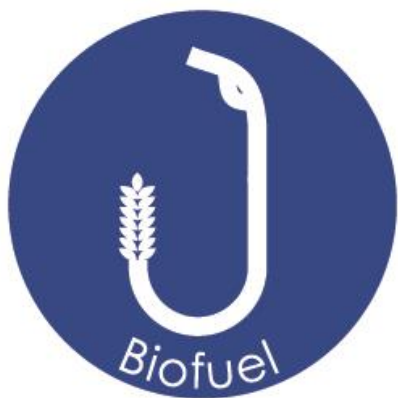


The Bioeconomy Consultants

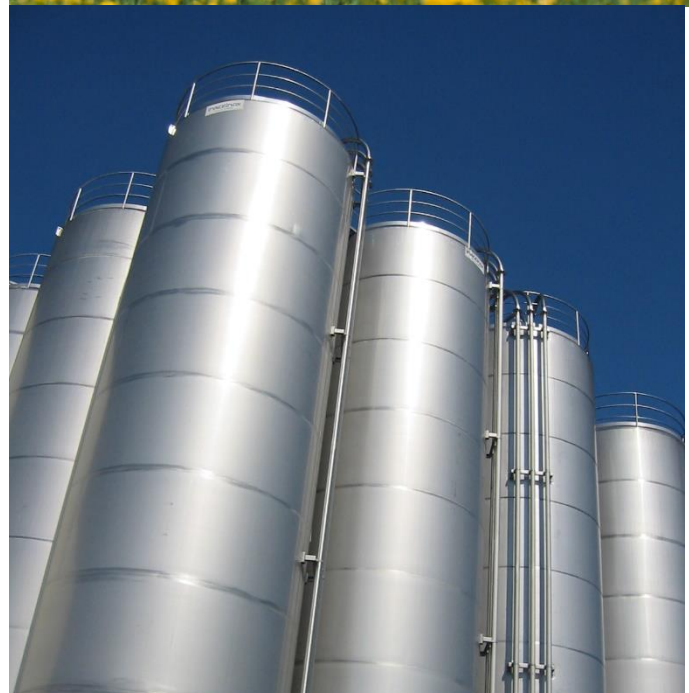


## News Review

Issue Seventy-Two

March 2018

**Each month we review the latest news and select key announcements and commentary from across the biofuels sector.**



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# Foreword

Welcome to March's Biofuels News Review.

This month, we saw the achievement of a great landmark for aviation biofuel.

Back in October, we reported that Australian airline Qantas had announced that all of their flights from Los Angeles airport would be powered by a 50% biofuel blend by 2020. Back in January, they achieved a milestone in this transition, by undertaking the first successful trans-Pacific biofuel powered flight. The 15-hour flight from Los Angeles to Melbourne utilised 24 tonnes of blended biofuel, derived from *Brassica carinata*. The blend used on this flight was only 10%, but shows promise for Qantas' future target of 50%. Qantas claim that once the project comes to fruition, the biofuel-powered flights will show an 80% reduction in carbon emissions from these flights. Hopefully, if this conversion is a success, other long-haul airlines will follow in their footsteps. Many airlines are currently trialling biofuels, and thus the future looks bright for this technology.

This month there is also a lot of news surrounding microbial biofuel production, as ExxonMobil and Synthetic Genomics Inc. announced their progress into the next phase of development for algal biofuels. Tests are now being conducted in outdoor ponds in order to learn the best approach for scaling up the technology. The partnership is targeting biofuel production of 10,000 barrels per day by 2025.

Another potential breakthrough in microbial production has occurred at the US Department of energy. Aromatic compounds such as toluene are sometimes added to fuels to increase the octane level of the fuel. However, these traditionally come from petroleum sources, and thus biobased alternatives are desirable due to their greater sustainability. The researchers have discovered a new enzyme that is capable of enabling microbial production of toluene, making this the first ever instance of microbial production of aromatic biofuel.

In the final microbe-related news story, Novozymes has released a yeast platform that they claim dramatically reduces fermentation time on starch, allowing for bioethanol production with much greater efficiency. They also claim that the new yeast strain solves a common problem with bioethanol plants: that they can suffer unwanted shutdowns due to adverse conditions killing off yeast, simultaneously reducing production and increasing costs as the problems are dealt with. The new yeast strain is apparently much more tolerant of high temperatures and lower pH levels, reducing the risk of shutdowns and providing a reduction in costs.

Read on for the latest news.

# Policy

## US anti-dumping duties to price out Argentine and Indonesian biodiesel

AHDB reports that The US Department of Commerce has set final anti-dumping duties on Argentine and Indonesian biodiesel imports at 60.44-86.41% and 92.52-276.65% respectively. These are markedly higher than the initial proposals made back in late August 2017, where maximum levels of 64.17% were suggested for Argentina and 68.28% for Indonesia. This means that Argentine and Indonesian biodiesel will be priced out of the US market, and so should encourage greater domestic biodiesel production in the US to fulfil mandates. Nevertheless, this recent hike in anti-dumping duties is unlikely to move the market considerably, as the original decision to introduce duties has already been factored in by the market.

Click [here](#) for more information.

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# Markets

## China ups tariffs on US ethanol imports

China is threatening to impose extra tariffs on imported ethanol and 27 other products from the US, following President Donald Trump's steep protectionist tariffs on imported steel and aluminium.

The new ethanol tariff would bring the total tariff on US ethanol imports to 45%, following a 30% tariff imposed by China in January 2017. The hike is expected to essentially halt US exports of the biofuel to China, which is the world's third largest producer of the product.

China's imports of ethanol from America were 189 million litres in February, the highest since May

2016, reported Bloomberg, citing Chinese customs data.

China is trying to increase its domestic ethanol production as it readies itself for a national policy requiring petrol to comprise 10% ethanol (E10) starting in 2020 – a move aimed at assisting its wider efforts to reduce air pollution and greenhouse gas (GHG) emissions.

According to the US Department of Agriculture (USDA), China produced over 1 billion gallons (3.8 billion litres) in 2016. Forecasts from the department suggest that with rising gasoline consumption, an extra 3.6 billion gallons (13.6 billion litres) of ethanol will be needed by 2020, putting China ahead of the EU as the world's third-largest ethanol consumer.

Any push to reach that target will likely be highly dependent on US imports, meaning additional tariffs imposed now are only like to slow compliance and increase fuel prices.

Click [here](#) for more information.



*Flickr*



# Research & Development

## Algal biofuels program enters next phase



*Wikimedia Commons*

ExxonMobil and Synthetic Genomics Inc. announced a new phase in their joint algae biofuel research program that could lead to the technical ability to produce 10,000 barrels of algae biofuel per day by 2025.

The new phase of research includes an outdoor field study that will grow naturally occurring algae in several contained ponds in California. The research will enable ExxonMobil and Synthetic Genomics to better understand fundamental engineering parameters including viscosity and flow, which cannot easily be replicated in a lab. The results of this work are important to understand how to scale the technology for potential commercial deployment.

Additional work will be required to advance larger-scale production. Both companies are continuing with fundamental research on algae biology in their laboratories as the field study advances. ExxonMobil anticipates that 10,000 barrels of algae biofuel per day could be

produced by 2025 based on research conducted to date and emerging technical capability.

This outdoor research follows the companies' years of fundamental biological research into understanding and improving algae oil production.

In 2017, ExxonMobil and Synthetic Genomics announced breakthrough research published in *Nature Biotechnology* that resulted in a modified algae strain that more than doubled oil content without significantly inhibiting growth, a key challenge along the path to commercial scalability.

Click [here](#) for more information.

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## Reducing microbe contamination in biofuels

Most people are cautious around gasoline and diesel for good reason, but some microbes love the stuff—especially biofuels that contain fatty acid derivatives. So, as the world tries to go "green," it also has to consider the slime that such microbes leave behind, clogging up equipment and killing engines. An article in *Chemical & Engineering News (C&EN)*, the weekly newsmagazine of the American Chemical Society explores the issue and what's being done about it.

Senior Correspondent Mitch Jacoby explains that these microbes are not much of a concern for the typical motorist. But for airlines and other organizations that store large amounts of fuel, contamination could be a problem. The U.S. Air Force, for example, has a mandate to rely more on biobased fuels in the coming years. Before using biofuels, military personnel made sure that the substances wouldn't interact badly with other materials it would come into contact with. However, they didn't consider the effects of microbiology. And as fleet operators started using blends of biodiesel and conventional fuels, they noticed contamination where none had existed.

This caused some experts to look down on the alternative fuels.

But scientists are on the case. One team recently identified several bacteria and fungi wreaking havoc in actively used fuel tanks. The microbes coated metal panels placed in the tanks with orange and red slime, and caused corrosion and pitting. Another group has been analysing genomes to help understand how microbes metabolize the fuels, and their findings could lead to safer ways of preventing contamination. Much more work is needed to sort through all of the possible factors, but scientists are well prepared to tackle this puzzle.

Click [here](#) for more information.

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## Microbial production of aromatic fuels

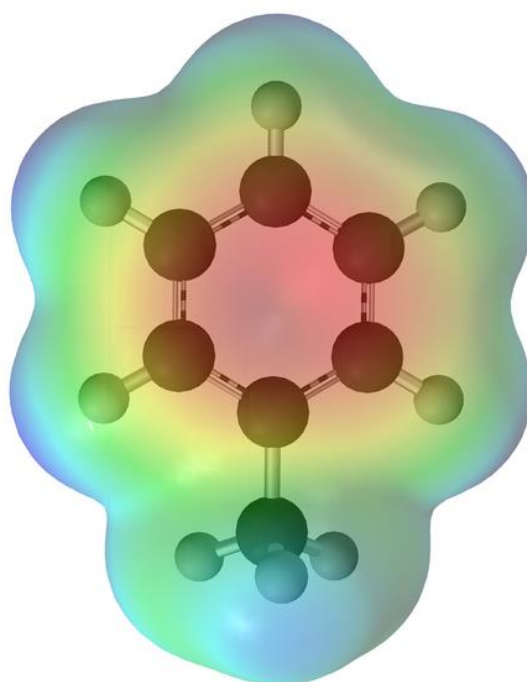
Researchers at the U.S. Department of Energy Joint BioEnergy Institute (JBEI) and Lawrence Berkeley National Laboratory (Berkeley Lab) have discovered a new enzyme that will enable microbial production of a renewable alternative to petroleum-based toluene, a widely used octane booster in gasoline that has a global market of 29 million tons per year.

A major focus of research at JBEI, and in the broader community of biofuel researchers, is the production of industrially and commercially relevant fuels and chemicals from renewable resources, such as lignocellulosic biomass, rather than from petroleum. The enzyme discovered in this study will enable the first-time microbial production of bio-based toluene, and in fact, the first microbial production of any aromatic hydrocarbon biofuel.

The process of enzyme discovery for this project was both challenging and unconventional. The researchers first started working with a bacterial species reported to make toluene, but when those reports appeared to be irreproducible, the scientists turned to the environment for toluene-producing cultures - specifically to municipal sewage and anoxic lake sediment.

An intriguing question arising from this research is: why would a bacterium produce toluene? The researchers don't have the definitive answer but present two hypotheses in the paper. One possibility is that the bacterium is producing toluene as a toxin to outcompete other microbes in its environment. Another hypothesis is that the phenylacetate decarboxylase (toluene-producing) reaction provides a strategy for the bacterium to regulate its internal pH in a somewhat acidic, fermentative environment.

Click [here](#) for more information.



*Wikimedia Commons*

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## Approval for Italian advanced biofuels scheme

The European Commission has approved an Italian support scheme for the production and distribution of advanced biofuels, including advanced methane, for use in the transportation sector. The scheme has an indicative budget of €4.7 billion (\$5.92 billion) and will run from 2018 through 2022.

A notice released by the European Commission notes that advanced biofuels and methane are the most sustainable and environmentally friendly biofuels, and have a much higher production cost than the fossil fuels they replace. Under the scheme, producers of advanced biomethane and biofuels receive a premium that allows them to compensate for these higher costs and compete with fossil fuels in the transportation sector. The premium can be increased if producers also make investments to improve the distribution and liquefaction of advanced biomethane.

In addition, the scheme provides incentives to farmers to produce biofuel and biomethane from manure and other agricultural residues.

The European Commission noted that the level of the premium will be updated annually in relation to production costs to ensure that producers are not overcompensated.

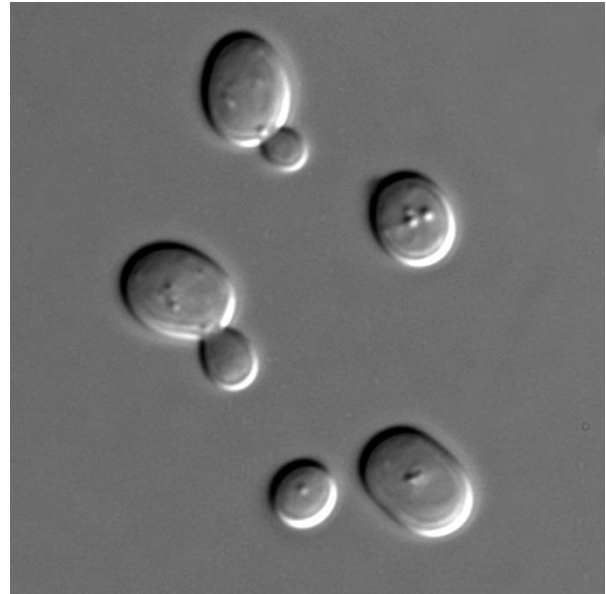
The scheme will be financed by fuel retailers who are required to include a certain percentage of advanced biofuels and biomethane in their fuel blend.

Click [here](#) for more information.

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# Bioethanol

## Novozymes new yeast product solves ethanol production problems



*Wikimedia Commons*

Novozymes has revealed its new yeast platform for starch-based ethanol, while also introducing the first product, Innova Drive. A completely new yeast strain, the product can reduce fermentation time by up to two hours compared to current yeasts.

The new yeast is also tougher, continuing to ferment in adverse conditions such as higher organic acids and temperatures. This stress resistance increases ethanol output and reduces operational costs.

Recent surveys show that more than half of all ethanol plants face operational upsets, many related to yeast. High heat, infections, organic acids, and throughput limitations are stressors that plague current yeasts, requiring plant personnel to increase antibiotics, reduce inputs such as corn solids, and add more yeast – all contributing to process complexity. This leads to a double-impact of increased costs and lost revenue.

Novozymes has used its expertise in enzymes to develop a perfectly matched yeast that delivers higher ethanol yields and reliable performance. The result is a game-changing solution for the industry that sets a new standard for fermentation performance.

During fermentation, Innova Drive produces a novel, higher-performing glucoamylase enzyme. The enzyme is twice as effective as glucoamylases produced by other yeast products in converting sugar into ethanol. And, when ethanol producers pair a specially designed, complementary Novozymes fermentation enzyme with Drive, the combined performance allows producers to maximize ethanol conversion and starch conversion efficiency.

Click [here](#) for more information.

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## **Chinese refiners in rush to blend ethanol**

China's top independent oil refiner is buying ethanol and two others are seeking government approval to blend the biofuel into their gasoline ahead of the country's 2020 deadline to add it to the nation's fuel supply, several sources told Reuters.

China mandated last September that gasoline supplies should contain 10 percent ethanol, an alcohol typically produced from corn, in a blend known as E10. The push by the private refiners is the first sign of preparations to prepare for the roll-out of the new standard in the world's biggest automotive market.

While China is the world's third-largest ethanol producer, with output of about 2.1 MMtpa, it is far below the top two producers, Brazil and the United States.

The government aims to double output by 2020 to 4 million tonnes.

Click [here](#) for more information.

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# Biodiesel

## **Enerkem develops high-octane biofuel from waste**

Enerkem Inc., a world-leading waste-to-biofuels and chemicals producer, announced during the 255th American Chemical Society national meeting in New Orleans, that it had succeeded in producing a new high-performance biofuel that could improve the octane rating of fuels sold on the market and reduce their carbon footprint.

The chemical engineering expertise at Enerkem's Innovation Centre in Westbury, Quebec, allowed the company to successfully develop a process that uses its proprietary waste-to-biofuel technology to produce a new biofuel with a Research Octane Number (RON) of up to 112. This is 20 points higher than the average octane rating found in regular motor gasoline. By using bio-dimethyl ether (Bio-DME), a product derived from Enerkem's biomethanol, combined with a DME-to-high-octane-gasoline catalyst developed by the National Renewable Energy Laboratory (NREL) in the United States, the Enerkem-NREL team were the first to demonstrate at pilot scale the production of an alternative fuel rich in paraffins.

In addition to the various environmental and economic upsides, there are many possible applications for a high-octane biofuel derived from Enerkem's bio-DME. The non-oxygenated additive could serve the specialized fuels market, such as the aviation gasoline and professional motorsport sector. As with the biomethanol and advanced ethanol produced today at commercial scale by Enerkem, this new biofuel allows better combustion, replaces fossil fuels and reduces greenhouse gas emissions.

Click [here](#) for more information.

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## Clariant releases de-waxing catalyst for diesel

Clariant, a world leader in specialty chemicals, announced the launch of its latest diesel dewaxing catalyst, HYDEX E. The new catalyst is an extension of Clariant's well-established HYDEX series, designed for selective hydrocracking of long-chain normal paraffins to improve the cold flow properties of middle distillates. HYDEX E maintains its predecessors' exceptional robustness and flexible application, yet considerably increases diesel yield while reducing by-product formation. Consequently, producers not only benefit from higher cost-efficiency but also improved sustainability.

Catalytic dewaxing is essential for regulating fuel fluidity characteristics of diesel fuel to ensure reliable applicability and performance. This is particularly true for cold weather conditions. Clariant's HYDEX catalysts have been successfully used for this purpose at more than 30 refineries around the world for over 20 years. The robust dewaxing catalysts allow versatile cold flow adjustment from 0°F to 120°F. Besides their excellent activity, long service cycles, and high tolerance to contamination, the catalysts also owe their success to extremely convenient installation. They offer a simple drop-in solution as a dewaxing layer in existing hydro processing units and require no further equipment.

Until now, the series included HYDEX G for dewaxing diesel and kerosene, HYDEX L for viscosity adjustment of heavy hydrocarbons, and special catalyst solutions tailored to customer needs. The range was expanded to create a new catalyst that allows operation under full sour service conditions. HYDEX E achieves this thanks to its robust zeolite content, which is combined with non-precious metal composition to ensure stable hydrogen transfer. On-site testing of HYDEX E in an ultra-low sulphur diesel (ULSD) hydro treater pilot plant resulted in approximately 4%-wt. more on-road diesel product compared to previous HYDEX generations. This significant

reduction in by-products presents a major financial advantage for producers.

Detailed standalone testing also demonstrated further benefits of the new catalyst's non-precious metal groups. These included improved desulfurization, additional product swelling, and a favourable shift towards combustion-benign mono-aromatics. These features will prepare producers for upcoming fuel regulations, which will stipulate more stringent limits on particulate formation. Even facing the conversion of complicated opportunity crudes.

Click [here](#) for more information.

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## Valtra now selling all tractors with biodiesel on startup



*Wikimedia Commons*

Finnish agriculture machinery giant Valtra has become the first tractor factory in the world to begin using renewable diesel as the start-up fuel for all of its new tractors.

Neste MY is a low-carbon biofuel produced from 100 per cent renewable raw materials and residues, which claims to reduce up to 80 per cent in greenhouse gas emissions over its lifecycle compared with fossil diesel.

Valtra claims about 700,000 litres of fossil diesel fuel will be replaced each year by 100-per cent renewable fuel.

All new Valtra tractors that roll off the assembly line will be tanked with Neste MY, as will the forklift trucks that operate in the factory.

Valtra claims the reduction in emissions achieved by using renewable diesel corresponds to the removal of almost 560 cars from roads a year or about 46,000 tractor hours without emissions annually.

Renewable diesel can be used in tractors and forklift trucks without any additives and without having to make any changes to today's engines.

Each new Valtra tractor will be delivered to customers with a 100 per cent renewable fuel of the future that is refined according to the principles of the circular economy — a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing energy and material loops.

Nine out of 10 new tractors manufactured at the Valtra's Finland factory are exported to more than 75 countries. Neste MY is only available in Scandinavia and the US.

Click [here](#) for more information.

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## Aviation Biofuel

### First trans-Pacific biofuel flight

In January 2018 the world's first dedicated biofuel flight between the United States and Australia took off from Los Angeles to Melbourne. The historic trans-Pacific 15-hour flight operated with approximately 24 000kg of blended biofuel, saving 18 000kg in carbon emissions. Qantas used biofuel processed from Brassica carinata, a non-food, industrial type of mustard seed, developed by Canadian-based agricultural-technology company, Agrisoma Biosciences.

The flight was part of the partnership announced in 2017 which will also see the companies work with Australian farmers to grow the country's first commercial aviation biofuel seed crop by 2020. Qantas International CEO Alison Webster said it was fitting that the airline's game-changing

Dreamliner 787-9 will showcase the future of sustainable aviation.

Across its lifecycle, using Carinata-derived biofuel can reduce carbon emissions by 80 % compared to traditional jet fuel. The 10 % biofuel blend used on today's flight will therefore see a 7 % reduction in emissions on this route compared to normal operations.

Carinata requires no specialised production or processing techniques. It is water efficient and The University of Queensland field trials in Gatton, Queensland, and in Bordertown, South Australia, have demonstrated it should do very well in the Australian climate.

It is sown in either fallow areas where food crops fail or in between regular crop cycles, known as "cover cropping". Rotational or break-crops can improve soil quality, reduce erosion for food crops and provide farmers with additional income. Agrisoma CEO, Steve Fabijanski, said biofuel produced from Carinata provides wide ranging benefits.

Qantas' first trans-Pacific biofuel flight was made possible with the support of AltAir Fuels and World Fuel Services. QF96 departed LAX on Sunday, 28th January and arrived in Melbourne on 30th January (local time).

Click [here](#) for more information.



*Pixabay*

## Specification change opens up opportunities for Byogy's alcohol jet fuel



*GoodFreePhotos*

California biofuel company Byogy Renewables welcomes ASTM's Alcohol-to-Jet (ATJ) ethanol-based specification ballot measure approval, putting Byogy on track as a leader to produce one of the world's first "full replacement" renewable jet fuels.

The ASTM emerging fuels division voted in favour of a new global specification that can now open the floodgates to significant volumes of renewable aviation fuel. This historic jet fuel specification is a direct nexus between the global ethanol industry and the aviation sector, connecting two mature industries that could never be linked in the past. Now ethanol can be used as a feedstock to make renewable jet fuel.

The global network of ethanol production and distribution is well established, as is the downstream petroleum infrastructure delivering jet fuel. This new ASTM specification allows these two global supply chains to connect so as to produce renewable jet fuel in significant volumes, and in places where it could not be produced before.

As the pioneer of the ATJ process, Byogy is one of the few companies that produce full replacement fuels, as opposed to only blend-stock products. Significantly, Byogy's fuels may ultimately be able to be distributed into the existing fossil fuel infrastructure at any point and at any ratio without tracking. This will allow carbon credit accounting to take place at the production source, similar to

the carbon credit bookkeeping of the wind and solar industries.

The new specification modifies a previous ATJ specification to allow ethanol as a feedstock with a maximum final fuel blend of 50 percent. The specification will officially adopt on April 1, 2018. Byogy will commercialize using this new specification, but in parallel continue to advance the ASTM process to develop a full replacement specification.

Click [here](#) for more information.

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## Other Fuel

### Hydrogen from algae still in early development

Extensive effort is being made to explore renewable energy in replacing fossil fuels. Biohydrogen is a promising future fuel because of its clean and high energy content. A challenging issue in establishing hydrogen economy is sustainability. Biohydrogen has the potential for renewable biofuel, and could replace current hydrogen production through fossil fuel thermochemical processes. A promising source of biohydrogen is conversion from algal biomass, which is abundant, clean and renewable. Unlike other well-developed biofuels such as bioethanol and biodiesel, production of hydrogen from algal biomass is still in the early stage of development. There are a variety of technologies for algal hydrogen production, and some laboratory- and pilot-scale systems have demonstrated a good potential for full-scale implementation. This work presents an elucidation on development in biohydrogen encompassing biological pathways, bioreactor designs and operation and techno-economic evaluation. Challenges and prospects of biohydrogen production are also outlined.

Click [here](#) for more information.

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# Events

## **Global Bioeconomy Summit 2018 Berlin, 19th-20th April 2018**

The first Global Bioeconomy Summit was held in 2015 and brought together more than 700 bioeconomy stakeholders from over 80 countries. Since then, Bioeconomy has taken a steep and exciting way forward. Many notable initiatives and collaborative efforts have been initiated by the bioeconomy community in order to drive the development of sustainable bioeconomies in their countries and regions.

The 2nd GBS will focus on emerging concepts and future trends in bioeconomy, the latest on challenges and opportunities related to ecosystems, climate action and sustainable development along with the bioeconomy innovation agendas and global governance initiatives to manage them.

Click [here](#) for more information.

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## **EUBCE Copenhagen, 14th-18th May 2018**

The core of the traditional EUBCE conference will be held over 4 days.

There will however be an extension to the core conference and exhibition in order to showcase the many achievements in the field of full scale biomass utilisation in Denmark that are an integral and major part of the country becoming fossil-free by 2050. Members of the national organising committee will organise special technical visits to sites in the centre of the country where biomass is the key renewable feedstock into processes producing renewable energy, biofuels, biochemicals and biomaterials as well as integrating bioproducts into traditional established fossil-based systems.

Click [here](#) for more information.

## **RRB 14 Ghent, 30th May - 1st June 2018**

The 14th edition of the International Conference on Renewable Resources & Biorefineries will take place in Ghent, Belgium from Wednesday 30 May until Friday 1 June 2018. Based on the previous RRB conferences, this conference is expected to welcome about 350 international participants from over 30 countries.

Delegates from university, industry, governmental and non-governmental organizations and venture capital providers will present their views on industrial biotechnology, sustainable (green) chemistry and agricultural policy related to the use of renewable raw materials for non-food applications and energy supply. The conference further aims at providing an overview of the scientific, technical, economic, environmental and social issues of renewable resources and biorefineries in order to give an impetus to the biobased economy and to present new developments in this area.

The conference will provide a forum for leading political, corporate, academic and financial people to discuss recent developments and set up collaborations.

The three-day international conference will consist of plenary lectures, oral presentations, poster sessions and an exhibition. Companies and research organizations are offered the opportunity to organize a satellite symposium.

Click [here](#) for more information.

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## **EFIB Toulouse, 16th-18th October 2018**

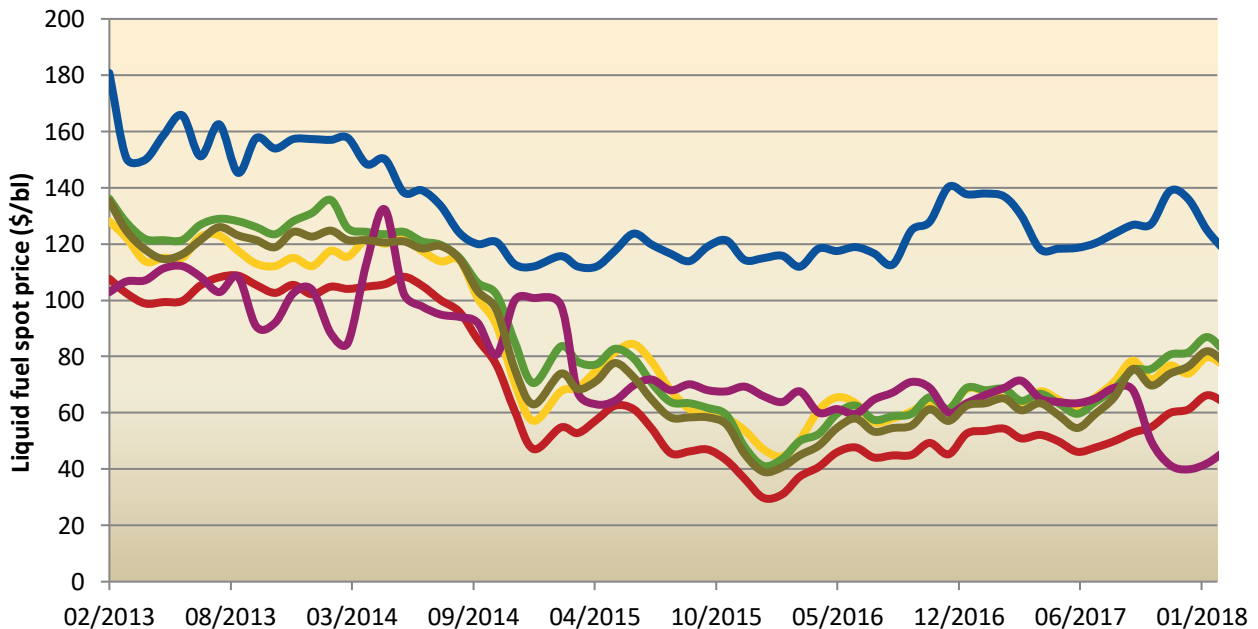
Join over 650 bio-based leaders in 2018 for the 11th edition of EFIB in Toulouse, France, on the 16th, 17th and 18th of October.

Click [here](#) for more information.

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# Price Information

Historical spot prices of liquid fossil fuels and liquid biofuels. Five years prices and up to February 2018 are given in \$ per barrel.



- Crude Oil (petroleum), simple average of three spot price
- Gulf Coast Gasoline
- Diesel - New York Harbor Ultra-Low Sulfur No 2 Diesel Spot Price
- Ethanol Average Rack Prices F.O.B. Omaha, Nebraska
- Jet Fuel Spot Price FOB - U.S. Gulf Coast Kerosene
- FAME 0° FOB ARA

Prices of Crude oil, diesel, gasoline, and jet fuel are recorded from [www.indexmundi.com](http://www.indexmundi.com); Price of ethanol from [www.neo.ne.gov](http://www.neo.ne.gov); Biodiesel spot prices from <http://www.kingsman.com>



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