even to 18% in coming months), which in turn implies that gasoline imports will rise in the future. However, industrial development programmes continue, with the aim of acting now to anticipate increasing demand from the USA driven by the need to meet US government targets.

The national biodiesel programme was launched in 2005, with the progressive obligation to distribute B2, followed by B3 in 2008, before the introduction of B4 and B5 in 2010.

Asia-Pacific region

In Asia, countries with active biofuels policies often set ambitious targets, which sometimes prove difficult to achieve. Within Asia, it is possible to identify different biofuel-producing country profiles based on their market development motivation. The developed countries, like Australia, Japan and South Korea, are focused primarily on reducing CO_2 emissions in accordance with the Kyoto Protocol, but are facing resource availability problems as a result of limited agricultural production capacity. The developing countries, like China, India, Indonesia, the Philippines and Thailand, are focused more on reducing their dependence on oil, and base their resources on using surplus agricultural capacity and developing an internal market without the need for imports. All of these countries have set significant ethanol production targets for 2020, most of which involve the general introduction of E10. High targets for biodiesel development have been set essentially by those countries with abundant oil-producing potential, like Indonesia, the Philippines and Thailand.

China has quickly established itself as Asia's leading producer of biofuels, having introduced programmes at the beginning of the 2000s. The fact that bioethanol is by far the most dominant biofuel in the market, compared with biodiesel, is largely a result of the historically well-established market for beverage ethanol (China is the world's 3rd largest producer of ethanol). Current production of fuel ethanol is 1.1 Mtoe, compared with the National Development and Reform Commission (NDRC) target set in 2007 of 6.4 Mtoe by 2020.

In 2009, India's policy on biofuels approved an ambitious national target of 20% biodiesel and ethanol incorporation in fuels by 2017. Programmes to increase consumption of fuel ethanol were first introduced in 2002, with E5 distribution following in 2007. Nevertheless, the incorporation of ethanol has fluctuated, since it depends directly on the availability of surpluses of sugar and molasses in the domestic market (2.3 Mt in 2007, but less than 1 Mt in 2009). In July 2011, the country's Ministry of New and Renewable Energy (MNRE) published a report suggesting that the 20% target be replaced by the introduction of E10 for ethanol and B2 for biodiesel.

Thailand has set a biofuels consumption target of 20% by 2022, to be achieved by the eventual incorporation of 8 Mtoe of ethanol and 1.35 Mtoe of biodiesel (compared with 0.22 and 0.5 Mtoe respectively today). Amongst those resources implemented, E10 was widely introduced throughout the country in 2010, and the progressive development of E20 and E85 began several years ago, accompanied by the promotion of FlexFuel vehicles and associated infrastructures. In addition, B3 was introduced in 2010, and B10 is expected to be introduced in 2022, made from 50% VOME and 50% HVO[3].

Malaysia and Indonesia both belong to the category of countries which have made biofuels a factor in their economic development. These two nations are effectively the world's leading producers of palm oil, and have developed a significant export market built essentially on supplying raw materials to the European Union (see following chapter).

(3) HVO: hydrotreated vegetable oil

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A word about Africa

Production of biofuels in Africa began in 2007, with ethanol. The level is increasing slowly, with a current fuel bioethanol production capacity of 70 ktoe, the majority of which is concentrated in Malawi, Swaziland and, to a lesser degree, South Africa. Other countries, like Tanzania, Mozambique and Kenya, have sector development programmes in place. The market for biodiesel has been the subject of many investment projects to introduce new crops, such as jatropha. At the present time, production is devoted exclusively to use in local applications, with the emphasis on powering electrical generators. Ethanol is also covered by development projects targeting its urban domestic use as a fuel for cooking. In Ethiopia and Madagascar, micro-distilleries are currently being considered as a route to producing ethanol for use as a cooking fuel to replace kerosene, coal and LPG stoves.

The international market for biofuels

The exporting countries are generally those with abundant raw material resources and the potential for industrial development of the sector (Brazil, Indonesia, etc.) and/or tax incentives to export products (like the USA). The importing countries are those that have regulatory targets in place for incorporating biofuels, but lack sufficient resources to achieve those targets (such as the USA and many European countries). Nevertheless, economic factors may periodically disrupt supply or demand, forcing some countries to change their market balance. In 2010, worldwide biofuel trading volumes totalled 3.5 Mt (2.2 Mtoe) for ethanol and 2.6 Mt (2.3 Mtoe) for biodiesel. In terms of production levels, biodiesel is traded more actively than ethanol, with an export/production ratio of 15.7%, compared with just 5% for ethanol. Nevertheless, these global trends have fluctuated over time.

Biodiesel trading

The European Union is not only the leading consumer of biodiesel, but also its leading importer, accounting for 82% of all biodiesel imports worldwide (nearly 2.1 Mt in 2010). Significant quantities of biodiesel are also traded between EU member states, the leading importers being Germany and Italy. Imports from outside the EU are currently sourced from Argentina (56%) and Indonesia (24%). Bear in mind that between 2007 and 2009, the USA was the leading supplier of biodiesel to the European Union.

Argentina is currently the leading exporter of biodiesel, and accounts for more than half of global biodiesel exports (1.36 Mt), much of which goes to Norway and the USA. Given the amount of industrial capacity now under development and future prospects for demand, the USDA estimates that Argentinean exports will increase by more than 70% over current levels to reach 8 Mt in 2020. The country saw significant industry growth between 2008 and 2009, with an increase in production of soya-based biodiesel of nearly 60% (1.8 Mt in 2009). 85% of this production is exported. This made it the 8th largest producer worldwide, and the No. 2 in South America, just behind Brazil. This progression was made possible largely as a result of a significant tax differential between exports of soya oil and exports of soya-based biodiesel, which encourages operators to export this oil in the form of a processed product. In 2010, the ratio had increased to 75%, as national consumption levels rose following the introduction of B7.

In Asia, it is the palm oil producing countries that have the largest markets for biodiesel, and the largest of these is Indonesia, which recently overtook Malaysia as the leading producer of palm oil. Not only biodiesel, but also palm oil, is exported, with the majority going to supply the European biofuels market, although the percentage of oil exported to this market remains below 5% of total Asian production. Following significant growth in biodiesel production between 2007 and 2008, 2009 was impacted by a series of debates within the European Commission and the European Union about the compliance of palm oil-based biodiesels with sustainability criteria (minimum reduction in greenhouse gas emissions, compared with diesel produced from fossil fuels). Whilst awaiting implementation of the certification mechanisms outlined in the European Directive, Indonesian exports recovered in 2010 to account for 78% of national production.

It is only since 2007 that the USA has seen significant growth in biodiesel production, most of which is soya oil based. Exports then accounted for 50% of production. In 2008, we saw an explosion in the market, at which time exports represented more than 80% of national production (Figure 7). This trend was supported by the 2007 introduction of legislation granting advantageous tax credits on every litre of biodiesel blended with conventional diesel, regardless of quantity. Using a practice referred to as "splash'n dash", a group of American traders then developed the export market by marketing B99 (in which the biodiesel was sourced primarily from Asia and South America at very competitive prices) in Europe. In March 2009, the European Commission introduced the first measures to re-establish the competitiveness of European producers by imposing a high anti-dumping tax on 20-99% blended biodiesel from the USA. US exports fell significantly as a result, although volumes of B15 made their way to England, France and the Netherlands in 2009. Canadian exports of biodiesel also grew strongly between 2009 and 2010, with a significant proportion of product originating in the USA. The initial European anti-dumping measures were then extended in spring 2011 in an attempt to stem all flows of excessively subsidised American biodiesel to Europe.

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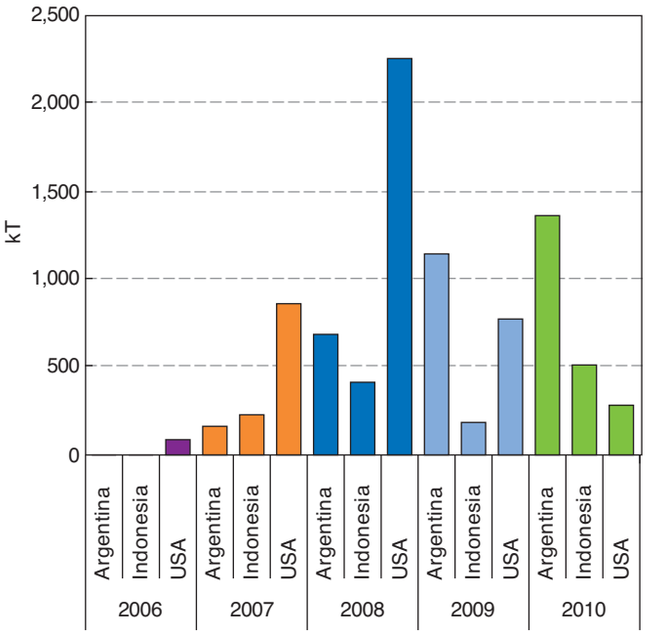
Fig. 7 – Trend in exports of biodiesel in the leading export regions

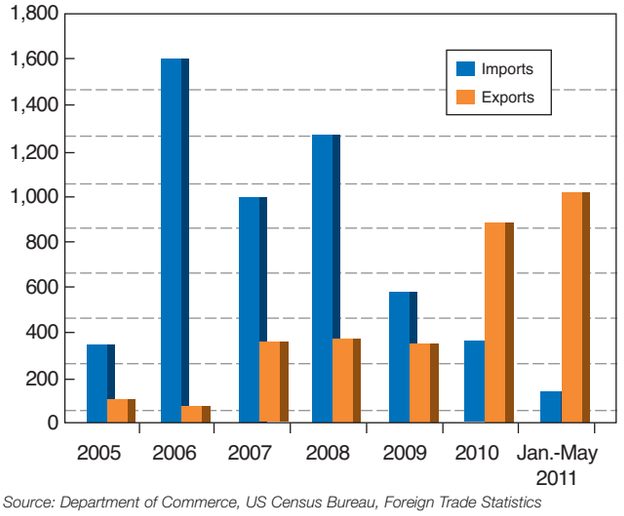


Source: FO Licht

Fuel bioethanol trading

As a result of the more competitive cost of producing ethanol in Brazil (higher sugar yields from sugar cane and lower operating costs), Brazilian ethanol has historically dominated the export market. The combination of corn becoming progressively competitive as sugar prices rose significantly in 2009, the weakness of the US dollar and the appreciation of the Brazilian real, American ethanol has been recognised as increasingly competitive in the international market. As a result, US ethanol exports have grown significantly since 2010 (Figure 8). In response, the European Commission is planning to introduce a procedure designed to check that these exports are not subsidised by indirect support. At the same time, Brazil has had to turn to imports.

Fig. 8 – Trend in US external trade in ethanol since 2005, in $ million



Source: Department of Commerce, US Census Bureau, Foreign Trade Statistics

In 2010, the leading importers of ethanol — the USA, Canada and the European Union — all imported similar volumes of around 500 million litres (0.4 Mt).

Assessment and short-term outlook

Despite current economic and financial events, the biofuels market continues to grow. The breakneck growth of the early 2000s has slowed, but production and consumption remain sustained overall as a result of policies to introduce renewable energy sources for transport, combined with continued central government support.

International trade in processed products has increased significantly. The USA has become the leading exporter of ethanol and significant biodiesel exporting centres have emerged. Argentina and Indonesia have consciously targeted their markets on exports, whilst the USA has periodically benefited from advantageous tax arrangements.

The biofuels currently offered in the market are essentially "first-generation" technology products. Their growth is limited by the availability of agricultural resources, and constrained by the sustainability criteria imposed by current and future legislation (GHG emissions in the main). Nevertheless, these markets should continue to grow at least until 2015-2020, whilst we await the emergence of second-generation biofuels that use "non-food" resources. The use of lignocellulosic biomass should relieve the pressure on food usage in competition with previous sectors, deliver more effective environmental benefits and therefore result in more sustainable sectors, at the same time as increasing the proportion of biofuels used for transport applications.

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