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transfer their process to

demo scale

and

validate

For companies who are looking to

various biomass sources.

processes to help them

to

enabling commercial scale biorefineries in Europe

How Hero BX has solved issues of methanol recovery, material

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The commercialisation of bio-based products is a challenging

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production

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Brazil’s dramatic experiences in sugarcane ethanol production are relevant for

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Brazil’s dramatic experiences in sugarcane ethanol production are relevant for

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Debating until you’re RED in the face

Days before this edition of Biofuels International went to press, news came through that the European Parliament had voted in favour of the revised Renewable Energy Directive – the infamous RED II. It’s a development which answers some questions, but raises many others.

The plenary vote means that the European Parliament has agreed on its RED II stance, however, a final draft of the legislation must now be agreed with the executive European Commission and the national governments within the EU. In other words, another two groups need to reach an agreement before the legislation comes into effect.

RED II dominated the European biofuels agenda in 2017, and judging from industry reaction to the January vote this will continue into the New Year. The biofuels industry surely needs certainty if it’s to thrive. The continued debates over RED II mean that still seems far off.

This apparently never ending cycle of debate-disagreement-decision isn’t limited to Europe. As much of the world was fighting off its New Years’ hangover and coming to terms with the reality of returning to work, Brazilian President Michel Temer signed RenovaBio into law. The legislation is designed to reduce uncertainties for biofuel producers by creating blending mandates that apply for the next ten years. It actually passed the lower house of Brazil’s Congress back in 2016, but was subject to a range of delays and obstacles.

Back in December 2017, the US Environmental Protection Agency announced the final required volume obligations (RVOs) under the country’s Renewable Fuel Standard. The decision came after months of uncertainty, heavy campaigning and debate in the US. The final decision has split the US biofuel industry, some trade associations lauding the outcome, others deeply critical of it. However, it has at least provided some level of legislative certainty – for now.

Compared to Europe, Brazil and the USA seem to finally have achieved some level of stability in regards to renewable fuels policy, although for how long is anyone’s guess. It will be interesting to see how this benefits the two countries’ biofuels industries in 2018.

Of course, keeping track of what’s going on in our industry can be a challenge. Fortunately, Biofuels International’s website is updated daily with all the latest news. Visit www.biofuels-news.com to make sure you know what’s happening.

Daryl Worthington
Editor
European Parliament draws a RED line under palm oil, sets biofuels position

After much deliberation, the European Parliament has voted in favour of the revised Renewable Energy Directive (RED II).

The plenary of the European Parliament adopted its first reading position on RED II on 17 January. It has been met with mixed responses within the biofuels industry. While some have commended the decision to allow crop-based biofuels to be included towards RED targets and lauded the support to advanced biofuels, others have questioned the distinctions RED II makes between different fuels.

Designed to boost renewable energy use in the EU, the renewable energy directive establishes an overall policy for the production and promotion of renewable energy. The original directive required the EU to fulfil at least 20% of its total energy needs with renewables by 2020.

In November 2016, the Commission published a proposal for a revised RED, aimed at ensuring the EU would reach its target of a 27% renewable energy mix by 2030.

A key decision made in the voting is to remove biodiesel made from palm oil from the list of biofuels counting towards EU renewables targets from 2021.

Another key outcome of the vote relates to biofuels produced from food and feed crops. This amounts to a cap on conventional biofuels used in transport to existing levels. The plenary vote has also increased the target of renewable energy use in the EU economy to 35%, with a specific transport target of 12%. It also includes an increased incorporation obligation for fuel suppliers of up to 10%.

Emmanuel Desplechin, president of the European ethanol association ePURE, said: “The Parliament has sent a message that not all biofuels are created equal by focusing on getting rid of those that drive deforestation like palm oil. But its amendments still risk making it harder for EU Member States to realistically boost renewables in transport.”

“As the main EU institutions begin negotiations on renewables policy for the post-2020 period, the EU must remain committed to a meaningful binding target for renewables in transport – one that does not rely on artificial multipliers to create the illusion of better performance and make it easier for countries to meet their targets,” Desplechin said.

Bangladesh to allow 5% ethanol blend conventional fuels, but does not mandate production levels

Local news outlets are reporting that the government is allowing a 5% blend of bioethanol with octane and gasoline. According to them, the government is responding to interest from producers to set up the plants.

Plant owners will have to get government permission before producing ethanol, and all produce is to be sent to the state-run Bangladesh Petroleum Corporation.

It is unclear whether or not feedstock will be sourced solely from waste. Reuters has previously reported that government officials raised concerns about the plan’s effects on food supply, and questioned whether the plan was even necessary considering Bangladesh’s negligible contributions to global greenhouse gas emissions.
Gevo still committed to renewable jet fuel despite company cuts

Next generation biofuels company Gevo has reaffirmed its focus on the commercial development of renewable jet fuel, renewable isooctane, isobutanol and related products, in its corporate update for 2018. The commitment comes amid a range of cost saving measures at the company which have seen staff reductions and pay cuts.

According to the update, issued on the company’s investor relations website, Gevo aims to “aggregate enough confirmed commercial off-take to support the capital expense of expanding its Luverne, Minnesota facility.” The company plans to expand its business development capabilities in 2018 to achieve this goal.

In the coming year, Gevo is expecting to improve cash flow out of the Luverne Facility by optimising the plant’s ethanol production processes, developing value added products for ethanol and animal feed produced at the plant and further lowering the cost of the plant’s carbohydrate feedstock. According to the update, these initiatives are also expected to improve the cost of producing Gevo’s isobutanol.

“In 2017, we again showed that isobutanol can be produced in full scale equipment, we were able to meet the variable cost targets that we set out for our isobutanol production and we continued to demonstrate that there is growing demand for our products. That said, we have a “chicken and egg” problem,” said Dr. Gruber.

“Large scale product demand requires us to drive cost out of our production processes, which we expect to be able to achieve through greater production scale. However, raising the capital necessary to expand the Luverne Facility is more easily achieved, and at lower cost of capital, if we had large scale offtake agreements with customers. In 2017, we did make progress in this regard, including the contract we signed with HCS Holding (Haltermann Carless) to supply isooctane, but we need more. In 2018 the goal is to obtain off-take agreements for our products that will support financing the Luverne Facility expansion. Concurrently, we are looking extensively into ways to extend our cash runway as far as possible to give us the time to land and negotiate these contracts properly.”

Dr. Gruber continued: “We also see significant opportunity to improve the performance of the Luverne Facility in the near term, which is expected to benefit the company regardless of whether we are producing ethanol, isobutanol, or both. Luverne is an excellent plant site given the low cost and low environmental footprint of its corn supply.”

Another significant announcement in the company’s 2018 update is that Gevo expects to sign its first commercial license in India in 2018, through its partnership with Praj Industries.
New opportunity for grain sorghum-derived biofuels

On 19 December, the EPA published a proposed rule that would classify the fuels as ‘advanced biofuel’ in the Renewable Fuels Standard.

If approved, the EPA would set out a new fuel pathway for the distilling of the oil into fuel. The provisional rule is to be released onto regulations.gov for comment.

The document stems from an EPA assessment of lifecycle GHG emissions in grain sorghum refinement. The study concluded that the grain’s performance represented a halving of emissions compared to baseline petroleum fuels, qualifying it for ‘advanced biofuels’ status under the Renewable Fuel Standard (RFS):

“Based on our [the EPA's] GHG lifecycle evaluation described above, we propose to find that biodiesel and heating oil produced from distillers sorghum oil via a transesterification process, and renewable diesel, jet fuel and heating oil produced from distillers sorghum oil via a hydrotreating process meet the 50% GHG reduction threshold requirement for advanced biofuel and biomass-based diesel.”

John Duff, the strategic business director for National Sorghum Producers said that the ruling was something “that sorghum producers, their allies, and friends in the ethanol industry have been working for about four years to get to”.

“I’m glad we’re at a point where we have a proposed rule in draft form. I think what this does is, it affirms sorghum’s viability and sorghum’s promise in its ability to reduce greenhouse gas emissions.”

Under the RFS, oil refiners and importers are required to buy renewable identification numbers (RINs) to show that they are complying with efforts to replace or reduce a mandated volume of non-renewable fuels. ‘Advanced biofuels’ RINs cover four of the five RIN codes that oil businesses are required to buy according to their obligations under the RFS. ●

Australian canola meets GHG requirements for ‘$1 billion’ EU market

Canola grown in Australia is eligible to enter the EU market as an environmentally-friendly biodiesel feedstock, opening up a potential $1 billion export market for Australian farmers of the crop.

The European Commission has confirmed that Australian canola meets the EU’s strict new feedstock requirements for biodiesel. Stringent EU greenhouse gas reduction targets could have seen the European market closed to Australian farmers from 2018, had they not demonstrated they grow low-emission canola.

A Commonwealth Scientific and Industrial Research Organisation (CSIRO) report funded by the Australian Oilseed Federation and the Australian Export Grains Innovation Centre (AEGIC) was submitted to the European Commission to prove the crop’s green credentials. According to AOF executive director Nick Goddard, Australian canola growers will be ‘relieved’ over the decision. The EU is Australia’s largest canola export market, with the majority of it is used in biodiesel production.

“The EU market is too valuable to lose for Australian canola growers. In 2016/17, Australian canola exports to the EU were typically worth over $1.0 billion, with nearly all those exports being used for biodiesel production,” Goddard said.

AEGIC’s Chief Economist, professor Ross Kingwell, highlighted the positive impact the decision would have for Australia’s canola industry. “Many Australian farmers rely on canola production, and securing access to lucrative markets like the EU is crucial to underpin the security and general profitability of cropping in many farm regions across Australia,” Kingwell said. ●
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2015
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2012
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2009
Corn oil extraction aids
$76.8 million advanced biofuel demonstration plant coming to Norway

A (CDN)$76.8 million (€50.7 million) industrial scale advanced biofuel demonstration plant will be constructed at a former pulp mill in Tofte, Norway. The new facility is apparently a step towards the creation of a commercial scale project.

Danish-Canadian clean-fuel company Steeper Energy is partnering with Silva Green Fuel, a Norwegian-Swedish joint venture, on the project. Steeper will license its proprietary Hydrofaction technology to Silva, who will construct the facility over the next 18 months. Feedstock for the plant will be woody residues which are converted to renewable crude oil before being upgraded to renewable diesel, jet or marine fuel. Silva selected Steeper’s Hydrofaction system following a review of around 40 other technologies. According to a statement, the partnership between Silva and Steeper aims to verify data and design protocols in order to de-risk future commercial scale facilities planned to be built by Silva. The technology will eventually be offered by Steeper to other biofuel project developers around the globe. “This partnership positions Steeper Energy as a leader in providing advanced renewable fuels that can not only help reduce net carbon emissions, but also produce in-demand renewable diesel for use in heavy and long-haul transport sectors,” said Perry Toms, Steeper Energy’s co-founder and CEO.

California bus company adopts 100% renewable Neste diesel

According to a press release from Tri Delta, a bus company who conduct three million journeys a year, the switch has meant lower emissions and a better customer experience.

Tri Delta says that the new fuel will mean a more comfortable experience for riders due to reduced fumes from the new fuel. According to the company, there have been no complaints from drivers over vehicle performance, saying that drivers had not been told about the switch and hadn’t noticed a difference.

Jeanne Krieg, chief executive officer of Tri Delta said in a statement: “By switching to renewable diesel, we will reduce our output of greenhouse gases by up to 80%.”

In 2016, Governor Edmund Gerald Brown Jr. signed the California Global Warming Solutions Act of 2006 into law. The bill requires a 40% reduction in GHG emissions by 2030 compared with 1990 levels.

In October of this year, Neste’s stock jumped 7.44 points after the company reported a solid Q3 performance with an operating profit of €339 million. The company put the success down to good performance by the Services & Marketing Division, as well as refinery outages in the US.
‘Super yeast’ could be a game-changer for US ethanol production

US researchers have developed a ‘super strain’ of yeast that can efficiently ferment ethanol from pretreated pine – one of the most common tree species in the US. The scientists from the University of Georgia (UGA) claim that their research could help biofuels replace gasoline as a transportation fuel.

Joy Doran-Peterson, professor of microbiology at UGA, and doctoral student G. Matt Hawkins, used direct evolution and adaption of Saccharomyces cerevisiae, a yeast species used for corn ethanol production, to generate the super yeast.

Published in the journal Biotechnology for Biofuels, the research shows that pine fermented with the new yeast can withstand toxic compounds, and produce ethanol from higher concentrations of pre-treated pine than previously possible.

The strain of yeast is capable of producing ethanol in fermentations of pretreated wood containing as much as 17.5% solid biomass. Until now, researchers were only able to produce ethanol in the presence of 5-8% solids. Previous studies of 12% solids demonstrated a marked decrease in ethanol production.

In the new process, the pinewood needs to be pretreated with heat and chemicals prior to fermentation, then the yeast is applied. The pre-treatment helps enzymes break down the cellulose down into sugars.

The discovery could be hugely significant for the US biofuels industry. Pine plantations account for 50% of harvested timber in Georgia, and the loblolly pine used in the research is among the fastest growing trees in the US South.

“We’re talking about using forestry residues, waste and unsalable timber,” said Doran-Peterson, “Alternatively, pine forests are managed for timber and paper manufacturing, so there is an existing infrastructure to handle tree-farming, harvest and transportation for processing.”

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Agrisoma Biosciences

Location: Uruguay

Location: Low carbon bio and aviation fuels

Alternative fuel: Carinata

Construction / expansion / acquisition: Canadian company Agrisoma Biosciences and Uruguay agreed a partnership aimed at introducing a new, renewable, low carbon cash-crop for farmers. The deal gives the Quebec-based company the opportunity to grow its business outside of Canada by planting thousands of new hectares of the Carinata seed in Uruguay.

Completion date: May 2017

Comment: “This partnership is a shining example of how foreign governments and Canadian business can work together to find sustainable farming solutions that address consumer’s increasing demand for healthy food production and renewable energy, says Rodolfo Nin Novoa, Uruguay’s Minister of Foreign Affairs.

“This is a made in Canada solution,” says Steve Fabijanski, CEO of Agrisoma. “Carinata, is a new crop first developed, tested and grown in Canada and now going global, being farmed as a new second, cash-crop alternative,” says Fabijanski.

ICM

Location: Sao Paulo, Brazil

Alternative fuel: Ethanol

Construction / expansion / acquisition: US biofuels process technology provider ICM will be opening a regional office in the city of Sao Paulo, Brazil. ICM’s plans to develop enhanced operations in Brazil were initiated by the transformation taking place in the country.

Project start date: October 2017

Comment: In a statement, the company said: “Today, Brazil’s strong agricultural economy, favourable growing conditions producing record corn yields, infrastructure development, and local demand for grains use in livestock productions and ethanol use are aligning to bring great opportunities within the country.”

BP Biofuels and Copersucar

Location: Brazil

Alternative fuel: Ethanol

Capacity: 180 million litres storage capacity

Construction / expansion / acquisition: BP Biofuels and Copersucar have agreed to a new joint venture to own and operate a major ethanol storage terminal in Brazil. According to a statement from BP, the aim of the new terminal is to ‘better and flexibly’ connect ethanol production with the country’s main fuels markets. The equally split joint venture will own and operate Terminal Copersucar de Etanol in Paulinia in the State of Sao Paulo. The facility is currently solely owned by Copersucar. In operation since 2014, the terminal has ten tanks with a total storage capacity of 180 million litres of ethanol and moves around 2.3 billion litres per year, with the possibility of further expansion.

Project start date: December 2017

Investment: €1.3bn for 20 years (proposed)

Comment: Dev Sanyal, BP’s CEO Alternative Energy, said: “BP is committed to the dual mission of delivering the energy that the world needs while advancing the low carbon world that we all want. We believe that biofuels offers one of the best large-scale solutions for decarbonising the transport sector and demand will continue to grow for decades to come. Brazil is one of the largest markets globally for ethanol as a fuel and this collaboration with Copersucar enables us to extend and expand our existing value chain to meet its growing demand.”

FS Bioenergia

Location: Mato Grosso, Brazil

Alternative fuel: Corn ethanol

Capacity: 60 million gallons of corn ethanol, 6,200 tonnes of corn oil, 170,000 tonnes of feed rations for Brazil’s livestock industry

Feedstock: Corn

Construction / expansion / acquisition: An international collaboration has resulted in the creation of Brazil’s first corn ethanol project, which aims to meet the country’s growing ethanol needs and introduce new feed options to the livestock industry. FS Bioenergia will employ roughly 150 full-time workers.

Designer/builder: ICM

Project start date: Early 2016

Completion date: August 2017

Investment: $115 million (€93 million)

*This list is based on information made available to Biofuels International at the time of printing. If you would like to update the list with any additional plant information for future issues, please email daryl@woodcotemedia.com
A summary of the recent explosions, fires and leaks in the biofuels industry

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Company</th>
<th>Incident information</th>
</tr>
</thead>
<tbody>
<tr>
<td>15/01/18</td>
<td>Newcastle, Australia</td>
<td>N/A</td>
<td>A B-Double lorry carrying ethanol was involved in an accident with three other vehicles. The resulting explosion killed the driver and ignited a bushfire that spread over 15 hectares.</td>
</tr>
<tr>
<td>06/12/17</td>
<td>Fort Dodge, Iowa</td>
<td>Valero Renewables, Canadian National Railway</td>
<td>Six tankers derailed, with no injuries or ethanol spilled. Authorities attributed the cause to a malfunctioning switching mechanism used to transfer the ethanol from container to container.</td>
</tr>
<tr>
<td>22/11/17</td>
<td>Annawan, Illinois</td>
<td>N/A</td>
<td>8,000 gallons of ethanol spilled from a truck trailer after it collided with the centre meridian on Interstate 80. There were no injuries reported.</td>
</tr>
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Looking ahead for 2018

Dr. Ravindra Utgikar, vice president Corporate Strategy & Marketing at Praj Industries

2018: A game changing year

The dynamics of global energy business are changing fast as a result of change in energy consumption patterns, driven by geopolitical developments and technological advancements amongst other things. Growing environmental concerns such as climate change and global warming in addition to volatility and rising oil prices have resulted in increasing focus towards alternative energy sources like bioethanol. Using a variety of bio based feedstock, ethanol plants can produce fuel ethanol and with some modification also isobutanol. In the past few years more technologies have been developed globally to create isobutanol from renewable sources.

The bioethanol industry, both in India and the world over, is likely to experience market consolidation in 2018 and then may return to a growth path in the following year. The biofuels industry is in the midst of a critical transition; one where there is a wave of second generation alternative fuel technologies graduating from the laboratory phase and into the commercialisation phase. Going forward, Praj envisages greater integration of first and second generation biofuels by way of drop-in fuels like bio-jet and isobutanol, in addition to ethanol.

Let’s take a look at first generation ethanol mandates globally. The strategic plan issued by the US Department of Energy in December 2017 projected that biofuels can comprise 25% of America’s transportation fuels by 2040. The EU has released a revised Renewable Energy Directive (RED) and proposed the phase-out of food crop-based biofuels from 2021 while introducing a sub-mandate for advanced biofuels.

China plans to roll out the use of fuel ethanol in E10 blends nationwide by 2020. The Government of India has proposed an indicative target of 20% blending of ethanol in petrol by 2030. Several other countries in Latin America, Africa and Asia have the potential to become major producers and exporters of biofuels. South-East Asian countries which are large palm oil producers could develop competitive biodiesel production and export business. Interestingly, there are indications of rising interest in second generation biofuels globally.

Praj has made advancements in commercialisation of second generation ethanol technology. Last year, the company set up an integrated biorefinery demonstration plant in Pune, India, for producing renewable fuels and chemicals, based on its proprietary second generation technology. This plant can produce one million litres of ethanol per year (1MLPA) by processing a variety of agri-residues like rice and wheat straw, cotton, bagasse, corn cobs & stover, etc.

To meet ambitious targets reaffirmed in global environmental summits such as the COP 21 in Paris, policy continues to play a vital role. Global acceptance and success of second generation biofuels will be contingent upon the introduction and implementation of second generation ethanol mandates with blending incentives. Such mandates need to be sustained and even introduced where they do not exist, while the biofuels industry gears up to deploy second generation technology.

Over the next few decades, global demand for transport fuel is forecasted to grow significantly; by as much as 55% by 2030, from the base levels of 2004. This will also accelerate the growth in demand for biofuels, as they are poised to make an increasing contribution to meeting the future energy needs of mankind.
The details on how to reduce transport emissions are being debated in discussions on the revision of the Renewable Energy Directive (REDII).

The European Commission proposed a specific mandate for advanced biofuels, defined by a feedstock list (Annex IX part A). The EU institutions are currently finalising the legal texts. Such a mandate would enable further investments into lignocellulose and waste & residue based advanced biofuels.

UPM has built a commercial scale biorefinery based on its own innovative technology and own wood-based residue of the pulp production process, crude tall oil, as feedstock. The annual production capacity is 120 million litres of wood-based renewable diesel, and a smaller portion of renewable naphtha that can be used as a gasoline component or for replacing fossil raw materials in bioplastics. UPM BioVerno renewable fuels can be used to significantly reduce tailpipe emissions and to reduce greenhouse gas emissions by up to 80% when compared to fossil diesel. The commercial production of our first of its kind biorefinery in Lappeenranta, Finland started in the beginning of 2015, and has now reached our initial goals. We continue to streamline the production efficiency and expand our customer base in the EU.

For UPM, advanced biofuels create new opportunities for growth. We have taken a bold leap away from the traditional forest industry towards the bio and forest industry, and have recently put together a team with the mission of identifying growth opportunities in advanced biofuels including new raw materials and technologies. We believe in the need of huge capacities of truly sustainable advanced biofuels for transport, especially in the heavy duty and marine sector in the 2020s. Lately we have been positively surprised by the wide interest in UPM BioVerno renewable fuels by companies wanting to choose truly green and sustainable solutions in order to cut their own carbon footprint. We believe that this trend will continue beyond the 2020s.

Looking at the mandates, the US has a very ambitious biofuels policy and recently EPA released its final rule for the Renewable Fuel Standards. The demand for biomass-based diesel is strong on a federal level and in addition to this states like California have their own even more ambitious solutions in order to cut their own carbon footprint. We believe that this trend will continue beyond the 2020s.

Passenger car transport will go through a major transformation in the next decades. Despite the recent debate, it is not really about electric cars vs. biofuels. Both electric cars and renewable fuel have an important role in increasing the air quality in big cities and reducing GHG emissions. Renewable diesel causes less particle and NOx emissions than fossil diesel, which makes it a good solution, especially for heavy-duty vehicles that cannot be electrified as easily as light-duty vehicles. Today, 70% of global diesel is consumed in heavy duty road transport and demand is projected to grow 45% by 2040. In addition, the growing airline industry needs sustainable aviation fuels.

Advanced biofuels provide concrete and fast solutions for the long-term decarbonisation of the transport system, while creating additional jobs and opportunities for growth. However, a decision on a stable, long term regulatory framework for biofuels is necessary to secure investor confidence.

Angel Alvarez Alberdi, secretary general of the European Waste-to-Advanced Biofuels Association (EWAB)

2018 will be the year in which the almost endemic regulatory uncertainty affecting the sector might be over. That alone would be good news, but as they say the devil is in the detail: the European Union (EU) will finally come up with a comprehensive revision of the Renewable Energy directive (REDII). RED II is the main driver of the EU biofuels markets as it will set the basis for the regulatory framework of biofuels in EU Member States for the 2020-2030 period. EU policymakers have in their hands the fate of a large and complex set of industries using a wide array of technologies to transform different feedstock into renewable fuels. The legislative passage started over a year ago, and industry stakeholders in Brussels are as active as they are nervous. Stakes are particularly high as policy decisions will have a very real and tangible impact on past and future investments, jobs and ultimately the actual survival of many companies.

Of interest for the industry at large, REDII will settle (at least for some time) the food vs. fuel debate in the EU by sending a clear message on the scope of the already limited contribution of crop-based
biofuels to the EU fuel mix and establishing improved sustainability requirements for biofuels. This is a slippery territory and EU policymakers will have to strike a difficult balance between economic interests and the demands from an especially determined and vocal civil society. It seems that a nearly total ban of palm oil biodiesel based on its dubious sustainability profile might be the price to pay to allow other crop-based biofuels to continue being commercialised until existing capped levels. Particularly relevant for the waste-based biofuels industry, RED II will for the first time put forward a clear definition of what is to be considered as “advanced biofuels”, and, more importantly, it will establish a series of measures to promote those alternative fuels that the legislator deems worthy of policy incentives, essentially “advanced biofuels” defined as sustainable, waste or residue-based and non-food or feed-competing (coupled with renewable electromobility, renewable fuels of non-biological origin, and possibly waste-based fossil fuels).

The EU legislator is aware that the superior greenhouse gas reduction credentials of these sustainable alternative fuels merit policy support given that their cost of production is always higher than that of crop-based biofuels. In this context, a blending obligation such as the one being proposed in REDII appears to be an adequate promotion mechanism. Additional measures such as multiple accounting may also help if they are well defined. Once more, the devil is in the detail and the industry at large is so complex that the final deal might be less than optimal for this technology/feedstock or the other. Let’s keep in mind that the ultimate objective here is to progressively decarbonise the EU transport sector.

Waste-based biofuels such as used cooking oil methyl ester (UCOME) or tallow methyl ester (TME) have the highest possible greenhouse gas savings in the alternative fuels spectrum. Let us hope that the REDII brings a solid regulatory framework that brings the industry much needed stability for the years to come.

2018: Year of the reality check for EU energy policy

Emmanuel Desplechin, secretary general of ePURE, the European renewable ethanol association

As 2018 begins, two major initiatives – one that is well under way and another that is still in the starting blocks – will highlight the need for a reality check for EU transport energy policy.

One of them is a major recast of the Renewable Energy Directive, known as RED II. The legislation is currently being hashed out by the three main EU institutions, which have different post-2020 visions for the EU’s transport energy mix. The stakes are high, as some policymakers are pushing for a total phase-out of biofuels, even those like renewable European ethanol that contribute significantly in the fight against climate change.

The other is the EU’s Clean Mobility Package, unveiled in November by the European Commission. Intended to lay out a future of clean transport for cities, the package will include a range of measures aimed at reducing emissions of pollutants and greenhouse gases. However, it is missing some of the most obvious mobility solutions that already exist and could be helping in the fight to improve air quality and energy use.

Fortunately, on both measures there is room for sustainable biofuels to play an important role if politicians make the right choices.

The RED II battle is now at a crucial stage. EU Member States agreed a general approach just before Christmas, and the European Parliament will vote in plenary in January. Then the real work will begin, as the EU institutions begin negotiations to finalise the legislation.

Already there have been some strange messages and alliances in this debate. The Commission is now pushing just as hard against biofuels as it did for them only a few short years ago, claiming to want high ambitions for renewable energy in transport but leaving the door open in 2030 for fossil fuel to provide over 90% of EU road and rail transport energy, thereby reducing the 2020 ambitions.

EU Member States in the Council are pushing for more flexibility to meet their renewables targets, leaving in place a 7% cap for crop-based biofuels but allowing countries to lower their targets for renewables in transport. And the European Parliament’s position is still yet to be determined by the plenary vote, but could push for a total phase-out of crop-based biofuels by 2030. The coming weeks will be interesting to see how those differences get ironed out.

The stakes are high. Europe needs to foster renewable energy uptake in transport if it wants to meet its climate goals and achieve its ambition of at least 27% renewable share in its energy mix. Maintaining the 7% cap for crop-based biofuels – including renewable European ethanol, which delivers significant GHG reductions – in a firm obligation is essential.

The other big biofuels-related issue for 2018 in the EU is the Clean Mobility Package. Ethanol and biofuels in general are not mentioned in this initiative, which instead assumes (or at least hopes) that in 2030 EU road transport will be dominated by electric vehicles.

A lot of the discussion at EU level on the future of mobility focuses on finding one right answer to decarbonisation – with EVs usually the default response – and in pitting renewables against each other. This has led to some rather strange positioning – for example one environmental NGO recently was arguing AGAINST setting a high ambition for renewables in transport.

But the fact is we need a lot of different solutions, not just now but also in the coming decades. For sure, EVs will be a major part of road transport. But even the most optimistic models show that in 2030 combustion engines will still be a significant part of Europe’s auto fleet. Why not let them run on low-carbon fuels that can make sure they are helping in the decarbonisation effort?

In dealing with both of the big biofuels issues for 2018, the EU needs to have a more realistic vision of the transport energy mix. One that includes so-called zero-emission and low-emission options to power all the vehicles that are still on the road. One that acknowledges the contributions that sustainably produced crop-based biofuels like ethanol can make. And one that allows for a growing contribution from second-generation biofuels like cellulosic ethanol.

Only then can Europe have any hope of making its climate ambitions a reality.
US biodiesel faces challenges, but poised for growth in 2018

Donnell Rehagen, CEO, National Biodiesel Board

2018 is a landmark year for the US biodiesel industry as its trade association, the National Biodiesel Board, celebrates 25 years of challenges, opportunities, and achievements. We are proud of the substantial growth of our industry over these 25 years and the many benefits it brings to the US.

The biodiesel industry in America has been built from visionary leaders all throughout our history. In the early days, the board was created by state soybean groups designed to develop an industrial outlet for the vast surplus of soybean oil paired with a vision for improving American energy security. The US grows more than 80 million acres of soybeans a year, producing more than 40 million tonnes of soymeal to feed livestock and more than 20 billion pounds of oil that go into food and industrial uses. In 2017 the biodiesel industry utilised more than six billion pounds of soybean oil and another six billion pounds of other fats and oils. But before those industrial uses were a reality for soybean oil, that lack of demand was a severe detriment to soybean values and rural economies.

This ability to grow food, feed, fibre, and fuel on the same acre of land provides tremendous efficiency and benefit far beyond those of simply producing a renewable, cleaner-burning fuel like biodiesel. The environmental benefits of the US biodiesel industry have been confirmed by US EPA, the California Air Resources Board, Purdue University, and many others. Again, a great source of pride for our industry.

State and federal programmes that support biodiesel in the US like the Renewable Fuel Standard, California low carbon fuel standard, and the biodiesel tax incentive are designed to create jobs, increase our nation’s energy independence and improve air quality. Consumers today are significantly more conscious of the impact of the products they purchase and consume and biodiesel offers many benefits.

After a decade of steady growth, the US biodiesel market is nearing three billion gallons annually. In order to continue on that path, this industry needs clear and consistent signals from our government in the form of annual growth and support of the RFS and a long-term biodiesel tax credit. These signals are critical to seeing the investment that is necessary for significant growth in both biodiesel production and supply chain infrastructure. These signals will provide certainty and stability to biodiesel producers and suppliers who compete in a marketplace long-dominated by well-established cartels in the Middle East that can easily manipulate prices of competing products.

When looking back over the last 25 years of biodiesel in the US, the challenges we’ve faced and obstacles we’ve overcome as an industry are remarkable. I’m convinced we have succeeded because of each and every individual that makes up this great industry. Their vision, strength, resilience, and love for what they do has carried us all to where we are today and has laid the groundwork for our future growth.
Recognised the economic success successive governments have seen continued growth as change. In Canada, we have policy to address climate development of the Clean Fuel sector. Consultations on the important reductions in GHG intensity targets for separate carbon pools that will deliver important reductions in GHG emissions in the transportation sector. Consultations on the development of the Clean Fuel Standard – including key policy elements as well as technical details – are underway now. The government, in its recent announcement, has recognised that the combination of a clean fuel standard and renewable mandates is a winning formula. Regardless, much work remains to be done. It is anticipated that the draft regulations will be completed at the end of 2018.

The encouraging signs we are seeing in Canada are reflected elsewhere. Last autumn, China announced plans to roll out the use of ethanol in gasoline nationally by 2020. Beijing’s move to a 10% mandate will boost industrial demand for corn and assist in the government’s efforts to reduce air pollution. Coupled with China’s recently announced plans to establish a national carbon trading market – initially in the power sector – it appears that the world’s top polluter is poised to become a leader in the battle against climate change and greenhouse gas emissions. Brazil, Argentina, and countries in the European Union, southeast Asia, and parts of Africa have had substantial biofuel blend requirements for at least five years. The US has seen its use of renewable fuels go from 8 billion gallons in 2008 to an estimated 25 billion gallons in 2017 – a 300% increase in ten years. It is projected that US biofuel consumption will increase to 36 billion gallons in 2022.

Though the nature of politics still means that some will continue to debate the scope of the climate change challenge and pace at which solutions should be implemented, a global consensus has emerged on the need to embrace cleaner fuels. All countries are constantly on the lookout for proven technological advancements and policy innovations that can help them deliver on their climate change commitments.

One final cautionary note is merited, however: while our industry is currently part of the solution, we should keep in mind that governments will largely remain agnostic as to the means that are implemented to achieve their GHG emission reduction commitments. That being the case, it is incumbent upon leaders in our industry to keep doing what we do best: research, experiment and develop ways to continue to deliver even greater reductions in greenhouse gas emissions.

Good reason for optimism

Jim Grey, Chair of Renewable Industries Canada and CEO of IGPC Ethanol

At the end of every year, our industry takes stock of the economic, political and environmental developments that have affected our market over the past 12 months and examines what the signals are for the coming year.

Over the years, we have encountered many challenges and opportunities. On the whole, the biofuels sector in Canada has fared well as the world continues to develop comprehensive policy to address climate change. In Canada, we have seen continued growth as successive governments have recognised the economic and environmental value of nurturing a domestic biofuels industry.

At risk of being overly optimistic, Canada’s biofuel sector may be poised for a great leap forward in 2018. The key to this is that the governments in Canada’s five most populous provinces – Ontario, Quebec, British Columbia, Alberta and Manitoba – have embraced or are in the midst of exploring progressive approaches to promoting enhanced use of clean fuels.

At the federal level, there is also reason for optimism. Canada’s Department of Environment and Climate Change published the Regulatory Framework for its Clean Fuel Standard in December 2017. The objective – to deliver 30Mt of GHG emission reductions by 2030 – will be met using a combination of policy tools including partitioned carbon intensity targets for separate fuel pools that will deliver important reductions in GHG emissions in the transportation sector. Consultations on the development of the Clean Fuel Standard – including key policy elements as well as technical details – are underway now. The government, in its recent
Overcoming barriers to ethanol

Emily Skor, CEO of Growth Energy

Last year the US ethanol industry defeated existential threats to the Renewable Fuel Standard (RFS). First, we faced efforts by a small group of refiners to upend the RFS by shifting the point of obligation, which would have resulted in years of red tape and negated any incentive for retailers to carry higher blends. Then, the Environmental Protection Agency (EPA) issued a Notice of Data Availability looking to ultimately lower blending targets for biofuels and was rumored to be considering attaching RINs to exported gallons of American ethanol. Fortunately, we won those big fights, ensuring no legislative changes to the RFS. And despite cellulosic blending targets coming in lower than desired, the 2018 Renewable Volume Obligations (RVOs) for conventional ethanol were finalised at 15 billion gallons. We made dramatic headway in achieving Reid Vapour Pressure (RVP) parity for fuel containing 15% ethanol (E15). An outdated regulation currently prevents American fuel retailers from offering E15 to consumers from June 1 to Sept. 15, but by positioning retailers as the new face of the RVP battle, we made inroads with parties who were previously uncooperative toward ethanol. Now we have the momentum, and an EPA administrator who has pledged in writing to give RVP due consideration. We will redouble our efforts in 2018 to ensure that the progress we have made with both conventional and cellulosic ethanol in the US continues. There is also a world of opportunity for American ethanol in the international marketplace. Through our participation in the industry’s Ethanol Export Steering Committee programmes, Growth Energy representatives traversed the globe in 2017 to promote pro-ethanol export policies and confront trade barriers challenging our industry. Countries around the world can all benefit from cleaner burning biofuels, and we are working every day to educate the administration on the importance of global trade and our need for US government intervention to open new markets and help eliminate recently erected trade barriers. With China, Mexico, and Canada all announcing proposed increases in future biofuel blending in 2017, China announcing it will remove the value-added tax on imports of DDGS, and Vietnam notifying the US that it will resume imports of American DDGS, continuing to facilitate a favorable market for exports will be a chief objective for this year and beyond.

At the end of the day, Growth Energy works to ensure that its members can provide renewable biofuels to their neighbors, and to people on the other side of the world. Here at home, that means protecting the RFS, facilitating the expansion of E15 and higher blends, and engaging consumers on the benefits of ethanol. Abroad, it means working with our administration and foreign governments in places like the European Union, China, Brazil, and Peru to resolve tariff issues, build infrastructure, and promote open trade so that renewable biofuels continue playing a critical role in moving the world toward a cleaner, healthier future.
Enabling commercial scale biorefineries in Europe

Building a lignocellulosic future

Fossil based resources currently make up the majority of the feedstocks used to produce fuels, chemicals and materials, representing a series of environmental and economic challenges. These include issues related to global warming, price volatility and on the longer term, security of supply.

The forest regions of the EU-27 have access to a large supply of biomass resources (25 billion m³ growing stock) that are not in competition with food supply. In combining woody biomass supply, expertise in wood processing and chemicals production, it is expected that lignocellulosic feedstock will soon become a key strategic resource for chemical intermediates. Building towards this goal is the priority of Bioforever.

Producing chemical building blocks from woody biomass

Following the introduction of cane sugar ethanol as a biofuel in Brazil in the 80's and corn ethanol, particularly in the US, over the last two decades, the discussion about the use of agricultural land for biofuels production has resulted in initiatives aimed towards developing and implementing technologies for the production of advanced biofuels. This includes biofuels produced from agricultural or forestry residues or from so called lignocellulosic energy crops produced on marginal land. Several companies have invested in commercial scale cellulosic ethanol plants in order to demonstrate the technical and economic viability of their technologies. The intention of the Bioforever consortium is to raise the bar even further by demonstrating the viability of technologies that can produce clean cellulosic sugars; sugars that can be used as a feedstock for fermentation processes to produce various chemical building blocks (ethanol, butanol, FDCA), enzymes and all other products that can be produced via fermentation. The consortium will focus on using woody biomass as a feedstock, e.g. spruce, poplar and waste wood, with technology partners converting these feedstocks in their demonstration plants to cellulosic sugars on a tonnes scale.

Four conversion technologies will be demonstrated

One of the challenges of the Bioforever project is the creation of cellulosic sugars that are sufficiently clean for the production of various bio-based products. Contrary to ethanol, where distillation is used for downstream processing (DSP), some other chemical building blocks require crystallisation as DSP. As a result, starting from a black liquor type substrate will not deliver the required product specifications.

Four partners in the Bioforever consortium have developed technologies that can produce clean sugars from lignocellulosic biomass: API Europe’s AVAP technology is an organosolv technology that has been demonstrated for two years already in the company’s Thomaston demonstration plant in Georgia, USA.

Avantium’s Zambezi technology uses concentrated hydrochloric acid in a demonstration facility in The Netherlands that is scheduled to be operational in the course of 2018.

Borregaard’s BALI technology is a biorefinery concept developed for the production of lignin performance chemicals and cellulosic sugars. The technology has been scaled up and demonstrated in the Biorefinery Demo plant, a 1 mt/day facility located in Sarpsborg, Norway.

DSM is collaborating with the Bioprocess Pilot Facility in Delft, Netherlands to demonstrate a mild acid/steam explosion technology in combination with their proprietary enzymes technology for hydrolysis of the released (hem) cellulose sugars.

Realising a commercial scale biorefinery

The ultimate goal of the Bioforever project is to have one or more bio-based value chains commercialised in Europe. Biomass availability (up to 500,000 tonne per annum on a dry mass basis) at affordable prices (the Bioforever target price is Euro 70/tonne on a dry mass basis); private equity contribution (up to €100 million) and public financial instruments are important topics that are being addressed by the consortium partners. So far, 20 European sites have shown an interest in developing and hosting a biorefinery project. Five sites have been selected to do a ‘deep dive’ in order to assess the feasibility of a commercial biorefinery project. This ‘deep dive’ will facilitate a go/no go decision to start the Engineering, Procurement and Construction phase for a biorefinery by mid-2019.

Bioforever (Bio-based products from Forestry via Economically Viable European Routes) is a three year project that will demonstrate the feasibility of a commercial scale wood biorefinery in Europe. It is supported by the Bio Based Industries Joint Undertaking – BBI JU – a cooperation between the Bio-based Industries Consortium and the European Commission. The project group consists of fourteen partners from seven countries. This project has received funding from the Bio Based Industries Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement No 720695.

For more information:
This article was written by Anton Robek CEO Bio Refinery Development at Bioforever. Visit: www.bioforever.eu
How Hero BX has solved issues of methanol recovery, material compatibility, wastewater volume and logistics

Firing on all cylinders

Long gone are the days of napkins and plastic straws being caught in the feedstock pretreat strainers, but what has been learned from those type of experiences carries on through present day.

Lake Erie Biofuels producer Hero BX just marked a decade of producing America’s advanced biodiesel at its production facility on the shores of Lake Erie. Turning waste into energy was what first attracted Erie-businessman Founder & CEO Samuel P. ‘Pat’ Black, Ill, to the industry. Nature has its own way of recycling everything. Modeling the Hero BX production after that has not only succeeded, but gives back more energy than it takes. Recycling everything but napkins and plastic straws, that is.

Starting from scratch in 2006 at the Erie, Pennsylvania facility has allowed for an easier time in de-bottlenecking processes and adapting to new and changing feedstocks as the years have progressed.

Breathing new life into an existing facility in Moundville, Alabama, over the last two years hinged on that knowledge and experience gleaned from years of operation in Erie and the result has been a plant running on all cylinders. But not without many fits and starts.

Not unlike the rest of the industry, the main torment was methanol recovery along with material compatibility, wastewater volume and logistics. It is also notable that morale boosting was difficult as many employees had suffered through previous failed mergers, acquisitions, bankruptcies, shutdowns, etc. and were a bit weary – but their expertise proved invaluable in righting the ship.

The Alabama facility continues to hit record numbers each month and is a big contributor to the overall Hero BX volume. Methanol recovery dogs the industry. There was an existing and quite large methanol distillation column, the reboiler and condensing capacities. The original design had incorrectly evaluated the heating and cooling capacity needed to effectively run the system. The column continually built pressure despite being vented though a condenser, precariously impacting the boiling point of the methanol contained within to the point of becoming recalcitrant.

Simply put, the size and style of condenser was not allowing the methanol vapours to escape the column so a new condenser was installed, immediately improving efficiency. However, within a few weeks Hero BX engineers were frustratingly chasing their tails again with the very same issue.

The reboiler that was in place was stainless steel -- fine for most applications, but, in this case, the salts in the glycerin were corroding the stainless tubes, allowing steam to blow directly into the column. The column that contains methanol, remember. So a new reboiler made from a compatible material was installed and the plant was quickly back up and running better than ever.

A lot of brain power and a bit of luck led to a larger, more compatible reboiler, a larger condenser, and ultimately production rates that were greatly increased as well as higher efficiency achieved by minimising methanol loss. Based on that, the new reboiler and condenser were

Of course, any problem that arises from the fact of running over capacity is a good problem to have. But it is still a problem that needs a solution.
also oversized to allow for continued future growth.

**Boosting the steam supply**

Almost like a teenager that keeps coming back for more allowance money, Hero BX is still wrangling with that column, this time with the steam supply. This was never an issue until the facility began running at a rate even higher than projected. Of course, any problem that arises from the fact of running over capacity is a good problem to have. But it is still a problem that needs a solution.

Material compatibility wasn’t perfectly designed either, as it never is when repurposing an existing facility. Hero BX engineers fought with acid esterification reactors that were not the correct material of construction, but were able to plan for this capital expense as we knew upon purchase that replacement was on the immediate horizon. It was clear that minimising wastewater was also critical, so a process was designed by the Hero BX team to address both of these obstacles within one project. A large amount of wastewater was produced in the pretreatment wash step and it was determined that if the new reactors were large enough, and had sufficient mixing, it would be possible to skip the wash step altogether. This causes a slightly slower reaction time, but the oversized reactors allowed for the facility to continue to run at full design rate and eliminated a large and costly wastewater stream.

This all hinged on the actual mixing in the reactors themselves. The Moundville team had experience with this very thing in the past, so that knowledge was applied to the new reactors: multiple mixing units installed at specific angles inside the reactors as well as a valving system to control flow to each. And so far, knock on wood, this has worked even better than expected. There is no need to acid or water wash incoming feedstock at all, just straining the material and drying it is all that is needed to get an even more complete reaction.

Finally, inbound and outbound logistics in Moundville were not ideal. Consequently, there wasn’t a single minute of give regarding the timing of feedstock arrival as well as releasing outbound biodiesel. It is always hard to avoid every potential logistical issue from lack of drivers to railroad delays, so Hero BX needed to find a more reliable way to create more flexibility. We knew what worked in Erie and employed the same in Moundville, coupled with 800,000 gallons in storage tank additions in 2017. Now the purchasing and storing of extra feedstock on the front end of the process can ensure that the facility never runs short. On the back end, storing over two weeks’ worth of biodiesel is possible for times when rail or trucks are delayed.

Hero BX Alabama was on pace for 10 million gallons of production in 2017 – the day has finally come where all of this has fallen into place. And I’ll go on record here and now that 2018 might just crack 15 million gallons.

Ten years from now, HERO BX will continue to offer innovative, sustainable fuel technology and remain committed to finding avenues to increase biodiesel use across the United States and beyond. Biodiesel has the ability to pave the way for future generations as the industry gives value to waste by converting it to energy.

**For more information:**
This article was written by John Nies, vice president of Operations, Hero BX
Visit: www.herobx.com
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Rob van der Meij, Investment Manager, Capricorn Venture Partners

Visit www.WorldBioMarkets.com for more information
The commercialisation of bio-based products is a challenging and resource-intense process. Sander van Pelt details the Bioprocess Pilot Facility’s (BPF) experience in best practice for bioprocess technology piloting and scaling up.

The realities of scaling up fermentation

Typically, biotech processes are difficult to scale up and it is a challenge to convert lab scale knowledge into industrial scale practice. Piloting plays a key role in closing the critical gap between scientific feasibility and industrial application. Increasing complexity and aggressive market timelines make the relevance of piloting more important for today’s biotech processes. Piloting is needed in order to develop a technically and commercially viable business case in order to convince investors or produce test samples of the product.

The most successful approach to scaling up is scaling down. This basically means that the process should be designed with the end-goal in mind.

The bioprocess value chain flows from biomass to product, however, the recommended design direction is the complete inverse of this.

The scale down approach starts with the reversed process:

- What are the targeted product specifications and needed downstream processing (DSP) schemes?
- What is the best choice of feedstock to make the targeted product assuming product-market combinations are already in place?
- What is the targeted industrial scale size? Can the conditions of this industrial scale size be mimicked in the lab for developing the process?

The scale down approach is not new, as it goes back to the 80’s Delft school of biotechnology, but it’s been revitalised because of the latest biotech challenges. It is important to stress that experience and hands-on knowledge are key to a successful project in order to develop a technically and economically viable process. BPF has significant experience in the translation of industrial scale processing to the right set of piloting conditions. The following examples cover some of BPF’s practical experiences in process development for fermentation and downstream processing, where the effectiveness of the scale-down approach is clearly demonstrated.

**Best practices in fermentation and DSP**

**Raw materials**

Use the final product target as a starting point for selecting the raw materials. Is the product envisioned to be used in pharma, feed, food, or as a bulk chemical? Choose the right raw material grade from the start to prevent a switch-over of raw materials later on in the development.

For example, choose a food grade anti-foam in the lab fermentation development if the targeted product is to be used as a food ingredient. Furthermore, take into account the raw material costs. As an example, assume the envisioned production scale is 200m³ and that kanamycin is needed to maintain plasmid stability of the production organism. Kanamycin concentration is 50mg/L and its cost price is $3/g. The process was developed on 10L lab scale by the customer, which makes the total cost of kanamycin $1.50 (€1.23) per fermentation.

On 200m³ scale, the total cost of kanamycin will soar to $30,000 (€24,500). A great technical choice at lab scale is not always economically viable at commercial scale, depending on the targeted end-product selling price.

**Seed train**

The seed train is the starting point for a fermentation process.

A typical example: one culture cryo-tube is added to a flask containing 500ml of medium. After 48 hours of incubation the complete flask is transferred to a lab scale fermenter containing 9500mL of medium (5% inoculum ratio).

This implies that on a 200 m³ factory scale 20,000 flasks would be needed to inoculate...
the fermenter in order to obtain a similar amount of generations of growth. Obviously, this is not practical.

If more generations are needed for the planned scale of production, it is vital to study the effect of more generations and of the inoculum strategy on the process on lab scale or pilot scale. Are productivities maintained? Is the plasmid stable? Do viscosities change?

**Foaming behaviour**
Foaming behaviour is complex to model and in some cases unpredictable. Finding the right balance between aeration and agitation while the fermentation is proceeding without interruption is a challenge. Extensive foaming interrupts the process and leads to yield loss or loss of the complete fermentor. Dosing anti-foam to the fermentor can keep foaming under control.

However, anti-foaming agents can inhibit growth and can affect DSP by, for example, blocking membrane filters or negatively influencing product crystallisation. Depending on the final application, the choice of antifoam can give rise to issues with final product registration.

Careful selection of a suitable antifoam type and determination of the maximum amount of antifoam that can be added without hampering DSP needs to be determined on lab or pilot scale.

**Oxygen enrichment**
Some lab scale fermentation processes are developed with the highest cell density in mind. Oxygen transfer might therefore become limiting in a small-scale reactor and as a result pure oxygen is mixed in with the supplied air. This additional oxygen enables the formation of higher biomass concentrations and hence increases the productivity of the process. However, the implementation of oxygen enrichment on a larger scale is very costly due to the higher costs of pure oxygen, the oxidising aspects of O₂ and the safety measures needed. Moreover, with higher oxygen consumption more heat is produced which will need to be cooled back by the cooling system of the fermentor. As the surface to volume ratio of a fermentor decreases when scaling up, restrictions related to the cooling capacity are likely to be encountered, even under normal aerated conditions. This restriction will become even more apparent when applying oxygen enrichment. Keeping the large-scale fermentor specifications in mind might lead to a different process design.

**Summary**
Biotech processes are highly complex and can be difficult to model. Multiple parameters determine the efficiency of the process. BPF’s recommendation is to always keep the scale-down approach in mind. A process optimised on lab scale for maximum productivity without keeping the end-goal in mind is most likely to run into some kind of limitation during scale-up trials. Consider the final product specs and DSP train in the beginning: avoid by-products and excessive waste, modify strain if needed and carefully consider raw material selection. Of course, it also remains key to understand the limitations of transport phenomena as well as the robustness of the process.

**References**

**For more information:**
This article was written by Sander van Pelt, manager Process Technology at BPF
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Maximising the value of ethanol

Ethanol production today is not the same as it was thirty, twenty or even five years ago. While the basics of brewing are the same as they have been for thousands of years – pretreatment, saccharification, fermentation, and separation – specific technologies and improvements have developed to increase production value. Just like any other industry, ethanol producers have had their eyes on growth, efficiency and driving more value from the same process. In my 20 years in the industry, it’s always been about doing more with less – getting more out of that same kernel of corn.

We’ve seen the number of ethanol gallons grow substantially, to over 15 billion gallons of US production each year, and as a result the industry offers arguably the cleanest-burning high octane fuel accessible to drivers worldwide. To implement the growth we’ve seen in the past few years, it wasn’t just business as usual in our industry. Due to great efforts in biology and engineering, coupled with a desire to continue adding value to the process to increase the economic value of each gallon of ethanol vis-a-vis its blendstock value with gasoline, yields went from 2.70 to 2.90 in twenty years, and nearly every plant has implemented corn oil extraction, pretreatment improvements, and more effective enzymatic solutions.

Even with all of these successes, turning out a high-quality fuel that offers a competitively priced octane around the globe while significantly helping air quality, the work is not done. At each plant, there is a team of people devoted to producing quality products and coming up with additional ways to add value to the process. Volatility in our industry is the norm, and when margins are great, we ramp up production; but when they’re not, that’s when the ingenuity of our industry really shines.

This is why it’s no surprise that ethanol producers continue to add value to their processes by implementing technology to convert the fibre from the corn kernel they grind everyday into cellulosic biofuel. Not only can a producer increase yield by converting more corn into biofuel, the cellulosic gallons offer a higher value across the country, a lower carbon intensity rating, and additional market opportunities such as in California to meet low carbon goals.

Some US ethanol plants today are already producing cellulosic ethanol from corn kernel fiber, and many more are evaluating whether to diversify into this product. Three key questions that each team should ask are: What is the cost and return? Is it easy to implement? What is the value of cellulosic ethanol?

What is the value of cellulosic ethanol?

Cellulosic gallons receive the higher-value D3 RIN in the US under the Renewable Fuel Standard (RFS). Additionally, value is available through the California LCFS programme, or in a few other states that are developing similar programmes. The per gallon value of cellulosic ethanol is typically two-to-three times the value of commodity ethanol, and the incremental value is not directly related to commodity ethanol margins. Therefore, in an industry in which volatility is the norm, cellulosic ethanol can be an ingenious hedge.

Edeniq has six customers that are currently receiving D3 RINs and two customers that have completed the LCFS qualification process, with more expected to come online in 2018. These customers are helping ethanol – which is already the cheapest and cleanest high-octane blendstock in the world – become even cleaner.

Many plants are also realising that the improved process of manufacturing cellulosic ethanol has the added benefits of increased starch ethanol and corn oil production. These improvements sit squarely in the sweet spot of the industry’s goal to maximise value out of the corn kernel.

Looking Forward:

Creating additional value to a process by adding cellulosic ethanol production doesn’t have to be expensive or difficult, and the opportunity is here and now. And just like ethanol plants have continued to improve their efficiency over the years, the industry can expect more of the same from burgeoning cellulosic ethanol technologies, with even more upcoming opportunities to unlock value from the same kernel of corn.

For more information:
This article was written by Brian Thome, president and CEO of Edeniq. Visit: www.edeniq.com
South America is delivering strong signals of intent in the biofuels industry

by Colin Ley

Biofuels progress in South America shows many favourable signs.

There is certainly no lack of opportunity or ambition for biofuels developers in South America, with Brazil in particular driving towards a 2030 vision where 80% of the country’s energy mix is made up of renewable supplies, double today’s figure.

The region’s challenge, as in many other parts of the world is to create and sustain a policy and investment environment so current plans for renewables enhancement can be delivered effectively and efficiently over the next 12 years.

The latest advance in Brazil’s biofuels’ goals was completed at the end of 2017 when the federal government’s pro-renewables National Biofuel Policy (RenovaBio Programme) was signed into law.

This completed an approval process which began in late November when the Chamber of Deputies, Brazil’s lower house of Congress, gave their backing to the programme.

While not everyone likes the development, the new programme has certainly delivered a strong signal of intent to gasoline distributors in Brazil. It reinforced that the government is committed to imposing further and significant cuts in carbon emissions, a process which will require an increased future role for ethanol and biodiesel.

For an investor perspective on what such a declaration might mean in practical terms for the renewables sector, Biofuels International called NexSteppe, a US-based company dedicated to pioneering the next generation of sustainable feedstock solutions for biobased industries and which already has major production commitments across South America.

“We see many favourable signs emerging at present; certainly in Brazil but also in South America more broadly,” said NexSteppe President and CEO, Anna Rath, whose company’s Brazilian investments sit alongside product registrations which are either completed or well underway in Argentina, Paraguay and Uruguay.

“In Brazil certainly, with its new commitment to market pricing, higher blending mandates, fairer taxes and the prospect of RenovaBio, the environment is looking positive for the country’s ability to continue to be a leader in biofuels across the region.”

This is despite a few inevitable and obvious challenges, Rath added, the first of which concerns the need to maintain the stability of the country’s renewables and energy policies in such a way that enables sufficient investment to be generated to achieve the Brazilian government’s ‘aggressive growth targets’.

“The second challenge centres on the adoption of efficiency improvements and new technologies, such as our own Malibu sweet sorghums, which will allow the country’s processing mills to begin crushing earlier in the season and operate for more
months of the year than was previously possible. These will prove to be key factors in enabling the industry to deliver on the government’s promise.”

Turning to the biofuels picture across South America in general, Rath said she believed increasing political stability, a growing commitment to renewables and a desire for energy security were all helping to create a favourable environment for biofuels in the region. Converting such feelings into increased output, however, will still be hard work.

Today’s mix of challenge and opportunity in South America, she continued, is still subject to the commercial reality of many areas, with the region currently having far less installed processing capacity than will be required to hit the biofuels’ output targets which the politicians are now outlining. Lack of workforce experience in these same industries is also an issue which needs to be addressed.

“Investments in both infrastructure and human capital need to be made,” she said, adding that current structures were creating opportunities for new operations to leapfrog existing businesses in the region, both in terms of their efficiency and their willingness to adopt to new technologies.

A prime example of such new and progressive technologies starting to move forward in the region came in August 2017 with the official opening of FS Bioenergia, the first corn ethanol project to be launched in Brazil, thanks to international collaboration between the Brazilian agribusiness, Fiagril, and the US-based Summit Agricultural Group, located in Iowa.

“We believe corn-based ethanol represents the most attractive area to participate in the opportunity for biofuels growth in South America,” Summit’s Justin Kirchhoff told Biofuels international.

“The new plant is already producing 60 million gallons of ethanol, alongside over 150,000 tonnes of dried distillers’ grains, both figures being calculated on an annual output basis. In addition, we are in the process of advancing our future production plans and expect to formally announce FS Bioenergia’s next stage of growth early in 2018.”

The new technology which FS Bioenergia is employing cashes in on recent advances in seed technology which have delivered a transformation in output of both corn and soybean production in Brazil, particularly in the Mato Grosso region, where the new plant is located.

“Double cropping has allowed corn production in Mato Grosso to increase by more than five times over the last decade, enabling the state to produce over 1 billion bushels of corn in the last 12 months,” said Kirchhoff.

“We also believe this output level can be doubled again with Mato Grosso having the potential to produce the cheapest corn in the world in the foreseeable future. This is creating a unique opportunity to produce corn-based ethanol in the country.”

As for how the RenovaBio programme plays into Brazil’s technology progress, Kirchhoff added: “We view the programme as an extension of Brazil’s multi-decade embrace of biofuels in general and ethanol in particular.

“We are also pleased to see the country starting to provide additional clarity around how they view the fuel mix in Brazil, going forward. Relative to other countries that have utilised ethanol, Brazil has done a fantastic job of allowing consumer choice at the pump based on free-market economics. In this context, it appears the RenovaBio programme will create a commercial environment in the future that will give Brazilian consumers additional incentives to choose ethanol at the pump.”

While FS Bioenergia’s official opening was obviously an important occasion for its two commercial backers, the event was also used by Brazil’s President, Michel Temer, to highlight his government’s achievements in general, not just as applied to renewable energy generation.

The president spoke of his government’s success in reversing the most severe economic recession in Brazil’s history; of helping to restore the confidence of investors and consumers and of seeing the country’s economy finally start to add jobs once again after a prolonged period of employment decline.

Temer also pointed out that his administration has been taking the necessary measures to ensure that Brazil is once again a country in which it is safe to invest, a claim which has clearly been reinforced by businesses like Nexsteppe and Summit, both with their recent biofuels investments and with the promise of more to come.

“The Brazilian sugar-to-ethanol industry is one of the examples looked at by countries around the world as a model of how to build a domestic renewables industry that leverages a host country’s strengths, while producing key benefits in relation to reduced climate impact and greater energy security,” said Rath.

“In a world that is not yet aligned on how to move forward on climate policy, Brazil is taking strong and admirable leadership steps on climate issues, alongside supporting and growing its important domestic biofuels industry.”

It would be wrong, of course, to suggest that everything in the South American biofuels ‘garden’ is rosy. The region certainly isn’t without its pressures, most noticeably on trade and subsidy issues with the United States.

In early December, for example, the United States International Trade Commission ‘determined’ that the US industry was being materially injured by imports of biodiesel from Argentina (and Indonesia) that the US Department of Commerce deemed to be subsidised. As a result, the department has announced countervailing duty orders on imports into the US of biodiesel from Argentina (and Indonesia).

In addition, US ethanol trade groups are pressing the US government to respond to new Brazilian ethanol import tariffs by penalising Brazilian trade flows into America, on a ‘tit for tat’ basis. However, with the vast majority of Brazilian ethanol being consumed domestically, the general view on this action is that a US tariff is unlikely to have a significant impact on the Brazilian ethanol industry. Summit’s view certainly remains upbeat.

“We take a long-term view of the sector as it relates to trade flows and ethanol consumption globally,” commented Kirchhoff. “Given, in addition, that we are a low-cost producer of ethanol globally, utilising corn sourced at the very centre of South America, we remain optimistic about the future, irrespective of trade measures that may impact flows at the margin.”

There is one last note of caution to be added to the Brazilian renewable story, however, namely the fact that the country is heading for its next general election in October this year.

The first national ballot box test for President Temer since he replaced Dilma Rousseff, who was impeached and removed from office in August 2016; the coming elections will be seen by many as a test of his success over the last 18 months, with the result standing as an important indicator of whether or not the policy stability which investors crave so much in South America is as solid and secure as Temer says it is.
At a time when ethanol production globally is expected to double in volume over the next dozen years, Brazil’s significant experiences in sugarcane ethanol production are relevant for other developing countries

**Lessons from Brazil**

Brazil’s sugarcane-based ethanol fuel programme has allowed the country to become the world’s second largest producer of ethanol, the world’s largest exporter, and a major consumer of ethanol domestically. In 2003, Brazil began producing flexible-fuel vehicles that can operate with any mixture of hydrous ethanol and gasohol (blend of anhydrous ethanol and gasoline). In 2015, these flex-fuel vehicles made up 68% of Brazil’s fleet of light commercial vehicles, and are predicted to make up over 85% by 2020. This, combined with a government requirement for 27% ethanol-blend fuel (E27), creates a substantial domestic ethanol market. The sugarcane industry employs more than 1.1 million Brazilians, who earn an average wage roughly double the national minimum wage, according to UNICA, the Brazilian sugarcane producers’ association. The industry is also an environmentally-friendly one. The combination of sugarcane ethanol and flex-fuel vehicles is estimated to have reduced Brazil’s carbon dioxide emissions by more than 189 million tonnes since 2003 – the equivalent of planting and maintaining 1,355 million trees for 20 years*, according to UNICA. This economic and sustainability success in Brazil is valuable experience globally, as ethanol is expected to increase in importance as part of the global transport fuel supply.

**Why ethanol and electric cars will coexist**

Around 25% of global CO² emissions currently come from the transportation sector, and different strategies are being considered to address this. Currently, a favoured political strategy in many countries is moving towards electrical cars. This is needed and positive, however electrification alone will clearly be inadequate to cope with the size of the challenge ahead. Less than a third of the installed base of cars is expected to be electric by 2050. Further, over half of CO² emissions coming from transportation in 2050 will be coming not from cars but from heavy vehicles (airplanes, ships, trains, trucks), which will be very difficult to electrify. They could run on ethanol fuel blends though.

In this context, it’s worth taking a look at the developments that led Brazil to become the world leader in sugarcane ethanol production, as these offer a potentially important model for other developing countries. According to the United Nations Food and Agricultural Organisation, over 100 countries are producing sugarcane today, including the tropical zones of Latin America, the Caribbean, Africa, India and Southeast Asia.

**The difficult years**

The Brazilian experience has included some very big ups and downs. From 2009 to 2011, growth in capacity and investment slowed, but sugar prices continued to be high and mills were generally profitable. Harder times hit from 2012–2015, when more than 60 Brazilian mills (one in seven) went bankrupt. In addition, debt levels increased dramatically, compromising the financial stability of many mills.

Causes for the crisis came from many different directions, and included low prices for both sugar and ethanol, poor sugarcane harvests due to bad weather, reduced availability of credit lines, governmental controls on gasoline prices that limited the profits of ethanol producers, and many other factors.

As a result, by November 2013 only 23% flex-fuel car owners in Brazil were using ethanol regularly, down from 66% in 2009. In 2014, Brazil actually started importing ethanol from the US.

Today, while the country is still in a general economic crisis (Brazil has experienced negative GDP growth over the past two years), the Brazilian ethanol market is more cheerful. An important, new piece of Brazilian legislation, RenovaBio, will provide significant new incentives for biofuel producers. RenovaBio was signed into law in December 2017, and is similar to California’s low-carbon-fuel programme.

Meanwhile, the Paris climate-change agreement of 2016 has increased expectations for global ethanol production, now predicted to double in volume by 2030, according to the International Energy Agency. Latin America alone is expected to ramp up ethanol production by...
roughly 20 billion litres/year in the next dozen years.

Innovation, efficiency, resilience

Those in the Brazilian sugarcane milling industry who lived through the crisis years have learned valuable lessons about investing in innovation, flexibility, efficiency and controlling costs to make the business more crisis-proof.

To succeed, any industry needs to increase revenues or reduce operating costs. Brazilian sugarcane mills are hungry to do both, but they operate in an environment with an uneven playing field.

Methods to increase revenues are sharply limited. The industry has no control over prices, and has experienced big swings over the last 10 years. On the other side of the equation, mills can seek to reduce operating costs. And they are doing this – sometimes even when this reduces focus on overall plant efficiency.

The most innovative mills are now focusing on ways to increase yields and overall plant profitability (not only costs), a critical step to protect future profits.

Optimise to thrive

Some mills are exploring new avenues. Experience so far shows the upside financial potential can be significant.

The Danish-based biotech company Novozymes is working with regional partners to explore new ways to optimise production, and specifically in Brazil to boost capacity and free up space in fermenters. “While easily overlooked in strict cost-oriented environments like that of crisis-shocked Brazilian sugarcane mills, use of biotech tools has been shown useful in optimising the total cost-structure and overall profitability of mills,” says Silvio Andretta, an independent engineering consultant and expert in sugarcane ethanol fermentation.

Enzymes are proteins that have been shown to be effective in optimising yields, capacity and throughput, as well as having other benefits. Novozymes manufactures enzymes, yeast and microorganisms used in a wide variety of industries. To develop new products, Novozymes typically works with regional producers who are leaders within their industry.

Novozymes is using this partnership model in Brazil to develop new solutions to optimise the sugarcane production process, with the ultimate goal to make the regional industry more robust economically, even in hard times. This sort of innovative partnership has been shown to generate a high number of novel ideas, which Novozymes is later able to commercialise, while the regional producer gains competitive advantage in multiple ways. It’s a win-win for both partners.

Increase ethanol throughput by 3-4%

One example of using biotech to boost capacity is already available on the Brazilian market. Mills have been able to increase their ethanol throughput by an average of 3-4% using newer biotech-based methods to free up their fermenters. Novozymes estimates a 3-million-tonne Brazilian sugarcane mill producing 60/40 sugar/ethanol mix could produce an additional 4,000 m³ ethanol per year on average by shifting to biotech solutions, potentially boosting their revenue stream by an estimated USD $2 million (€1.7 million).

In addition, mills can save an average BRL 140,000 a year (around USD $42,000/€35,000) alone on foam-related chemicals by using biotech-based methods. While a relatively modest improvement, these cost-savings may be considerably higher if the indirect costs of harsh chemicals are also considered (e.g. lower productivity due to dead volume of fermenters caused by the foam, lower efficiency of centrifugation, equipment incrustation, etc).

These numbers help explain why Novozymes Fermax, an enzyme introduced in 2016, is already being used or trialed by 10% of all Brazilian sugarcane mills after less than two harvest seasons. Use of the enzyme is rising in popularity because it offers a flexible, cost-efficient way to increase ethanol throughput while preventing foam and achieving higher performance. More solutions like this are being worked on at Novozymes.

Summary

Brazil’s experience in ethanol production is relevant for other developing countries with sugarcane, potentially including over 100 countries globally. Experience and new biotech-based methods of optimising production hold the promise of making the industry more robust economically. The lessons learned in Brazil are relevant around the world.

(*Brazil’s Amazon rainforest is not suitable for sugarcane cultivation, and growing sugarcane does not contribute to deforestation. Brazil has simultaneously expanded sugarcane cultivation and reduced deforestation rates over the past decade, according to UNICA.)

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Ethanol demand is expected to double by 2030

Ethanol production is currently estimated at roughly 90 billion liters a year, and demand is expected to double by 2030, according to the International Energy Agency. Here’s why: Today 1.2 billion cars are on the roads. By 2050, this is predicted to double to 2-3 billion cars, of which over 70% are expected to be non-electric, i.e. fuel-burning. Meanwhile heavy vehicles (airplanes, ships, trains, trucks, etc) are expected to account for over half of total global CO₂ emissions from transport, and this sector will continue to be fuel-burning for the foreseeable future. Thus global demand for clean transport fuel is expected to rise, and along with it, ethanol.
ISCC on the balancing act of meeting sustainability challenges and biofuel regulations with sugarcane feedstock

Addressing the sustainability of sugarcane

Sugarcane is one of the major feedstocks used in the production of ethanol, accounting for 80% of the sugar produced worldwide. According to the OECD-FAO Agricultural Outlook 2016, around 22% of the total production of sugarcane will be used for ethanol production by 2025. This alcohol-based biofuel enjoys great popularity in the biofuels industry due to its low carbon footprint, reducing greenhouse gas (GHG) emissions by 71% by default compared to fossil fuel. Furthermore, it is a very efficient crop, producing around 600-800 gallons of fuel per acre, which is about twice as efficient as corn.

Despite the many positive aspects of sugarcane biofuel, sustainability challenges such as the need to protect high-biodiversity and high-carbon stock areas as well as to implement good agricultural and social practices cannot be neglected.

ISCC – solution provider for sustainable and deforestation free ethanol and sugar

In order to address these challenges while complying with national and international regulations on the sustainability of biofuels, many companies are choosing ISCC (International Sustainability and Carbon Certification) to prove compliance and show their commitment towards sustainable production. ISCC is a global certification scheme widely recognised for biofuels and bioliquids, and recognised by the European Commission under the Renewable Energy Directive (RED). Since its start of operation in 2010, over 16,000 certificates in more than 100 countries have been issued. An increasing number of certificates also cover markets for food, feed and biochemical.

ISCC provides full traceability along the supply chain through site-specific ISCC certificates issued by independent certification bodies. Certification of sugarcane ethanol starts at the plantation level where land and labour related criteria such as the protection of biodiversity, the preservation of carbon sinks, good agricultural practices and the respect of human and social rights are verified. Along the supply chain, processing units and traders are controlled with respect to traceability, quality management and GHG emissions. All ISCC certificates are published on the ISCC website and enable each player to source sustainable products from any certificate holder.

How does ISCC ensure credibility of its system?

Credible certification is essential in order to have a real impact on the above-mentioned challenges. The ISCC system uses and provides innovative tools and technologies which ensure a credible, effective and cost-efficient certification process. ISCC applies a high sustainability standard and strict rules of implementation and verification. ISCC certified supply chains are deforestation free and sustainable. Compensation for new plantings is not allowed.

In order to verify that no illegitimate land use change has taken place, ISCC uses GRAS (Global Risk Assessment Services), a web-based tool based on remote sensing technology which provides comprehensive sustainability-related geo-referenced information on biodiversity, land use change, carbon stock and social indices. It even allows its users to identify replanting activities, grassland conversion and cropping activities. Occurrence of land use change can be verified by using a simple to interpret greenness index called the Enhanced Vegetation Index (EVI). Using EVI time series

Fig. 1: Conversion of tropical forest to sugarcane in Thailand 2013

![Conversion of tropical forest to sugarcane in Thailand 2013](image-url)
from 2000 until today, GRAS users can differentiate among the types of green cover, see the history of the land use, and most importantly detect the exact point in time of land use change (see example in Figure 1). For producers, the use of GRAS is a secure and credible way to prepare for sustainability certification and to verifiably implement no-deforestation commitments. Auditors can use it for risk analysis prior to certification.

The major growth area for sugarcane lies within smallholders who depend on selling their agricultural products for their livelihoods but often face problems of low yields, little income and lack of market access. Sometimes the only option smallholders see to increase their income is to expand into forested areas. Certification can provide an option to increase productivity and thus increase income, raise attention to potential customers and ease selling products, taking away the need to further expand into forested areas. ISCC has developed a smallholder certification process addressing these issues. Apart from certification it is important to increase transparency to identify potential starting points for improvement in order to develop a region. Certifying plantations that are located in critical areas by means of compensation for deforestation activities does not solve the problem of deforestation and does not provide the right incentives.

To improve the audit and certification process, ISCC has developed an electronic tool, called Audit Procedure System (APS), increasing the efficiency of the audit process and decreasing the costs of certification. This tool assists auditors in conducting audits and makes the documentation process easier as it displays only applicable criteria. APS also generates automatically summary audit reports which are published on the ISCC website, contributing to increased transparency.

ISCC works continuously on improving the integrity and credibility of certification. Through its unique Integrity Programme, compliance of certification bodies and certified companies with ISCC requirements is monitored. The programme helps to increase the quality of certification. Three independent ISCC auditors conduct integrity audits. In 2017, 66 integrity assessments in Europe, Asia and North America were conducted. Furthermore, continuous multi-stakeholder dialogues around the globe support the practical implementation, verification and adequate increase of sustainability requirements. For example, a working group on social issues has been set up and continuous dialogue with companies, NGOs, research organisations, certification bodies and authorities takes place in order to discuss how to address pressing issues in the best possible way.

**Certification examples for ethanol and sugar**

More and more sugarcane producing and processing companies are getting certified under ISCC. They appreciate the opportunity to provide their ISCC product to all markets such as the bioenergy, food, feed and chemical markets with just one certification scheme. Since 2010, more than 200 ISCC certificates have been issued for sugar producing, processing and trading companies in the sector. Companies such as Pantaleon in Guatemala and Ingenio Sucroalcoholero Aguai in Bolivia have certified their sugar mills and ethanol plants under ISCC, as it enables them to not only supply their certified sustainable ethanol to the biofuels market but also their certified sustainable sugar under ISCC PLUS, meeting the sustainability requirements of major food producing companies. Pantaleon for example, has made commitments to social sustainability for both employees and local communities, as well as to environmental sustainability. As sugarcane is a thirsty crop, they are especially putting efforts into the reduction of water usage. Claudia Asensio, head of Sustainability for Pantaleon, says: "Our team and natural resources are both at the heart of our business. We find the ISCC sustainability principles to be robust, therefore ISCC certification is one of the vehicles to show our high standards to our customers and stakeholders".

Ingenio Sucroalcoholero Aguai was facing major ecological and social sustainability issues, which they addressed and worked against through the adoption of respective policies. Those are embedded throughout their decisions, processes and business partners, and reflect the shareholders vision and desire of building a sustainable company from the ground up. Cristóbal Roda Vaca, CEO of Aguai, points out: "The efforts made by Aguai have been backed by norms like ISCC, because they support the work we do, and encourage us to continue to pursue the well-being of all our stakeholders. With ISCC we have set ourselves apart as an example to our community as the leaders in environmental and human protection".

In economic terms, ISCC EU has opened the doors for mills like Aguai and Pantaleon, allowing them to export most of the ethanol produced. Thanks to ISCC PLUS, their second product (sugar) is also more attractive to larger corporations who value and only accept products that derive from a verified sustainable production. Through the ISCC logo on their product, the companies differentiate their products in the local market leading to improved sales opportunities (see Figure 2).

**References:**


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Volatility in the US biodiesel market intensified in December following the November 30 Environmental Protection Agency (EPA) final rule on mandated demand for renewable fuels in 2018. The agency did not increase the required volumes of biomass-based diesel, which is regulated through the Renewable Fuel Standard, disappointing the industry.

EPA set the annual Renewable Volume Obligation (RVO) for biomass-based at 2.1 billion gallons for both 2018 and 2019, up from 2.0 billion gallons in 2017 and 1.9 billion gallons in 2016. The National Biodiesel Board, the US trade group for biodiesel, had pushed for a 2.5 billion gallon RVO for 2019, down from an initial request of 2.75 billion gallons. The trade group and other interested parties said flat-lining the mandate would stunt growth for the industry.

In deciding against a higher RVO for biomass-based diesel, the EPA cited concern that a greater increase in the mandate would need imports to meet the requirement which contrasts with the Trump administration’s “America First” policy. In comments to the House Subcommittee on Energy and Commerce in early December, Scott Pruitt, EPA administrator, said the agency considered the higher mandate, but determined imports would be needed to fulfill the requirement so limited the RVO to the 2.1 billion gallon for both years.

Pruitt noted a high level of biodiesel imports to the United States from Argentina in 2016. The Energy Information Administration (EIA), the statistical and analytical division of the Department of Energy, said biodiesel imports from Argentina in 2016 totaled 449 million gallons, and accounted for nearly 20% of US biodiesel consumption. In 2016, US biodiesel consumption was 2.189 billion gallons, with 1.569 million gallons or 72% produced domestically. Imported biodiesel is primarily received along the East Coast and Gulf Coast regions of the United States.

EIA said US biofuel facilities achieved a 69% run rate in 2016, with annual production capacity at the start of the year totaling 2.270 billion gallons. US capacity expanded since then, with EIA reporting 99 biodiesel production plants in the United States with capacity of 2.348 billion gallons annually as of the end of the third quarter 2017.

Before establishing each year’s RVO, the EPA is required to consult with the EIA and US Department of Agriculture to ensure there’s adequate feedstock and supply to meet the mandate. As the RVO for 2018 was released, two cases against Indonesia and Argentina regarding antidumping and countervailing duties that put US producers at a disadvantage were brought to the courts by the National Biodiesel Board Fair Trade Coalition in early 2017 were continuing to advance. The coalition charged the two countries with subsidising their industries, and selling product below its fair market value that harmed US biodiesel producers.

In early December, the US International Trade Commission voted unanimously that both countries were unfairly subsidising their industries. The ITC ruling followed the US Commerce Department’s imposition of countervailing duties on soy-based biodiesel in August 2017, and in November 2017, issued an affirmative final determination. The decision set tariffs on the two countries’ biodiesel imports between 34% and 72% that are based on the producer or importer. Argentina, which had sent as much as 90% of its biodiesel exports to the United States, saw its exports drop by 30% in the third quarter. There were no biodiesel imports from Argentina in the fourth quarter, while biodiesel imports from Indonesia ended in 2016.

Through the first 10 months of 2017, the EPA shows qualified biomass-based diesel supply from domestic production and imports totaled 2.055 billion gallons, up 40.1 million gallons or 1.5% against the comparable year-ago period. The year-on-year increase came despite the lack of a $1 gallon tax subsidy for blending biodiesel that expired at the end of 2016.

US biodiesel industry participants were left on tenterhooks deep in the fourth quarter with the hope the US Congress would reinstate the credit retroactively as it has in past years. Those in the biodiesel market indicate the credit is crucial in bridging the price gap between their product and ultra-low sulphur diesel fuel that trades at a deep discount to biodiesel to move sales.

In Chicago, biodiesel in the spot market traded at a nearly $1.50 gallon premium to spot ULSD in the Windy City in December. During 2017, biodiesel’s premium to ULSD
in Chicago ranged from a low of $1.15 gallon in October to a high just over $1.80 gallon in late February, early March. These conundrums for the biodiesel industry are reflected in open market trading for Renewable Identification Numbers—the credit generated when a qualified renewable is produced or imported, and submitted annually to the EPA to show compliance in meeting the RFS. Shifts in the political winds can and do affect the biodiesel market, and especially the RIN market.

While obligated parties under the RFS, which include oil refiners and blenders, can secure a qualified renewable with a RIN and blend it into their transportation fuel and later submit the RIN to the EPA for compliance, not all refiners have the ability to blend. Smaller refiners and independent refiners such as Valero are forced into the RIN market to secure a compliance credit. During his testimony in early December, Pruitt told the House Subcommittee that he believed the RIN market needs reform, pointing to speculation in RIN trading, enforcement problems and fraud.

The climbing costs of RINs prompted some states with refineries disadvantaged by the compliance regime to seek exemptions or waivers from the programme, including Pennsylvania, New Jersey and Texas. US Senator Ted Cruz from Texas secured a meeting with the White House in early December to push for changes in the RFS programme that provide relief for embattled refineries.

In mid-December, a second meeting at the White House took place, with Cruz and US Senator Pat Toomey of Pennsylvania representing the interests of the oil industry, and US Senators Chuck Grassley and Joni Ernst of Iowa, and Deb Fischer of Nebraska representing the biofuel industry.

It was agreed that Cruz would deliver written proposals outlining ways that the refining industry could better meet the RFS compliance requirements. Grassley and Ernst said while they would listen to the proposals from Cruz, they would not agree to any plan that threatens the RFS.

Nonetheless, the discussions spurred speculation that an agreement between the senators would be reached, pressuring RIN values. D4 biomass-based diesel RINs sunk to a nine-month low at $0.85 in early December.

While trading in the physical market is caught up with the political drama, demand for US distillate fuel had surged year-on-year in 2017. In 2017 through the first week of December, implied distillate demand averaged 4.043 million bpd, up 258,000 bpd or 6.8% against the comparable year-ago period, EIA data show. EIA said biodiesel accounted for 4% of diesel consumption in 2016. In the United States, diesel demand has a strong correlation with economic growth, with the US economy in 2017 coming out of its years-long malaise, reporting annualised growth above 3% for the second and third quarters. The trend is expected to accelerate this year, with new orders for large trucks surging in late 2017 on expectations for a sharp increase in hauling demand in 2018. The outlook should provide support for US biodiesel producers.

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