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contents

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August summary

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impressions	profile visits	new followers

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All eyes focus on COP26 as countries are urged to take more action to shift away from fossil fuels

Concerns about the climate emergency facing our planet can, very quickly, shift from a sense of pessimism to optimism.

Read the front pages of many newspapers or go online and one can learn about the devastating effects climate change is having on our societies.

Most recently, Hurricane Ida has brought devastation to parts of Louisiana and the Eastern Seaboard of the US.

In the UK, this summer was also was also in the top 10 hottest ever recorded. It ranked ninth and was about 1˚C warmer than average.

The cycle of chaos has included severe flooding in Germany while temperatures in southern Europe hit 45˚C over the summer months.

Add wildfires to the mix and the need to act quickly has never been more urgent.

However, there are reasons to be optimistic, not least when delegates from across the world descend on Scotland for COP26 in November.

The COP26 summit is seen as a vital opportunity for countries to ramp up their pledges to cut carbon emissions and provide the long-promised climate aid to poorer states.

Among the subjects on the global agenda are clean energy, clean transport, nature-based solutions as well as financial aid to help developing nations who face their own challenges in meeting climate targets.

Thousands of representatives from about 200 countries are expected to be in Glasgow for the global spectacle.

There will also be thousands of climate activists keeping a watchful eye on proceedings and who will be demanding that more action is taken now rather than later to avert a climate catastrophe.

Paul Warner
Editor

UN ambassador meets Scottish innovators tackling climate change

UN Ambassador for the Convention on Migratory Species, Sacha Dench, touched down in Scotland where she visited Celtic Renewables.

There she met with company founder Professor Martin Tangney OBE as part of her Round Britain Climate Challenge to raise awareness of the effects of climate change, and shine a light on the innovators working to solve the crisis.

The UN Ambassador toured the Celtic Renewables plant – which will be the first biorefinery in the country – and learned first-hand how it has patented low-carbon technology converting unwanted and low-value biological materials, such as by-products from whisky distilling, into high-value, low carbon chemicals.

These can replace petrochemicals currently used in the multitude of products used every day from cleaning materials to food production.

Dench said: "I am delighted to be back in Scotland and visiting the beautiful capital and surrounds. I am looking forward to meeting people who are truly focused on answers to the climate crisis – not problems – and as such are inspirations to all. We're trying to answer the question: We drove the Industrial Revolution, can we drive the Green Revolution too?"

Tangney added: "We were thrilled to host Sacha here at Celtic Renewables as part of this ambitious Round Britain Climate Challenge. In our view, COP26 must move us from justifying why we need to tackle climate change, to determining how, and Sacha's expedition shining a spotlight on the people and initiatives helping us achieve net zero, is helping set this direction of travel.

"Celtic Renewables firmly believes it is part of the net zero future, and in bringing our first plant into operation we will show that low-carbon biotechnology can be both commercially sustainable and environmentally sustainable."

ePURE members produced 5.5 billion litres of ethanol in 2020

European renewable ethanol association (ePURE) members produced 5.57 billion litres of ethanol and 6.16 million tonnes of co-products in 2020, according to new data.

The figures showed a significant increase in production of ethanol for industrial use.

The new statistics confirm the importance of European renewable ethanol biorefineries to achieving EU Green Deal objectives by reducing transport emissions and ensuring sustainable domestic production of animal feed and other beneficial co-products, including captured CO_2.

More than 98% of the feedstock used to produce renewable ethanol by ePURE members – including cereals, sugars, wastes and residues – was grown or sourced in Europe.

Of the total ethanol output from ePURE members in 2020, more than 79% was for fuel use, with an average of more than 75% greenhouse gas savings compared to fossil petrol.

Of the remaining ethanol production in 2020, 5.6% was for food and beverage uses and 15.2% was for industrial applications, including hand sanitiser and other hygienic uses.

When the COVID-19 pandemic surged in early 2020, several EU ethanol biorefineries swiftly adapted production to supply ethyl alcohol for medical use, while continuing to make low-carbon renewable fuel ethanol.

"Renewable ethanol is more than a fuel," said Emmanuel Desplechin, secretary-general of ePURE. "As these numbers confirm, the additional benefits of European ethanol production include offsetting the need to import soybean meal for animal feed and ensuring a strong supply of alcohol for medical and industrial use.

"This is on top of the vital role renewable ethanol must play in achieving the ambitious decarbonisation targets of the EU Green Deal, as an immediate, cost-effective and socially inclusive carbon-abatement solution to power the vehicles of today and tomorrow."

ePURE represents 35 members (including 19 producers) with around 50 plants across the EU and UK, accounting for about 85% of EU renewable ethanol production.

TotalEnergies develops 100% renewable fuel for motorsport

TotalEnergies is developing a 100% renewable fuel for motorsport competition, which will be introduced from next season at the FIA World Endurance Championship (WEC), including the 24 Hours of Le Mans 2022, and at the European Le Mans Series (ELMS).

The 100% renewable fuel will be produced on bioethanol basis, made from wine residues from French agricultural industry, and from ETBE produced at TotalEnergies' Feyzin refinery near Lyon, from feedstock also sourced from the circular economy. The fuel should allow an immediate reduction of at least 65% of the racing cars' CO_2 emissions.

Named 'Excellium Racing 100', the fuel opens a new chapter in the Endurance racing and motorsport energy transition for all actors involved. It will have all the required qualities for a racing fuel and meet automakers' requirements, as well as the latest FIA criteria for sustainable fuels, by leveraging the expertise of TotalEnergies Additives and Fuel Solutions.

"Our ambition is to be a major player in the energy transition and to get to net-zero carbon emissions by 2050, together with society," said Patrick Pouyanné, chairman and CEO of TotalEnergies.

"TotalEnergies is supporting its customers and partners in their evolutions, by thus applying its strategy to motorsport: sustainable liquid fuels, electricity, batteries, hybridisation, hydrogen.

"Advanced biofuels have an undeniable part to play in helping the transport sector to reduce its CO_2 emissions immediately."

BA in SAF pledge during COP26 conference

British Airways (BA) said will source sustainable aviation fuel (SAF) to transport delegates between London, Glasgow and Edinburgh during the COP26 climate conference.

The COP26 conference in November will see world leaders discuss how to tackle climate change following the Paris Agreement that was signed in 2015.

BA said that the SAF it intends to use provides a lifecycle carbon reduction of up to 80% compared to traditional jet fuel.

BA has also announced a programme allowing its customers to purchase SAF to help reduce their personal carbon footprint via its not-for-profit organisation Pure Leapfrog.

Airlines, alongside fossil fuel firms, have been keen to push customers into taking responsibility for their carbon footprint as their own industries struggle to develop convincing strategies to reach net zero.

BA said it would invest £290 million (€337 million) over the next 20 years into further development of SAF, including partnerships with a number of technology and fuel companies such as Velocys in the UK and LanzaJet in the US.

British Airways' chief executive Sean Doyle said: "We're clear that we have a responsibility to reduce our impact on the planet and have a detailed plan to achieve net-zero carbon emissions by 2050, including investing in more fuel-efficient aircraft, improving our operational efficiency and investing in the development of sustainable aviation fuel and zero emissions aircraft.

"This commitment for COP26 is in addition to the mandatory carbon trading we already operate in the UK and our own further voluntary carbon offsetting of our UK domestic flights."

Epitome Energy selects Fagen to build US soybean crush facility

Epitome Energy has awarded Fagen the EPC contract to build a 42 million-bushel soybean crush facility in Minnesota.

Fagen is a major industrial contractor and green energy design-builder. Headquartered in Granite Falls, the company has built 60% of the US' ethanol production capacity, as well as multiple biodiesel, wind and power projects.

The $300 million (€257 million) processing plant will include a 42 million-bushel soybean crush facility and may include a refined, bleached, and deodorised oil refining operation as part of phase 2.

The facility in Crookston will provide a much-needed, value-added new market for the region's soybean farmers, as well as numerous, permanent employment opportunities once the plant becomes operational.

According to a recent study by the University of Minnesota Extension Office, the facility will generate over $300 million (€257 million) of new economic activity in the 11-county region of north-western Minnesota. In addition, it will improve the basis of every bushel of soybeans grown in the region.

"This is another significant step forward for us and Fagen was the clear choice when we looked at different contractors for the project," said Dennis Egan, CEO and president of Epitome Energy.

"Fagen's vast experience, quality workmanship, and commitment to safety were key factors in making this important decision. We are excited to see progress continue."

Fagen's CEO, Aaron Fagen, said the team is excited to break ground on the facility.

"We pride ourselves in being the leader in renewable fuels construction, and we share Epitome Energy's goal of providing facilities that benefit our nation's farmers and add value to the regional economy," said Fagen.

"Fagen has over 30 years of experience in this industry and we are proud to put our expertise to work right here at home in Minnesota."

The facility will enhance soybean grower profitability and endure market fluctuations by providing a year-round processing location for farmer's crops. Soybeans are a predominant crop in the area, with over 1.8 million acres planted in the counties surrounding Crookston.

USDA invests $26m in renewable biofuels infrastructure

The US Department of Agriculture (USDA) is investing $26 million (€22.2 million) to build infrastructure to expand the availability of higher-blend renewable biofuels.

Deputy Under Secretary for Rural Development, Justin Maxson, said the investment will increase biofuel availability by 822 million gallons annually in 23 states.

The USDA is awarding the funding under the Higher Blends Infrastructure Incentive Programme and marks its first anniversary. To date, the USDA has invested $66.4 million (€56.8 million) in projects expected to increase biofuels sales by 1.2 billion gallons annually.

In California, AltAir Paramount will use a $1.5 million (€1.28 million) grant to install a pump, safety infrastructure and piping at its fuel distribution facility. Funds will also be used to retrofit and upgrade a biodiesel storage tank. The project is expected to increase biodiesel sales by 135 million gallons per year.

In Ohio, United Dairy Farmers will use a $634,000 (€543,000) grant to replace 21 dispensers and four storage tanks at four fuelling stations. The organisation will also install 13 dispensers at two more fuelling stations in Ohio and Kentucky. The project will increase ethanol sales by 4 million gallons annually.

In North Carolina, Zenith Energy Terminals will use a $614,930 (€526,800) grant to install a truck rack at a fuel distribution facility.

Clean Air Biodiesel joins forces with Clean Fuels Ohio

Clean Air Biodiesel, Ohio's newest biodiesel producer, has become a member of Columbus-based coalition Clean Fuels Ohio.

Clean Fuels Ohio is a national Clean Cities Coalition that provides unbiased resources and information to stakeholders. The organisation provides insight on transport solutions that allow fleets and other implementers to achieve their goals around alternative fuels, sustainability, fuel savings strategies, and mobility solutions.

Clean Air Biodiesel has joined the group as a gold level member, along with other leading companies like Duke Energy, Honda, Cummins, Ohio Soybean Council, RNG Coalition and the American Biogas Council. The new biodiesel producer is scaling up production to produce more than 25 million gallons of biodiesel annually.

"We're so excited to have Clean Air Biodiesel Group join Clean Fuels Ohio as a member," said Rachel Ellenberger, director of business development and communications at Clean Fuels Ohio.

"As a fuel and technology-inclusive organisation, we are happy to work with a wide and diverse group of members that touch every corner of the transportation sustainability industry.

"Biodiesel is an important solution to help fleets and other implementers achieve significant emissions reductions in a very cost-effective way. We can't wait to see all we can achieve through this new partnership."

Bruce Burke, director of marketing for Clean Air Biodiesel, commented: "We're aware of some great organisations that we could join forces with to help reduce carbon emissions in the state of Ohio, but we reached out to Clean Fuels Ohio first. Its association with the US National Clean Cities Coalition is of great importance to us.

"As we build and expand our enterprise, the Clean Cities groups will become extremely important. We want to align ourselves with the nation's largest collection of advocates for advancing clean fuels."

In addition to joining Clean Fuels Ohio, Clean Air Biodiesel recently announced a waste cooking oil reclamation and recycling initiative for the City of Columbus. The organisation is Ohio's newest biodiesel producer with a new 30,000 square-foot facility opening this autumn.

The new facility in Columbus will house the waste oil collection programme, the biodiesel production line, administrative offices, and warehousing and product distribution. Restaurants, food trucks, and other businesses who need collection services can contact Clean Air Biodiesel. The company will also be building 24-hour waste cooking oil collection bins around the city and outside its headquarters for drop-off.

Strategic Biofuels achieves major CCS milestone in Louisiana

Strategic Biofuels' carbon capture and sequestration (CCS) test well programme at its Louisiana Green Fuels Project (LGF) is complete, marking a major step towards becoming the world's first carbon-negative renewable diesel plant.

Located on a 171-acre site at the Port of Columbia, the LGF plant will convert forestry waste feedstock into renewable diesel and is projected to produce 33.7 million gallons of renewable fuel per year once in operation.

The goals of the test well programme were to demonstrate that CO_2, the main greenhouse gas generated during fuel production, can be safely and securely stored deep underground and that the storage reservoir has sufficient capacity to store all the gas produced over the plant's lifetime.

Completing the test well programme is an essential pre-requisite for Strategic Biofuels securing the permit for the EPA Class IV sequestration well.

LGF has secured a 20-year agreement with an established, bankable feedstock supplier for the delivery of compliant feedstock to the plant, ensuring long-term and cost-effective supply. The waste material will be in-woods processed and delivered as chips.

The cleaner renewable fuels produced at the plant will be transported to California by rail for one of the largest truck stop operators in the country through a 20-year offtake agreement, including purchase of all the site's Federal (RFS) and California (LCFS) carbon credits.

"Carbon capture and permanent geologic sequestration is no longer a hypothetical scenario for LGF – successful completion of the test well is a major milestone that's not been achieved by any other renewable diesel project," said Dr Paul Schubert, CEO of Strategic Biofuels.

"These results enable us to move forward knowing that combining CCS with the conversion of sustainable forestry waste to renewable diesel at our project site will enable us to achieve our deeply negative carbon footprint goal.

"Deep carbon negativity greatly increases the potential carbon credit revenues from our fuel and vastly improves the project's returns. What has set us apart from other developers was recognising that the de-risking we could achieve with the test well more than justified the multi-million dollar expenditure for the programme at this early stage."

Strategic Biofuels is now moving into a phase of engineering design for the plant, which will give greater clarity on the overall long-term project costs, while also applying for the required regulatory permits and putting third-party contracts in place.

Although the data collection from the CCS test well is complete, it will remain in place as a monitoring well once the facility is built and CO_2 injection begins in its Class IV well. The current project schedule is for the plant to be mechanically complete in mid-2025 and achieve full commercial operation in late 2025.

Shell to build one of Europe's biggest biofuel facilities

Royal Dutch Shell has announced a final investment decision to build an 820,000-tonnes-a-year biofuels facility at the Shell Energy and Chemicals Park Rotterdam, the Netherlands, formerly known as the Pernis refinery.

Once built, the facility will be among the biggest in Europe to produce sustainable aviation fuel (SAF) and renewable diesel made from waste.

A facility of this size could produce enough renewable diesel to avoid 2,800,000 tonnes of CO_2 emissions a year.

The new facility will help the Netherlands and the rest of Europe to meet internationally binding emissions reduction targets.

It will also help Shell to meet its own target of becoming a net-zero emissions energy business by 2050, in step with society's progress towards achieving the climate goals of the Paris Agreement.

Advanced production methods will be used to make the fuels. The facility is expected to use technology to capture carbon emissions from the manufacturing process and store them in an empty gas field beneath the North Sea through the Porthos project. A final investment decision for Porthos is expected next year.

"Today's announcement is a key part of the transformation of one of our major refineries into an energy and chemicals park, which will supply customers with the low-carbon products they want and need," said Huibert Vigeveno, Shell's downstream director.

As part of its Powering Progress strategy, Shell is transforming its refineries (which numbered 14 in October 2020) into five energy and chemicals parks.

Shell aims to reduce the production of traditional fuels by 55% by 2030 and provide more low-carbon fuels such as biofuels for road transport and aviation, and hydrogen. The Energy and Chemicals Park Rotterdam is the second park to be announced, following the launch in July of the Energy and Chemicals Park Rheinland, in Germany.

The Rotterdam biofuels facility is expected to start production in 2024. It will produce low-carbon fuels such as renewable diesel from waste in the form of used cooking oil, waste animal fat and other industrial and agricultural residual products, using advanced technology developed by Shell.

A range of certified sustainable vegetable oils, such as rapeseed, will supplement the waste feedstocks until even more sustainable advanced feedstocks are widely available. The facility will not use virgin palm oil as feedstock.

SAF could make up more than half of the 820,000-tonnes-a-year capacity, with the rest being renewable diesel.

Shell said it can adjust this mix to meet customer demand.

Biofuels in Asia fighting back from impact of COVID-19

Palm oil production is starting to rise again in Indonesia after the impact of the pandemic on plantations

On the road to recovery

by Colin Ley

The bleak realisation that overcoming COVID-19 will be a long-haul process is a daunting prospect for us all. Early optimism that vaccination protection would facilitate a rapid return to normal has gradually given way to an acceptance that this is a pandemic which is more likely to keep hitting us in renewed variant waves for the foreseeable future.

Assessing the current state of the biofuels industry across Asia, therefore, it is clear the pandemic has had a marked production and demand impact on the sector, is still impacting businesses today, and will continue to do so in the months and years ahead.

Mixed picture

While Asian country reports from the US Department of Agriculture (USDA) tell a largely repetitive story of triumph, for some, in the face of COVID-19, there is also considerable evidence that others have struggled and have more battles still to face.

In Indonesia, for instance, the USDA's verdict is that the country has maintained its nationwide biodiesel programme this year, achieving a high on-road blending rate average of 30% since 2020. That is despite the financial challenge of supporting a widening price spread between palm oil and diesel prices during the pandemic.

To combat the spread of the pandemic in the Philippines, meanwhile, the government 'placed much of the country in various forms of quarantine, sharply eroding demand for both ethanol-petrol and on-road biodiesel-diesel in 2020'.

As a result, ethanol-petroleum usage in the country is projected to fall by 16% this year while biodiesel demand is forecast to be heading for a 21% decline.

At the same time, however, ethanol blend rates in the Philippines are expected to remain 'largely unchanged'.

This may increase the attractiveness of ethanol to both local and foreign investors, according to Manuel Sanchez, the US Grains Council (USGC) director for South East Asia, who also said that increasing ethanol blends into the transport fuel pool will position the Philippines as a leader in renewable energy policy in the region.

In India, meanwhile, the country's 2021 average ethanol blending rate is estimated to have settled at 7.5%, due to 'curtailed fuel pools from COVID-19 pandemic' alongside accelerated government efforts to divert more feedstock toward ethanol.

As for biodiesel, the Indian market remains 'limited', owing to high feedstock prices and pandemic-led plant closures.

In Malaysia, a 16% decline in biodiesel production has been blamed on a 'decrease in international and domestic diesel fuel demand stemming from COVID-19'. The decline also caused the country's government to delay its B20 implementation date, originally set for the first quarter of 2020.

Positives still exist

In the midst of such a daunting period, there is still much to be celebrated in relation to biofuels in Asia. The response of some countries to the challenge of climate change, for example, is impressive. South Korea and Japan have each set new carbon-

reduction goals, for example, with biofuels being well-positioned to play a major part in helping both countries to achieve their emission targets.

South Korea's commitment to achieve carbon neutrality by 2050 was unveiled last autumn, followed more recently by the launch of the country's Carbon Neutrality Committee.

Despite being Asia's fourth-biggest economy, South Korea's drive towards carbon neutrality will not be easy.

According to the Korea Energy Economics Institute (KEEI), the country's primary energy supply sources, as recorded in February this year, consisted of oil, on 37%; coal, 21.8%; liquefied natural gas, 23.7%; nuclear power, 11%; and renewables, just 6.4%.

That renewables figure is the lowest among Organisation for Economic Co-operation and Development members while fossil fuels, in one form or another, account for 82.5% of the South Korea's energy mix; nearly all of which is imported.

Included in the country's 2020 energy imports was 81 million gallons of US ethanol, a fact which helps to explain the involvement of the USGC in the country's carbon neutral adventures. In this context, Haksoo Kim, USGC director in South Korea, has already addressed the Korea Biofuel Forum and the new Carbon Neutrality Committee, focusing on the potential importance of South Korea establishing its own renewable fuel standard (RFS).

The US ethanol body is following a similar marketing path in Japan, where plans for carbon neutrality by 2050 are also being devised.

"Japan does not currently blend ethanol directly, instead relying on pre-blended ethanol in the form of ethyl tertiary-butyl ether (ETBE), which is reducing CO_2 emissions by 712,000 tons a year," said a spokesman for the USGC.

The Council further pointed out that while Japan currently has an average blend rate of just 1.9%, direct blending at an E10 level would immediately 'expand CO_2 emission reductions by five times'.

India's ethanol blending programme is being expanded to include sugarcane juice and spent grains as feedstocks

Commercial gains

Although COVID-19 has imposed many burdens on people and governments globally, there have been some commercial gains along the way, such as one positive recently identified by a USCG-commissioned study in India.

Noting that the country's industrial ethanol consumption has increased since the pandemic began, largely to meet rising requirements for sanitisers and disinfectants, the Council's findings highlight growing industrial and fuel market opportunities in India.

Prospects there are being helped by the Government of India's desire to achieve E20 blend rates by 2023, with the scope of the country's ethanol blending programme being expanded to include sugarcane juice and spent grains as feedstocks for future production.

These are clearly positive signs, especially when looking ahead to the anticipated return of pre-pandemic growth rates for fuel ethanol demand. This is all subject, of course, to vaccination rates in India reaching a suitably protective level.

Rising ethanol blends in the transport sector will position the Philippines as a leader in renewable energy policy in the region

And then there's palm oil

Another prominent Asian sector where there appears to be positive change taking place is palm oil, or at least the fact that the sustainable production of this product is beginning gain more global acceptance than in the past.

Although palm oil is used for many purposes, with biofuel production being only part of the picture, the

commitment of major global players to the product's sustainable future can only be of help to the entire industry. In this context, news that international food company, Nestlé, will only purchase 100% deforestation-free palm oil from 2022 onwards, brings a new commercial edge to the drive for future customer acceptance.

In similar vein, the global food, agricultural, and industrial products business, Cargill, is building a $200 million (€170 million) palm oil refinery in Lampung, Indonesia, with the aim of 'accelerating' efforts to develop a sustainable palm supply chain and to provide verified deforestation-free products to customers. Although designed as an edible product development, the investment is also set to add value to on a whole industry basis.

Latest indications from the Indonesian Palm Oil Association, meanwhile, is that production is starting to rise again after the impact of COVID-19 on plantations. Output returns for June this year show crude palm oil (CPO) at 4.48 million tons, with palm kernel oil (PKO) on 426,000 tons. This means that CPO+PKO production in 2021 is currently running 4.3% ahead of 2020 output figures.

In Malaysia, the most recent comment from the country's nation Palm Oil Board (MPOB) is that the sector 'remains resilient' despite the country's COVID-19 lockdown and protection measures.

Being required to operate under a movement control order at various points of the pandemic and having to adhere to standard operating procedures, including a 60% limitation on worker numbers, has inevitably had an impact on the sector.

As conditions start to return to normal, however, the need for plantations to 'seriously consider' applying mechanisation and automation solutions to address labour shortages, has been highlighted by MPOB director-general, Ahmad Parveez Ghulam Kadir.

Vietnam is promoting greater biofuel usage

"Assessing the current state of the biofuels industry across Asia, therefore, it is clear the pandemic has had a marked production and demand impact on the sector, is still impacting businesses today and will continue to do so in the months and years ahead"

In response to the industry's mechanisation and labour concerns, in fact, the Malaysian Government has introduced a stimulus package to encourage the adoption of new machinery, alongside a Workforce Recalibration Programme which allows illegal immigrants to now be employed as legitimate foreign workers.

Both moves are designed to ensure oil palm plantations run smoothly for the rest of this year, especially during harvesting activities which can impact productivity.

In addition to addressing the immediate business impact of the pandemic, the government-backed MPOB has voiced its expectation that palm oil production will still increase 'gradually and steadily' over the next five to 10 years.

The Board even went so far as to outline its vision for production reaching 22 million tonnes by 2025, before potentially rising to 25 million tonnes by 2030, with both targets being secured through better oil palm productivity, enhanced fresh fruit bunches and higher oil extraction rates.

MPOB has also said that it sees no reason why the size of country's available oil palm land area should present any barriers to the future upscaling of Malaysia's palm oil output. Instead, the Board believes that advancing technologies, alongside the use of higher yielding plants and the adoption of better mechanisation, will enable plantation owners to increase productivity.

In Vietnam, finally, the USGC's Memorandum of Understanding (MoU) with the country's Ministry of Industry and Trade, signed in late October last year, appears set to help boost Vietnam's development of future biofuels policies. Both sides believe the MoU will foster biofuel production and use in Vietnam, delivering real benefits to the business communities of both countries.

How sustainable biofuels can help drive 'Fit for 55'

Sweeping changes

Emmanuel Desplechin

New biofuels legislation has come into force

The name 'Fit for 55' may have many people scratching their heads – is it an exercise programme, or maybe a breakfast cereal? – but in EU circles it is already part of the common language – shorthand for a sweeping set of proposals to remake the legislative landscape for energy and climate policy.

For the EU biofuels industry, the new proposals – including major changes to policies on renewable energy, alternative fuels infrastructure, the Emissions Trading System and energy taxation, as well as a de facto deadline for the end of the internal combustion engine – promise a potentially bumpy road ahead as the implications become clear.

But one thing should be clear to policymakers as they fine-tune this legislation in the coming months: unleashing the true potential of crop-based ethanol and creating a policy environment that can spark investment in advanced ethanol are must-have components of any realistic roadmap to carbon-neutrality.

Crop-based biofuels are an immediate, cost-effective and socially inclusive tool to reduce the emissions of existing and future light and heavy-duty vehicles, and their use should not be limited to transport modes that cannot be electrified.

Transport decarbonisation

As usual, the signals from the Commission about whether biofuels can play a major role in transport decarbonisation are mixed. On the one hand, the Commission's new Fit for 55 package sets important new goals for emissions reduction and creates a solid foundation for reaching them by giving a role to renewable liquid fuels in decarbonising transport.

On the other, the Commission still hesitates to make the best use of emissions-reduction tools it has today, including biofuels – even when targets have been raised to such a degree that their contribution is essential.

Fully enabling biofuels in the drive to carbon-neutrality is just common sense. Even under a scenario in which electric vehicles make rapid gains in market share and the sale of internal combustion engines is phased out, the EU car fleet will consist predominantly of vehicles that run fully or partly on liquid fuel in 2030 and beyond.

For these petrol and hybrid cars, renewable ethanol is the most cost-effective and socially inclusive way to reduce emissions. Europe cannot afford to ignore this important part of the equation.

View on transport decarbonisation are mixed

Sustainability issues

With the main components of the Fit for 55 package, the Commission should fully maximise the tools it has on hand for decarbonisation – especially the Renewable Energy Directive (RED).

This is the third time since 2009 the Commission has tried to get RED right.

With Fit for 55, the Commission finally realises that to succeed it needs to focus on higher GHG intensity reduction targets that drive renewable energy in transport, without multipliers that hide the EU's continued reliance on fossil fuels. Now that sustainability issues have been settled, the EU should unleash the potential of crop-based biofuels and encourage the wider deployment of advanced biofuels.

The main questions about the sustainability of biofuels were settled after RED II was adopted in 2018 by phasing out high ILUC-risk biofuels. We know that deforestation and outdated 'food vs fuel' arguments do not apply to EU renewable ethanol.

So with this revision we should be taking the next logical step and unleashing the potential of good biofuels.

Other Fit for 55 components should work in concert to promote solutions that make a realistic impact on decarbonisation.

The CO_2 for Cars Standards should include more than just one technology and recognise the benefits of using renewable fuels such as ethanol to reduce the carbon-footprint of cars on the road. The Energy Taxation Directive should incentivise renewable fuels, moving away from volume-based taxation.

A parallel Emissions Trading System for transport should complement, not replace, binding national targets for emissions reductions in the Effort Sharing Regulation, and avoid increased fuel prices and social discontent.

As the European Parliament and EU Member States go to work on this legislative package from the Commission in the coming months, it will be interesting to see whether Fit for 55 can be made fit for purpose. ●

For more information:
This article was written by ePURE's secretary general, Emmanuel Desplechin. Desplechin will be speaking at the Biofuels International Conference & Expo in Brussels in March 2022. Visit: epure.org and biofuels-news.com/conference

Plant update: Asia

Mangalore Refinery

Location:	Mangalore, India
Date:	September 2021
Development:	Installation
Alternative fuel:	Bioethanol
Details:	Mangalore Refinery is planning to install a second generation (2G) ethanol facility in the State of Karnataka, India. Mangalore has awarded LanzaTech the contract to commence the basic engineering for an integrated processing facility to convert locally available agricultural residues to approximately 16,000 tonnes (5.3 million gallons) per annum of fuel grade ethanol. The plant is expected to be commissioned in 2024.
Comments:	"This is a project that will not only make clean fuel but will put most of the money back into the local economy and create much needed rural jobs."

Godavari Biorefineries

Location:	Atmanirbhar Bharat, India
Date:	June 2021
Development:	Plant expansion
Alternative fuel:	Bioethanol
Construction:	Godavari Biorefineries will expand its current distillery capacity to become India's largest syrup-based ethanol plant. Godavari has appointed Praj Industries for its new expansion plans. As a part of this project, Praj will expand Godavari's existing ethanol manufacturing capacity from 400 kilo litres per day (KPLD) to 600 KLPD using sugarcane syrup.

Neste

Location:	Jurong, Singapore
Date:	August 2021
Development:	Biofuel facility expansion
Alternative fuel:	Renewable diesel
Construction:	Neste's plan for a new production line is on track to be completed next year following the decision to expand its renewable products production capacity in the South East Asian country. When completed, Neste will have more options to choose between different product solutions in the whole production system. The investment will include additional logistics capabilities and enhanced raw material pretreatment for the use of increasingly low-quality waste and residue raw materials for the existing refinery. The Singapore expansion will extend Neste's renewable product overall capacity in Singapore by up to 1.3 million tons per annum, bringing the total renewable product capacity close to 4.5 million tons annually next year. Neste's target is to start up the new production line in Singapore during the first half of 2022.

*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 paul@woodcotemedia.com

The EU's Green Deal sets out a bold ambition and proposes supportive revisions to three key policy directives

The EU wants a SAF transition, but at what cost?

On 14 July, as part of the European Green Deal, the EU announced a broad new package of policy proposals which aim to accelerate decarbonisation of the aviation sector.

If fully implemented, the measures will have a significant impact on the EU's aviation industry. However, while the initiatives will undoubtedly increase costs for industry participants and passengers, will they achieve their objectives?

The new ReFuelEU Aviation Initiative mandates blending of sustainable aviation fuel (SAF) with fossil fuels at 5% by 2030, 32% by 2040, and 63% by 2050.

The initiative applies to all fuel suppliers providing fuel at EU airports and all airlines, whether EU or foreign, must annually uplift from each EU airport 90% of the fuel required for flights from those airports, to try to minimise unnecessary tankering.

Currently approved processes specify a maximum blending ratio of 50%, but Rolls-Royce has announced plans to make all its civil engines compatible to run on 100% SAF, with tests underway.

The revisions to the Emissions Trading System (ETS) will see fewer free allowances for aviation, further reduction over time and increased auctioning, reflecting the EU's desired 'polluter pays' policy.

This will, undoubtedly, make fossil fuel offsetting harder and more expensive.

The revisions to the Energy Tax Directive will initiate a tax on aviation kerosene and align its rate to motor fuel, as well as differentiate between first generation biofuels (around 50% of the proposed kerosene tax level) and advanced biofuels, including synthetic liquid fuels (around 1.5% of the proposed kerosene tax level).

John Goddard

Philip Meier

SAF to decarbonise aviation

The EU recognises that, in the medium-to-long term, the introduction of new propulsion technologies (e.g. hydrogen, electric hybrids and full electric) will transform the carbon footprint, appearance, performance and engineering of many aircraft.

However, current technology roadmaps suggest these will provide insufficient energy density for larger, longer-range aircraft. Hence, SAF is both the most immediately implementable solution and will be the only solution that addresses the whole industry for a considerable time to come.

Some additional benefits can still accrue from overall aviation system efficiencies not fully addressed in the EU Green Deal, such as the Single European Sky initiative that IATA believes should deliver a 10% reduction in current emissions.

The ongoing launch and rollout of newer more efficient aircraft – new generations of aircraft are typically 15-20% more fuel efficient per flight than the ones they replace from 15-20 years earlier – will also deliver some benefits.

Without SAF, the only other solution to accelerate decarbonisation would be draconian demand management policies, which would decimate the industry and are not a realistic alternative.

So, in the near-to-medium term, SAF, which currently represents less than 0.01% of EU aviation fuel, is the only solution to significantly progress aviation decarbonisation.

SAF currently faces five critical issues

The EU has established a target for SAF blending levels and is proposing to put in place elements of legislation and government support. However, five key issues remain to kick-start a ramp-up in SAF production:

1. There are no incentives specifically designed to drive uptake of SAF;
2. Currently SAF costs two-to-six times as much as kerosene, making it prohibitive for airlines;
3. Limited availability of sustainable feedstock;
4. No refineries are currently operating at a commercial scale and have a very limited total capacity;
5. SAF is not currently an investable proposition, so access to finance is limited.

There are no incentives specifically designed to drive uptake of SAF

Aviation's carbon emissions are a negative externality that society and governments are increasingly unwilling to accept given the need to target net zero. Hence, it seems reasonable that governments help incentivise and fund the start of the transition to SAF, essentially internalising those externalities.

The EU currently provides some financial support to biofuel development through H2020 funding and the European Strategic Energy Technology Plan (SET Plan) but these tend to be early stage and technology focused.

These programmes may lead to new solutions but are, in general, a very long way out.

The EU itself estimates that a price of at least €160 per tonne of CO_2 emissions would be required to make SAF commercially viable for airlines, yet the 2030 Climate Target Plan projects carbon prices for the ETS sector at between €32 and €65 per tonne of CO_2.

Ultimately, the updated EU aviation taxation scheme may have unintended consequences, in terms of relative competitiveness of the sector with other regions, for example, but it is much simpler and quicker to enact.

Note that it has taken 20 years from the start of the 'dot com' revolution for a global digital tax policy to be agreed by the G20 in response to companies optimising where they choose to recognise profits.

Currently SAF costs two-to-six times as much as kerosene, making it prohibitive for airlines

At the current negligible level of volume, the lowest cost pathway is Hydroprocessed Esters and Fatty Acids (HEFA) with costs higher for other less technologically mature pathways. The EU estimates industry cost increases of €15 billion to €20 billion to achieve the blending mandate which is equivalent to an approximate 8% increase in fares by 2050 (based on 77% growth in passengers).

Given that, on average, fuel represents 20-25% of airline operating costs (albeit significantly higher for long haul flights), the EU's estimate is likely to be on the low side.

Absent a significant reduction in SAF costs, there is also a real risk that airlines become 'price takers' in a tight supply market which damages their already sensitive operational economics and leads to higher passenger fares.

Limited availability of sustainable feedstock

Feedstock availability is challenging in the near-term and while cooking oil or animal fat can be utilised by the HEFA pathway, its availability is the limiting factor and it will not be a scalable solution.

Longer term advanced biofuels and synthetic liquid fuels are the only real solution, but the technology readiness of the processes and resource availability are expected to remain challenging for some time to come.

No refineries are currently operating at a commercial scale and have a very limited total capacity

Current SAF production is negligible and while plans for new facilities in the EU and UK have been announced, for example Altalto Immingham's waste to fuel plant and SkyNRG's HEFA facility, in the last couple of years, the current plans represent capacity of about 3 Mt in 2030 – just 6% of EU fuel requirement.

There are also a growing number of existing refineries producing biodiesel and bioethanol to meet demand from road transport that could be used to produce SAF.

In the near term, blending mandates, such as E10 in the UK, are likely to increase demand from road transport, albeit this capacity may be available for SAF longer term, as road transport transitions to electric vehicles or fuel cells. This, however, cannot be a planning assumption for SAF.

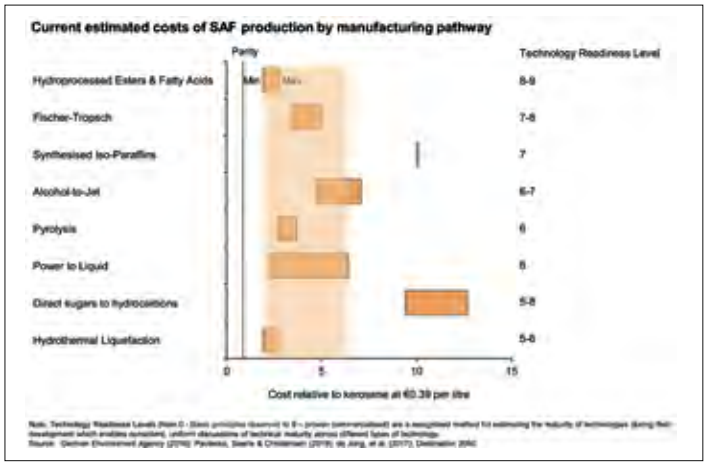
The EU assumes that around 100 additional SAF plants will be built by 2050 with a capacity of 25 Mt rather than the current rate of 0.1 Mt per annum.

This requires a step change in industry investment.

The EU estimates the required capex at just an incremental €10 billion in the aviation sector – this excludes the capex required to create new hydrogen and power generation infrastructure, which will also be needed to support production.

The €10 billion equates to just €420 per tonne of production capacity versus the €800 to €3,000 per tonne estimated by the International Civil Aerospace Organisation (ICAO).

The EU appears to be assuming a rapid technological development and a sharp reduction in capital and operating costs, as new larger facilities are built. These assumptions look very optimistic and, therefore, it is highly likely that actual industry costs will be much higher.



SAF is not currently an investable proposition, so access to finance is limited

Investing in SAF refinery capacity is currently perceived to be high risk and insufficiently attractive. Oil and gas majors have lucrative kerosene businesses that SAF would cannibalise and are waiting for the opportunity for SAF to become attractive and/or regulatory impetus.

Today, it is also perceived too risky for infrastructure type investors and airlines and airports lack the financial strength (particularly post COVID-19). The key risks are:

- Technologies remain unproven at commercial scale;
- Capital cost overruns are likely on the first wave of new refineries;
- Potential to be very uncompetitive on cost (vs kerosene);
- Risk that hydrogen or electric propulsion replaces jet engines in the 2040s resulting in only a 20-25 year lifespan for SAF assets.

It is important to recognise if the oil and gas majors decide to act, significant capital could be brought rapidly when one recognises annual refinery capex pre-COVID averaged $150 billion (€126 billion) and many oil majors now have emerging or new energy funds but are waiting for incentives and opportunities to leverage existing capacity.

Recent announcements from Chevron and Exxon that they are studying SAF production using existing refineries are signs of progress.

The EU's SAF blending targets will help provide some certainty, but fundamentally, there is still significant technology risk with a major cost differential to reduce.

There are significant barriers to establishing a scale SAF industry and further bold actions are required to deliver the EU's objectives.

The EU has rightly set ambitious objectives and is proposing to put in place some of the necessary legislative and government support, but addressing these five key issues to deliver the target reduction in aviation emissions is a massive challenge which will require:

- Developing new or substantially improved technologies to meet the cost and emission targets;
- Mobilising a broad industry coalition including both the aviation sector and critically the downstream supply chain to secure feedstock and the biorefineries to process it;
- Further policy and financial support from governments. ●

For more information:
This article was written by John Goddard, senior partner in L.E.K. Consulting's industrial practice and a founding member of the L.E.K. Consulting Sustainability Centre of Excellence's executive board, and Philip Meier, senior principal in L.E.K. Consulting's industrial practice. Visit: lek.com

Used cooking oil from the fast food company is turned into a feedstock for biodiesel

Serving up a solution

How Neste, McDonald's and HAVI created a circular economy that uses cooking oil to fuel logistics

The pioneering partnership between Neste, McDonald's Netherlands, and HAVI does more than cut fast food's carbon emissions. It proves that by scrutinising a company's sustainability practices, hidden ways to future-proof your business through circularity are revealed.

Every day, McDonald's serves fries and hamburgers to a multitude of customers. Many of them are unaware that behind the food counters and drive-through windows, a streamlined logistics operation ensures that each restaurant receives the supplies and ingredients they need to prepare meals for their guests.

Besides that, with production and food preparation comes food waste, packaging waste and used cooking oil (UCO) that needs to be collected and processed.

Someone who does think about these processes is Antti Koivisto, head of service development within renewable road transportation at Neste.

He said: "We buy UCO as feedstock for renewable diesel, and we realised that there are potential suppliers who could actually buy [the diesel] back as a product."

Opportunities

Here lies an exciting opportunity: if the waste provider buys back the biofuel refined from its own waste to fuel its logistics, that would create a circular economy.

Neste created the first circular model like this in the US, where the company sells an advanced biofuel refined primarily from sustainably sourced waste and residue materials, such as UCO, from hotels, stadiums, restaurants and many other locations.

In 2019, Neste partnered with the City of Oakland in California to collect and turn the city's waste into advanced biofuels. Each year, Neste and the City of Oakland's circular economy prevents 3,375 tonnes of greenhouse gas emissions from entering the atmosphere.

After successfully proving that a circular economy could work in the US, Neste looked for other opportunities around the world.

Finding a partner for another circular economy turned out to be a lot easier than Koivisto expected. He said: "I started exploring the issue, and, after a few discussions, I heard from a colleague that McDonald's Netherlands had already been in contact with them."

Without knowing about Koivisto's search, McDonald's Netherlands and its supply chain partner HAVI had approached the Neste refinery in Rotterdam to set up exactly this type of collaboration.

Jeroen Dekkers is head of supply chain at McDonald's Netherlands, and an expert on reducing carbon emissions at the company.

"We looked at all the different ways in which we could reduce our climate impact," he said, "and we figured that, even though it's not the biggest impact on our carbon footprint, the way we organise our logistics is something we have a lot of influence over.

"In addition to reducing climate impact, green logistics would also help to reduce air pollution, which is of increasing concern in Dutch urban areas."

At a global level, McDonald's has set science based targets to reduce its climate impact. "One climate goal is focused on our supply chain, so the climate impact related to all the food and packaging we source," explained Dekkers. "The climate goal for the supply chain is a reduction of emissions intensity of 31% between 2015 and 2030."

These goals were set in 2018, and with 2030 only 12 years away, every little bit counts. McDonald's scrutinised every aspect of the business to find ways to reduce its climate

impact, and one of these areas was logistics.

The circular economy involves thinking about waste as a resource, to keep materials in the production loop.

Circular economy

The circular economy is about a lot more than recycling household waste.

Repurposing waste from one industry can often create products for a second industry. This creates a circular economy. This can happen on a global scale, or – as the collaboration between McDonald's Netherlands, Neste and HAVI shows – the circle can be very small and efficient.

In the Netherlands, McDonald's works with logistics partner HAVI for all stock and waste transport to and from the restaurants.

HAVI's sustainability lead for the Netherlands Anne-Marie Verouden pointed out: "We at HAVI have committed to drastically cutting carbon emissions from our operations by 40% per tonne of goods delivered by 2030. The existing partnership with McDonald's will play a big role in achieving that goal."

Reinforcing the partnership, Dekkers added: "With HAVI we developed a roadmap to see what steps we could take to reduce our carbon emissions from the logistics side and make our logistics more future-proof."

"The circular economy involves thinking about waste as a resource, to keep materials in the production loop"

Many small steps will bring McDonald's Netherlands closer to its sustainability goals, but Dekkers mentions that there was one key insight that brought them to Neste.

"If we see the use of renewable diesel as part of this integrated logistics sustainability roadmap, should we not link this with another piece of work that we've been doing for years, namely selling our used cooking oil to a renewable diesel plant."

Collaboration

To make such a collaboration work, all partners need to place the same value on sustainability. HAVI, McDonald's Netherlands and Neste all had their own sustainability goals that perfectly matched what they wanted to achieve together.

For McDonald's Netherlands, that change involved rethinking the way it categorised the company's sustainable practices. "What's interesting is that we made a link between two different sustainability pillars," said Dekkers.

"We used to think of sustainable logistics as one pillar, and recycling UCO as part of another pillar with different teams and different budgets. But if you make links across these pillars, you can have much more impact."

That realisation led McDonald's Netherlands to rethink the way it was handling both its UCO waste stream and its logistics.

A quick calculation revealed that the amount of UCO that was used in its restaurants was enough to produce the equivalent amount of renewable diesel to fuel the trucks that supply the restaurants, as well as those that pick up the waste. Rather than selling the used oil, why not find a company that could directly convert it to fuel for the trucks?

With the involvement of Neste, the circle was complete, but setting up a new collaboration was not without challenges.

"It's been a learning journey for all of us," added Koivisto.

Branding and operational models of different organisations are not easily linked, and the refining, restaurant, and logistics industries all speak their own languages. For example, 370,000 gallons of UCO is an enormous amount for a restaurant but little for a refinery.

Once the agreement was completed, the process was put into action.

"HAVI's waste and recycling business unit picks up the UCO from McDonald's restaurants across the Netherlands and brings it to the Neste refinery in Rotterdam, where it enters the production chain to be converted into Neste MY Renewable Diesel," said Verouden. "HAVI then buys back an equivalent amount of renewable diesel to fuel its trucks for delivery of stock to McDonald's restaurants, where the cycle starts again."

These two successful circular economy programmes might seem like a drop in the ocean, but their value isn't just measured in the amount of reused cooking oil or carbon emission reduction.

For Neste, the partnerships with HAVI and McDonald's in the Netherlands and the City of Oakland in the US act as showcases to demonstrate what is possible when it comes to sustainable practices.

Likewise, with nearly 384,000 gallons of UCO per year, the fuel conversion for the McDonald's logistics operation in the Netherlands only contributes to a small part of its overall sustainability goals, but it makes for an important step in the way that the company thinks about its processes.

One of the unique aspects of this collaboration is that everything takes place within a closed loop and with only a few links in the chain. It's the ultimate example of a circular economy. ●

For more information:
Visit neste.com

Millions of people purchase French fries from McDonald's around the world

Filtration Group says it is focusing on the growing renewable hydrocarbon biofuels sector in a Q&A with *Biofuels International*

Experts in the filtration of biodiesel

Can you tell our readers a little bit more about the Filtration Group and what your main business is in?

Filtration Group is making the world safer, healthier and more productive by creating innovative filtration solutions that serve a highly diverse set of customers across life sciences, indoor air quality and industrial markets.

With a passionate team, global footprint and leading technology, Filtration Group is one of the fastest growing companies in the industry. The organisation serves its customers from over 100 facilities in nearly 30 countries, united behind its mission to make the world a safer, healthier and more productive place for generations to come.

Filtration Group is focusing on the growing renewable hydrocarbon biofuels sector. Can you explain what you here doing here?

Within Filtration Group, Amafilter® and Jonell Systems® provide expertise in the filtration of biodiesel and can provide the complete product solution for the pre-treatment of non-edible crude vegetable oil, used cooking oil UCO and animal fat.

The two businesses have joined forces to ensure we have the complete filtration solution for renewable fuel applications supported by a comprehensive range of products and an expert team. Whether you are looking to optimise your biodiesel process to improve productivity and product quality or are looking at an alternative biomass source, our expert team can assist find the perfect filtration solution for customers' requirements.

Can you explain what your Amafilter® and Jonell Systems® hope to achieve, particularly in the biodiesel market?

The increased use of biodiesel is an absolute must if we are to achieve the European CO_2 emission reduction directive and a growing number of refineries are adapting their hydrotreating units to be able to process animal fats and UCO, among others.

They are committed to reducing their use of fossil fuel in support of these regulations and as a filtration solutions provider, we are committed to assisting our customers as best we can and support them during these transitions.

We have an extensive product portfolio ideally suited for renewable fuel filtration and we are recognised for our expertise in biodiesel feedstock filtration and contaminants removal.

Jonell Systems® basket strainers

We work closely with customers to establish the perfect filtration solution for their specific requirements, which is often dependent on the type and characteristics of the feedstock they use as well as their plant process.

Amafilter® and Jonell Systems® are able to provide complete solutions from truck unloading with basket strainers to feed filtration, with our Cricketfilter® automated system and our range of pressure leaf filter systems, high flows and cartridges, and final/fine filtration to protect downstream equipment/units.

We strive to uphold our mission bringing our expertise in the filtration of biofuels, investigating, and researching new ways to effectively achieve filtrations solutions that meet customers renewable biofuel objectives, whether for existing or new biomasses.

The Jonell Systems high flow housings

What are the main feedstocks used in this process?

Amafilter® and Jonell Systems® have extensive expertise in providing renewable fuel filtration solutions that deliver feed pre-filtration and post-filtration for a wide range of feedstocks.

The main feedstocks we specialise in for the production of biodiesel and include pure vegetable oil, animal fats, UCO and waste oil such as rapeseed oil, canola oil, soybean oil, to name a few.

The viscosity of vegetable oil and animal fats must be reduced to create biodiesel and we provide solutions for a variety of processes, including pyrolys, micro-emulsification and transesterification.

The Amafilter® bag filter housings

Our product portfolio includes several products which have successfully been used in both the pre-treatment and after treatment phases of biodiesel, including the Amafilter Cricketfilter® and the Versis® Vertical Pressure Leaf Filter systems and Jonell Systems® bag filters, filter housings and high flow vessels.

More countries are targeting net zero emissions by 2050. What role, if any, is Filtration Group playing in this?

Our mission is to make the world safer, healthier and more productive. One of the ways we can do this is by bring innovative filtration solutions to the market, driving sustainability and actively supporting activities that create greener energy.

Filtration Group is an excellent partner for companies looking to lower their emissions, as several of our businesses offer solutions that support renewable technologies and drastically lower carbon emissions.

For example, the Cerafil product from ClearEdge has long been used to help clean the exhaust from ships in major shipping ports to ensure they meet local emissions standards to keep people and wildlife safe from pollution. Additionally, other Filtration Group companies partner with customers to support renewable biofuels processing by providing effective filtration solutions utilising a variety of used feedstock to replace fossil based fuels. We specialise in finding innovative filtration solutions that use feedstock sources, such as edible oils, UCO and animal fat, but also extend our expertise in supporting new feedstock applications, such as algae.

On a more general level, what do you think companies must do to reduce their reliance on oil and fossil fuels?

Companies must continue to seek more friendly alternatives to oil and fossil fuels, reducing CO_2, and driving more environmentally friendly renewable fuel solutions. Biomass energy has a great potential for addressing our energy challenges and finding new and better ways to utilise biomass feedstocks to create renewable fuel must be one of the key drivers.

But there are numerous other initiatives companies can embark upon:

1. Utilise internal resources to create energy efficiency programmes. Appoint a team with clear objectives which can develop and implement an energy savings plan, tracking and evaluating its success;
2. Conduct in-house energy audits to help companies quantify how much energy each department is consuming and when, allowing it to put into place initiatives that reduce that usage;
3. Strategically schedule machinery use to identify which equipment consumes the most energy. Peak hours can use up to 30% of a manufacturing facilities monthly utility bill.
4. Schedule shutdowns and start-ups, powering off for a period equipment during the weekend and off-shift periods. This can dramatically reduce industrial energy costs;
5. Optimise air compressors as these can use substantial amounts of energy. Improperly maintained air compressors account for high waste energy costs;
6. Invest in joint ventures with governments or universities to develop new renewable fuel alternatives.

We can work with companies to find filtration solutions for the renewable fuel market, using our expertise to pilot test and research new solutions that meet their requirements.

How has the COVID-19 pandemic affected your business?

To say that the pandemic brought unprecedented challenges to our business would be an understatement.

However, Filtration Group was uniquely positioned to rise to the challenge and continue to deliver life-saving products that kept front line workers safe and essential services functioning. While implementing new safety practices to keep our own team members safe, we pivoted as quickly as possible to ramp up production of essential products— like the AG Industries filter that is used in ventilators or the Porex foam that used in N-95 masks.

We also launched new products to help fight the pandemic itself, like the PuraShield line of air scrubbers, which removes 99.99% of aerosols carrying viruses from the air. Meanwhile, we continued to partner with our customers across industrial and energy markets to ensure they had the support and products they needed to keep their businesses running and adapt to the ever-changing demands of the economy. ●

For more information:
Visit: amafiltration.com and jonellsystems.com

The new Cricketfilter®

Advisian experts assess the emerging renewable fuels market

Counting the cost of the shift to renewables

In recent years, renewable technologies have reached technical readiness, providing commercially viable solutions for the energy transition – some backed by over 15 years of research and development.

But as legislation and technology for low-carbon energy industries converge, a new emerging market has been created – the renewable fuels market.

This market lies at the crossroads of two well-developed and formerly independent global industries – agriculture and energy.

The $5 trillion (€4.2 trillion) agricultural industry has the expertise to process large quantities of biological products. While the $3.3 trillion (€2.8 trillion) energy industry has the know-how to produce transportation fuels.[1]

The integration of these industries means we now have technologies that can convert bio-based feedstocks such as animal fats, used cooking oils, vegetable oils, and greases (FOGs) into fuels that can power the world's vehicles.

The shift to renewable fuels is taking off. As of 2019, the market is estimated at $160 billion (€135 billion). Today, the market is experiencing anywhere from 7-39% annual growth rates. This can be even higher for specific fuel types and regions.[2]

But what does the investment opportunity for renewable liquid fuels look like? How do operators and investors enter this market? What different investment pathways are available? What financing options should you consider?

Investment horizon: higher rates of return and early adopter advantage

Renewable fuels returns are positive. Potential returns are higher than the agriculture or fuels industries have seen in the past.

Low Carbon Fuel Standard (LCFS) credit prices have sustained values at the legislative cap of approximately $200 tonne (€169).

Additionally, through the federal Renewable Fuel Standard (RFS) programme, renewable fuels are also eligible for renewable identification number (RINs) credits.

The most common legislative approach for carbon pricing is to set a target for the carbon intensity (CI) of fuels, which require producers to meet these targets or purchase credits. This approach was implemented by California

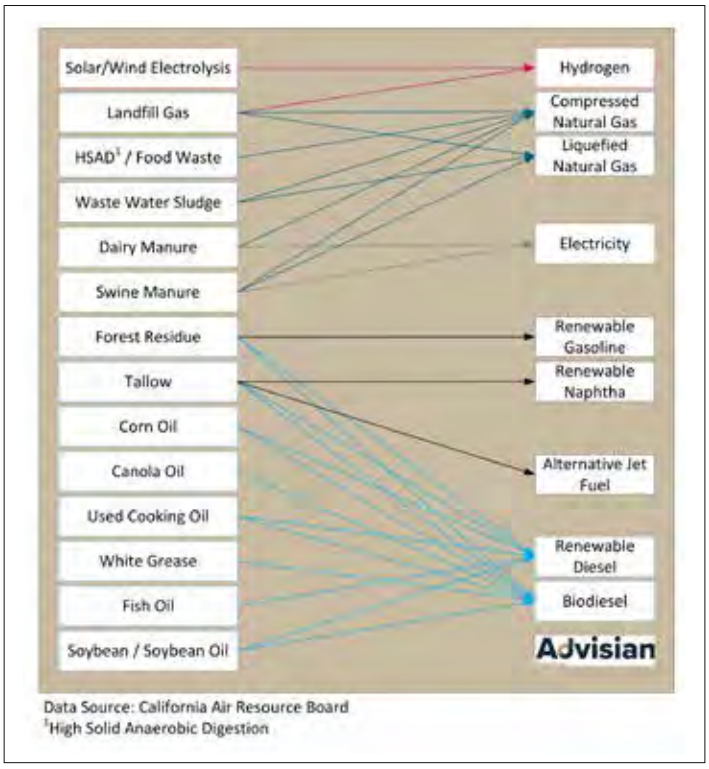


Figure 1. Certified alternative fuel pathways (2020)

which established LCFS for producers of transportation fuels such as gasoline, jet, and diesel. It has also been adopted by Oregon and British Columbia. Other US states are also considering limits on CI.

By producing fuel using a lower CI feedstock and pathways, producers can generate emissions credits to sell on the open market to less environmentally conscious producers.

Hypothetically, a relatively small production facility of 1,000 barrels of renewable diesel per day will generate a revenue stream from credits alone in the order of tens of millions of US dollars. In some cases, projects are forecast to break even in less than one year of production.

Investment opportunities are available in regions without carbon pricing legislation. As long as the renewable fuel producer can export to a jurisdiction where carbon pricing legislation is in place. In 2019, only 12% of all liquid biofuels were produced in California.

CI is a measure of greenhouse gas (GHG) emissions produced across the entire lifecycle of a transport fuel. CI calculations determine the net GHG emission reductions of a renewable fuel compared to its petroleum-based alternative.

Early adopter advantage is critical in the next several years

Producers and investors who mobilise quickly will be rewarded with an early adopter advantage because carbon credits will remain at a high price when there are more buyers than sellers.

While it is still early for most regions across the world, investing in production facilities will set up profitable businesses today and position these assets for even more upside potential as future regulations come into effect.

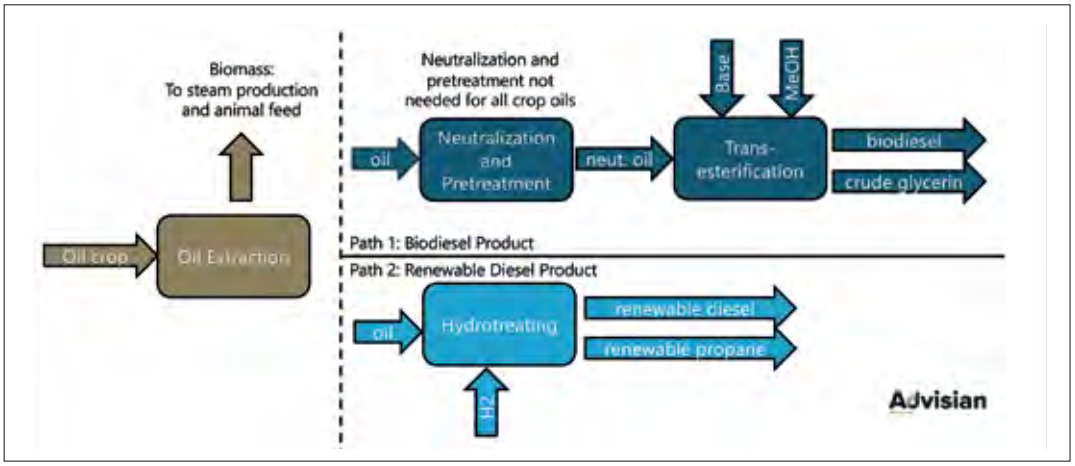


Figure 2. Biomass-based diesel types

Successful market entry depends on a clear investment strategy and understanding of capital and risk tradeoffs

The energy transition comes with a cost. Investments are needed to decarbonise and realise returns.

Based on our experience across many renewable fuel projects, the key to implementing a successful renewable fuels strategy is to de-risk potential investments.

This involves using the knowledge of industry leaders and key technology suppliers for quick, efficient, once-through project execution.

It also entails bolstering soft spots in investment using a robust financial model, and rigorous tools such as probabilistic risk analysis, sensitivity analysis, and/or business model selection.

Developing strong partnerships with entities that have existing assets, either as supply chain or business partners. Understanding how to balance capital and operating cost. For example, sizing a facility to take advantage of economies of scale without taking on excessive capital risk.

Staying current with legislation is especially important in the US, Canada, and Europe as different states, provinces, and nations adopt their own versions of an electronic trading system for emission credits.

Of course, all investments come with tradeoffs – paying higher capital costs tends to buy more processing capacity as well feedstock flexibility.

Location heavily impacts the availability of feedstock as well as inbound and outbound logistics. Additionally, various factors may sway companies towards different investment options such as available assets, available capital, and risk tolerance.

Co-processing is favoured as the lowest on the capital cost spectrum, thus limiting capital risk exposure. However, it requires an existing production asset (refinery) and, therefore, may be limited by that existing asset.

Revamping an existing unit is a great combination of low-medium capital cost while still producing a sizable amount of renewable fuels. In some cases, projects can leverage up to 80% of an existing unit's processing equipment.

A new unit adjacent to an existing facility is a medium-to-high capital cost but it allows for more capability and higher reliability. This investment option is prudent in cases where it is more efficient to build a new unit and retrofit only some of the existing infrastructure.

A new standalone unit is generally the highest capital cost option, but it allows for maximum flexibility as well as greater reliability. Reliability is key because, for many investments, the on-stream factor makes a major difference.

Current technology pathways for turning alternative feedstocks into fuels

When permitting a project, an application must be completed along with a GHG lifecycle analysis that will estimate a pathway's CI. Figure 1 summarises the current certified alternative fuel pathways as of 2020 by the California Air Resource Board (CARB).

Some of the available technology pathways include:

Biomass-based diesel

Biomass-based diesel is an increasingly popular choice for entering the renewable fuels market, especially in the US, Canada, and parts of Europe. However, it is important to distinguish the two types of biomass-based diesel.

Renewable diesel is the product of hydrotreated FOGs while biodiesel is fatty acid methyl ester (FAME) which is the product of the fatty acid triglyceride reaction with methanol.

Figure 2 shows the difference in the resulting product and manufacturing process for each type.

Both biomass-based diesel products have a good CI score and can, therefore, generate a significant number of credits.

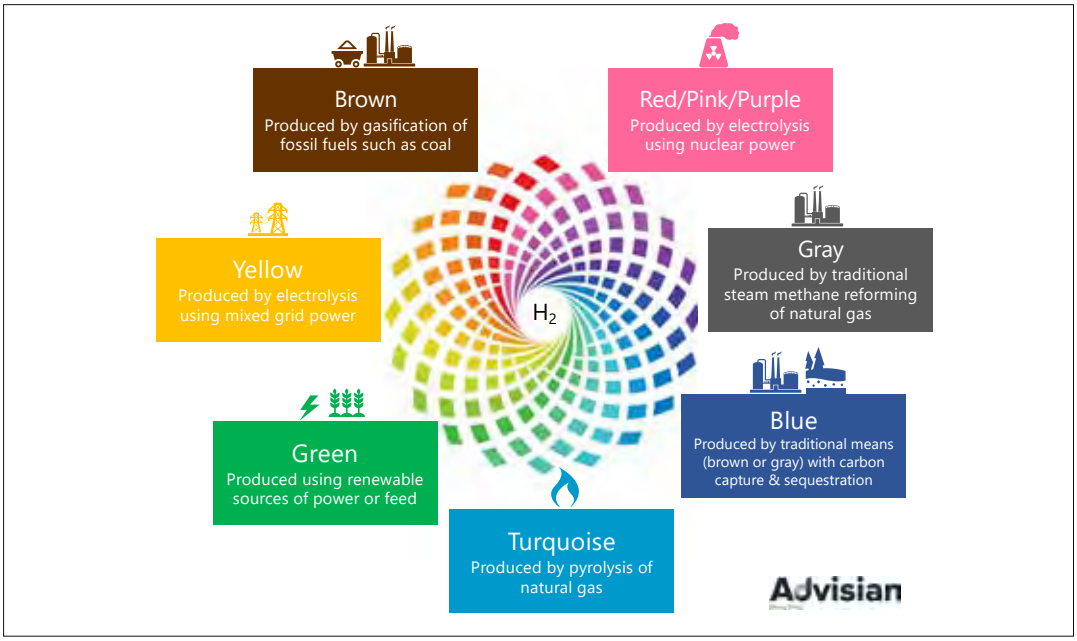


Figure 3. The hydrogen colour spectrum

However, renewable diesel is completely fungible with fossil diesel while biodiesel must be blended with fossil diesel.

Sustainable aviation fuel

There are several pathways to create commercial sustainable aviation fuel (SAF) and technology licensors have been able to successfully create a 100% SAF product.

Two that have reached commercial application are the hydrotreated biobased feedstock pathway and the Fischer-Tropsch pathway.

The hydrotreating pathway is very similar to the renewable diesel production process. The Fischer-Tropsch process requires a feedstock called syngas, a mixture of H_2 and CO, which can be created using fast pyrolysis or gasification technology and biowaste feedstocks.

Renewable naphtha

Renewable naphtha is often a co-product along with renewable diesel or SAF by hydrotreating renewable feedstocks. Renewable naphtha can be blended into gasoline or sold as an intermediate. It can also be used to produce plastics or renewable hydrogen.

Renewable hydrogen

Though not a liquid fuel, hydrogen plays a critical role in the renewable fuel economy. The topic of renewable hydrogen often gets colourful terminology that reflects the CI of the hydrogen production method. A variety of methods are shown in Figure 3.

Green hydrogen has the best CI score and can be produced using electrolysis technology which has been around for years.

A second method for producing green hydrogen is through traditional SMR technology, but using renewable feedstocks such as renewable natural gas, propane, or naphtha. Hydrogen produced using renewable feedstocks can have a significant reduction in CI.

While all these pathways are viable ways to enter the renewable fuels market, technical differences need to be considered when using alternative feedstocks. In some cases, a few of these pathways can be paired together to optimise the CI score and maximise emission credit generation. A snapshot of different ranges of CI scores can be found on the CARB website.

Financing options and business models play an important role

Depending on availability, some projects have used government guaranteed-loan programmes to help finance the required capital.

As for the business model options, the traditional engineering procurement and construction, joint venture (JV), or build own transfer business models all have different advantages that can be leveraged to strengthen investments in renewable liquid fuels.

Based on our experience in this emerging market, we're seeing quite a bit of JV activity – both in the form of multiparty consortiums as well as two-party arrangements.

For partnerships, proper structuring of junior and senior debt, and fair equity retention for resource contribution can impact the project finances. The pain-share/gain-share agreements can strategically improve the investment outlook while mitigating risk for all parties.

Producing renewable fuels is technically and financially feasible

Renewable liquid fuels are a tremendous opportunity for investors. A profitable market has emerged with no clear market leader. Those who can take swift and strategic action in the short term will emerge as a dominant force in this new market. ●

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For more information:
This article was written by Andrew Lui, consulting process engineer at Advisian; Andrew Sloley, principal consultant; Armen Abazajian, group manager; Bill Keesom, group manager; and Soheil Razjouyan, low carbon director. Visit: advisian.com

"The shift to renewable fuels is taking off. As of 2019, the market is estimated at $160 billion (€135 billion). Today, the market is experiencing anywhere from 7-39% annual growth rates. This can be even higher for specific fuel types and regions"

Exploring the various biofuel alternatives on the market to meet increasing green fuel demand

Feedstock matrix

A team from Net-Zero-Solution – a division of Channoil Energy – examined the rapid development of advanced feedstock markets covering the current regulatory environment and the impact it is having on advanced feedstock availability.

The team then looked at the matrix of feedstock types that are emerging and examined some of the new arrivals on the scene.

They then reviewed the two key biofuel production technology alternatives – biological and thermochemical – to determine if and how they compete.

Regulatory environment

Biofuels are not always price competitive against fossil fuels. So, mandates are generally required to drive their uptake. The US and Europe (EU and the UK) are the furthest ahead in setting requirements for the uptake of biofuels.

The EU under its latest release of the Renewable Energy Directive (RED II) has attempted to address some of the shortcomings to keep progressing with the decarbonisation agenda. Key to this has been:

- The introduction of the crop cap – a limit on production met by crop-based fuels;
- Setting rules for the minimum contribution of advanced biofuels;
- Taking steps to eliminate palm oil gradually from the fuel supply chain.

Table 1 shows the targeted mix from 2030. Remembering that some of the feedstocks or energy sources count double if they are sustainable, the volume percentages in the final fuel pool will be half the percentage shown in those cases.

What is a certainty is that non-crop biofuels are now mandated to a level that requires suppliers to diversify away from dealing with (almost) everything with just two products – FAME and first-generation bioethanol.

The combination of the volume mandates, the double-counting incentives and the intricate approval mechanisms for feedstocks is helping to create a market for sustainable advanced products.

In the US, there are two sets of mandates. Firstly, the US Renewable Fuels Standard (RFS) sets minimum bio-percentage quantities for the main transport fuel grades of petrol and diesel.

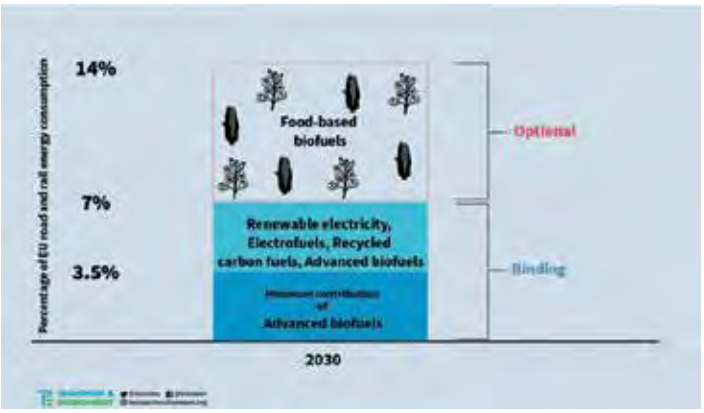


Table 1 outlines the targeted mix from 2030

Biofuels are not always price competitive against fossil fuels. So, mandates are generally required to drive their uptake

California has a more nuanced approach using its own Low Carbon Fuel Standard (LCFS). This sets a specific, 'sustainability score' for every feedstock and production technology combination that is used to make a biofuel.

These scores account for all of the well-to-wheel elements of sustainability and arguably give the most level playing field of any biofuel regulation.

Both the Californian and EU standards have been successful in incentivising the development of new production technologies and new alternative feedstocks.

The UK, which continues to parallel the EU RED II to a degree, has some stricter definitions than the EU on development fuels.

Feedstock types

Moving on to feedstock types. Here are some definitions:

- Carbohydrates – sugar and starch – these are used for traditional fermentation and distillation into ethanol;
- Secondly, lipids, or fats. These are oil-based crops such as sunflower, rapeseed and soy. Used cooking oil (UCO) and tallow are also lipids;
- Finally, cellulosic feedstocks. These are indigestible or hard process organic matter.

Cellulose is the compound that gives plants their structure. Typically, it has to be broken down in two stages to make the final fuel product.

It is in the lipids and cellulosic material that producers are seeing lots of innovation in the search for advanced feedstocks. This leads us to a matrix of feedstock types.

The matrix here considers, on the one hand, the type of feedstock – carbohydrate, lipid or cellulosic, and, on the other hand, the production technology – basically either conventional or advanced. However, there is a third category called 'intermediate', which could be argued to be the 'pre-advanced' category. Another dimension is production technology.

Emerging feedstock alternatives

So, what is emerging in the world of advanced feedstocks?

Firstly, there are what you might call intercrops – or crops that are grown between harvests of food crops.

The ones in vogue at the moment are some that are from the same 'brassica' family as oilseed rape, but offering better yields in varying climates.

Carinata and Camelina are the main ones that grow readily in more temperate or cooler climates. Chufa is another crop – in this case a tuber that produces a nut with a high oil content.

The next category is advanced lipids, excluding UCO and tallow, both of which are finite resources that are also crop and food supply chain dependent. This category is about finding new feedstocks that are otherwise going to waste. It includes:

- Palm oil mill effluent (or POME). Arguably a product of inefficiency, as the more effective the milling process, the less effluent is produced. Yet thanks to the incentives around finding advanced feedstocks, and palm oil's diminishing popularity, it is now turning into an attractive source of revenue for palm oil mills
- Spent bleaching earth is another by-product of vegetable and palm oil refining. The lipids are extracted from the bleaching material and returned into a hydrolysis or biodiesel production process
- Distillate corn oil is obtained as a by-product of corn alcohol production on an industrial scale and is currently used as a raw material in the biodiesel industry
- Wastewater sludge is a by-product of the sewage treatment industry and again can be re-treated to extract the lipids that remain
- A more familiar feedstock – trapped oil – or as it is sometimes called – fatbergs – essentially a gathering of solid high fat content waste material that can be physically extracted. The lipids are then separated and re-processed into biodiesel.

Cellulosic biomass is an interesting and diverse area. Forestry waste is a source of large amounts of biomass

	Carbohydrate	Lipid	Cellulosic
Conventional	Sugar cane, sugar beet, corn starch, wheat starch...	Rapeseed oil, soybean oil, palm oil...	n/a
Intermediate (EU RED II Annex IX B)	n/a	Used cooking oil, tallow	n/a
Advanced (EU RED II Annex IX A)	Residual carbohydrates e.g. wine residues	POME, DCO*, algal oil...	Agricultural waste, forestry waste, miscanthus, energy cane, bagasse...

Table 2 outlines the various feedstock types

material – it is basically the clearing of the forest floor from large-scale wood production. The question is going to be, what can be sustainably recovered without land degradation?

Then there are energy crops such as Miscanthus, energy cane and energy willow, plus others. The dilemma faced here is not land degradation, it is the land use itself, which is again potentially competing against the crop and food supply chain.

What is encouraging to note, is that markets develop quickly to allow supply chains to optimise these options.

All the main feedstocks trade as discrete grades and are increasingly covered by the price reporting agencies. There is no market yet for some of the exotic feedstocks, which is partly driven by availability and partly by the production technology not reaching scale yet.

There will also in some cases be no market where producers of the biofuel manage the feedstock supply chain directly.

Palm oil as a feedstock has declined in popularity

Production technology alternatives

Fuel production technologies can be grouped into either biological or thermochemical processes. Biological processes such as ethanol fermentation or algae cultivation for oil are low energy intensity technologies and are, therefore, more sustainable than thermochemical processes. This generally entails the use of temperature and pressure in a reactor, possibly followed by post-treatment or distillation of the finished product.

However, thermochemical processes can also achieve a more effective functioning substitute for the fossil fuel it replaces.

Renewable diesel and sustainable aviation fuel (SAF) are examples of this. These have often been discussed as competing alternatives.

However, in practice, both may be needed for technological reasons and simply to produce enough biofuel. Indeed, many advanced feedstocks will need a conversion pathway with both biological and thermochemical technology.

Conclusions

Total biofuels production is limited by feedstock availability and this will continue to drive the search for more feedstocks. This looks like a major challenge, because of large amounts of capacity coming on stream for producing hydrotreated vegetable oil and SAF.

Regulatory mechanisms are needed to incentivise advanced feedstocks, otherwise the producers might turn to more readily available primary crop feedstocks.

However, these mechanisms can have unintended consequences, such as POME being worth more to a palm oil producer than running the mills more efficiently.

There is potential in new areas such as intercrops, advanced lipids, and cellulosic material; these will broaden the available feedstock pool considerably.

However, diversion of feedstocks from their alternative use (e.g. to improve soil) will be an important dilemma to resolve.

Finally, especially considering the increasing range and production challenges of new advanced feedstocks, it is likely that both biological and thermochemical processes will be needed to satisfy demand. ●

Carbohydrates

- Typically food crops – sugar and starch
- Used for fermentation and distillation into ethanol

Lipids

- Oil-based crops such as sunflower, rapeseed and many more
- Used for chemical conversion into FAME
- Or for hydtrotreatment to convert into renewable diesel

Cellulosic feedstocks

- Indigestible or hard to process organic matter
- Lignin and Cellulose are the building blocks of a plant's structure
- Can be broken down into digestible carbohydrates or converted thermochemically (or a combination)

Advanced feedstocks

For more information:
This article was written by Mark Waddington, associate director Net-Zero Solution – a division of Channoil Energy. Visit: channoil.com

GIDARA Energy is using non-recyclable waste to fuel transportation. *Biofuels International* speaks to CEO Wim van der Zande about the process and how nothing goes to waste

Future of biofuels

GIDARA Energy CEO Wim van der Zande

GIDARA Energy is a Dutch technology-based energy company focused on converting non-recyclable waste into syngas – a clean and versatile source of energy.

The company's first plant, Advanced Methanol Amsterdam (AMA), will produce an average of 87.5 kilotons per annum (KTA) of renewable methanol from 175 KTA of local non-recyclable waste.

AMA includes a testing facility, knowledge centre, and full plant producing advanced methanol that meets the European biofuel mandate as well as Dutch legislation. The facility uses non-recyclable waste to produce advanced methanol for biofuel blending. Side streams such as green CO_2 and solid residues are used for greenhouses and cement filling, respectively.

AMA will be working in close cooperation with local partners and several universities. The plant is expected to be fully operational in 2024, with objectives to contribute to better fuels and a circular economy.

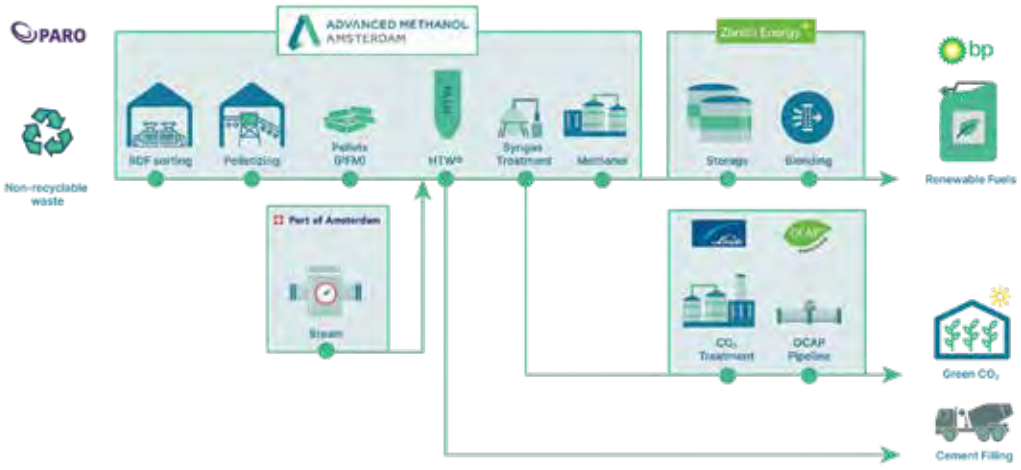
Can you walk us through the entire process chain of AMA?

AMA is conveniently located in the Port of Amsterdam's BioPark, where most of our partners are also located. Our value chain starts with refuse derived fuel (RDF) and waste wood being treated and pelletised creating pelletised feed material. These pellets are converted into syngas using our HTW Technology. The syngas is cleaned by our partner, Linde Gas. The clean syngas is converted into methanol, which is used for fuel blending by our partner, bp. Excess CO_2 is sent into the Linde OCAP pipelines straight to Dutch greenhouse horticulture. The bottom product will be used by the cement industry.

In what way is your technology compatible with the current transportation fuel market?

For a long time, fossil fuels were the only available option for transportation. Transport accounts for around one-fifth of global CO_2 emissions, and the demand is expected to grow across the world in the coming decades as the global population increases, incomes rise, and more people get access to cars, trains and flights. Combined, these factors will result in a large increase in transport emissions.

"Reducing CO_2 emissions in the transport sector over the next half-century will be a formidable task"



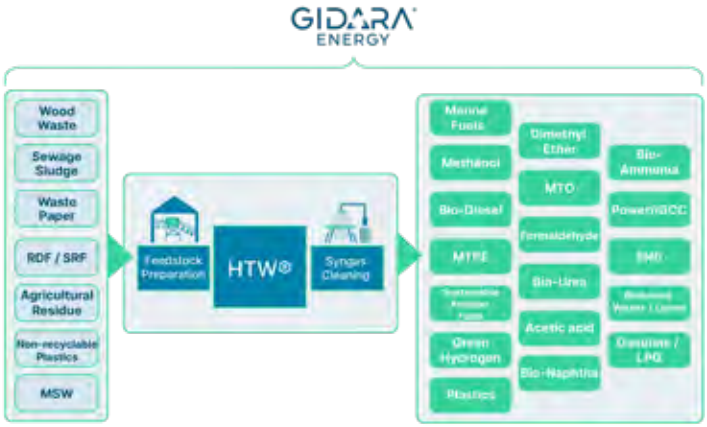
AMA's Value Chain

On the other hand, there is a growing global waste issue. The environmental impact is significant, with massive volumes of waste generated annually. Although a large portion of waste is recycled in northwestern Europe, significant amounts of non-recyclable waste are currently still being incinerated or sent to landfill. In other parts of the world the recycling rates are much lower.

These factors have been translated into regulation by the EU in the Renewable Energy Directive (RED II) and translated into national renewable energy mandates. It is, therefore, important to convert waste that is currently being landfilled or incinerated into valuable products, without the need to invent new value chains.

Our HTW technology is an integrated business concept that starts by pelletising non-recyclable waste, gasifying it to chemical building blocks that can be used to produce biofuels. Our technology is proven and our products can be directly and efficiently applied in the current market. The quality and quantity of our products: advanced methanol, CO_2 and bottom product meet market requirements and match existing product value chains.

The demand for advanced biofuels is has never been higher. To meet the European objectives, we will need to construct many more facilities that produce advanced biofuels from non-recyclable waste. Our first facility in Amsterdam will act as a blueprint for all future facilities. The newly implied 'Fit for 55' objectives will broaden the mandates to marine and aviation



Various high value end products

markets. Our technology allows us to produce fuels for those markets as well.

You mentioned aviation/ marine fuels, what are different possibilities for other end-products?

The clean syngas we produce using non-recyclable waste is a basic building block which can be used for a broad variety of end-products. In Amsterdam, we're converting the syngas into advanced methanol, which our offtaker bp is using for fuel blending. Other end-products are the before mentioned marine- and aviation fuels, DME, MTBE, gasoline and even green hydrogen. The possibilities are almost endless.

The chemical industry is another market that would benefit tremendously from our technology. Although there are no mandates for the chemical industry to utilise bio-based feedstock, we are able to produce many important end-products.

In what ways is GIDARA Energy contributing to a more sustainable future?

Currently, around 80% of all waste is recycled in the Netherlands. Worldwide, this number is much lower at around 13%. We want to live in a world where none of our waste is wasted. Our mission is to take the lead in forming a bridge between waste processing and the renewable fuels industry.

Our first facility in Amsterdam can run on multiple types of wastes and waste mixtures. It's very important to have a design that is both flexible and adaptable, because today's waste is different from tomorrow's waste and waste in Amsterdam is different than waste in Paris.

Our Centre of Excellence will continue to research a variety of new feedstocks and further develop our technology.

Although we have the ability to build larger facilities to meet the demand for biofuels, we prefer to work with standard sizes for our facility. We have chosen to exclusively use local waste for our Amsterdam project in order to prevent continuous transport of waste and fuels which is still happening around Europe.

Our AMA facility will save up to 350,000 tonnes of CO_2 compared to incineration or landfilling. This is an equivalent to the emissions of 114,000 cars annually. We use the waste equivalent of 290,000 households to produce our biofuels.

AMA maximises circularity and aims for near-zero emissions, therefore, all our side streams have a specific destination. In cooperation with Linde, we're connecting the CO_2 OCAP pipeline to provide Dutch greenhouses with our produced green CO_2. This green CO_2 is very important for the growth of fruits and vegetables, as the greenhouse industry is facing shortages.

What does the future look like for GIDARA Energy?

Our developments are going in multiple directions. We have standardised the design and layout of our flagship AMA facility, and with the flexible design in handling different waste mixtures, we have many options to geographically expand our business. We are able to develop facilities in many hubs (of waste and chemicals) and due to the high demand and urgency, we are planning to expand our business both inside and outside of Europe.

The European 'Fit for 55' framework will lead to opportunities in more markets. GIDARA Energy will cooperate with other parties to further develop and integrate these product value chains.

AMA will utilise our HTW 2.0 technology. We are always trying to improve our patented technologies for further improvement of our operating costs and maximising our availability. We are working with several universities to develop our Centre of Excellence and Pilot Plant, which will result in HTW 3.0.

Reducing CO_2 emissions in the transport sector over the next half-century will be a formidable task. Our technology and design allows a viable business model that ensures CO_2 emission reductions and a more sustainable industry. We are confident that our technology will benefit the reduction of the world's carbon footprint, as well as helping to reduce the global waste issue. ●

For more information:
Visit: gidara-energy.com, advancedmethanol.com. Contact: communications@gidara-energy.com

Advanced Methanol Amsterdam in the centre, surrounded by its feedstock supplier and offtaker

Highlighting biofuels production from syngas fermentation

Setting the course for sustainable aviation and marine fuels

Aviation and marine transport have a direct effect on global greenhouse gas emissions and air quality. The BioSferA project aims to mitigate this impact through the development of innovative and high performing biofuels.

That is why the project aims to develop a cost-effective production method of sustainable aviation and maritime fuels, by combining different technologies.

The project started in 2020 and will be completed by 2024. Despite the COVID-19 restrictions and after one year since the beginning of the project, the project's first results have been achieved.

This technical scheme in Figure 1 shows the full concept of BioSFerA. Biogenic residue and waste will be converted in two industrial fermentation steps after being gasified.

The first fermentation step will convert syngas, obtained from gasification, into acetate. This will be fed to the second fermenter where microorganisms will convert the acetate to microbial lipids. Microbial lipids are molecules similar to vegetable oils or animal fat, and can be further treated by hydrotreatment in a process similar to hydrotreated vegetable oil (HVO) production.

Conversion by means of industrial fermentation requires less energy than conventional thermochemical processes. This has a significant impact on the energy efficiency and carbon footprint of the conversion technology; a double target is reached. First of all, the feedstock has a low carbon footprint because it is derived from waste or residue (annex IX of Renewable Energy Directive), and, secondly, the conversion to final product requires less energy input.

Industrial fermentation is possible at a large scale and is less dependent on climate conditions. Moreover, the conversion can be executed close to the feedstock, which will have a significant impact on the total emission calculation of BioSferA product.

Finally, the BioSFerA project will undertake a full value chain evaluation that will result in a final analysis to define a pathway for the market introduction of the project concept.

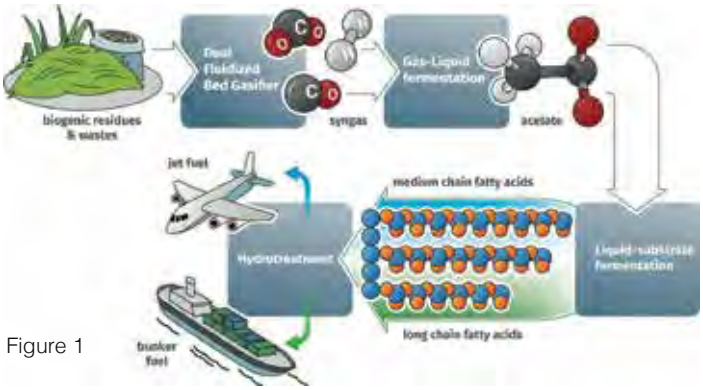


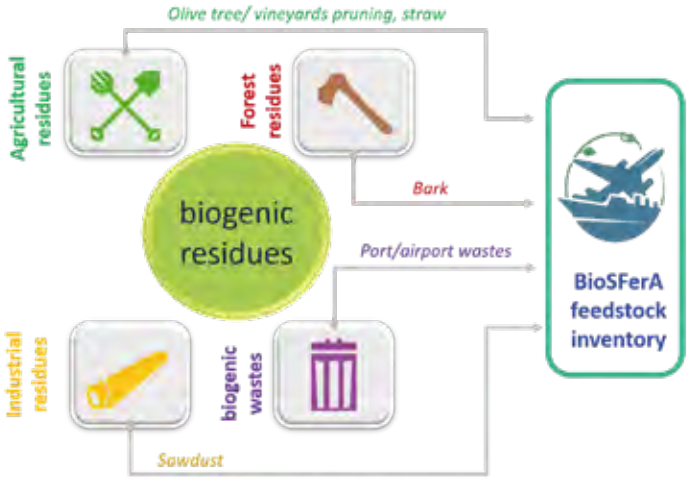
Figure 1

Some crosscutting evaluations carried out on all tested and validated processes will complete the results of the project from an economic, environmental, and social point of view. This full value chain approach, from waste to fuel, is also reflected in the multidisciplinary consortium of companies spread all over Europe as seen in Figure 2.

BioSferA's first results achieved

Firstly, thanks to the Dual Fluidised Bed Gasification technology developed by the Technical Research Centre of Finland, the process can be driven by flexible feedstocks, using a broad and variable portfolio of biogenic residues which may be lower quality carbon sources compared to the sugar-, starch- and oil plants used for conventional liquid biofuels, but nevertheless do not come into conflict with food production and tend to avoid land use restrictions.

In this light, the feedstock selection was based on the fulfilment of three main prerequisites: availability/sustainability (i.e. capacities for large scale applications), favourable technical



characteristics for good performance at the integrated BioSFerA system, and market competitiveness.

The selected feedstock inventory includes agricultural (prunings, straw), forestry (logging) and industrial (wood) residues as well as biogenic wastes from airports and ports.

Based on this selection, bench-scale gasification tests have been completed for the most of the selected feedstocks. VTT gasified five pelleted types of feedstocks, including forest residue, bark, straw, sunflower, and olive pruning. The gasification tests confirmed that all the feedstock types could be used in the forthcoming pilot phase. Research also revealed that tar reforming is a prerequisite of syngas fermentation due to the significant presence of inhibiting components.

Secondly, the Centre for Research and Technology Hellas (CERTH) carried out an assessment of the potential to replicate the BioSFerA concept across Europe at commercial scale. This assessment included specific case studies in four European countries – Greece, Italy, Spain, and Finland.

In each country, the consortium selected a location suitable to host a production plant with a 200 MWth capacity. Critical parameters for the selected regions were the average feedstock cost and the suitable feedstock type.

Even when calculating with the most conservative assumptions, it is possible to obtain biogenic waste feedstock at a maximum cost of €10/MWh. Moreover, together with the technology providers in the consortium, CERTH described a preliminary overall value chain for BioSFerA. Process models were developed and various simulations with altering operational parameters were performed.

The overall process can be separated in three distinct parts: the thermochemical, the biotechnological and the thermocatalytic part. Preliminary heat and mass balances were calculated and evaluated:

The Energetic Fuel Efficiency (EFE) – the energy content of the final liquid fuels – is measured at 31-37%, whereas the carbon utilisation – the carbon content of the final liquid fuels – has been calculated equal to 22-27%. These values are expected to improve through process optimisation in later stages.

In parallel, the syngas fermentation to acetate has proceeded and five acetogenic strains in eight different media have been examined.

Clostridia proliferate easily in YTF (fructose) medium and Moorella in TSB (Tryptic Soy Broth) medium. HCN, typically present in syngas from biogenic waste showed the highest consumption of CO and H_2, while M. thermoacetica had the best performance in terms of microbial growth and acetate concentration.

Genes have been selected to decrease or knock out ethanol production. Currently the Spanish National Research Council and the Bio Based Europe Pilot Plant are working with Moorella, while protocols are being developed to transform the Clostridia and Moorella strains by electroporation. All the described activities are highly active and the experiments are in progress.

Regarding acetate fermentation, seven strains of the oleaginous yeast Y. lipolytica have been tested.

All the experiments have been performed in shake-flask culture, which caused a slow growth of the yeast due to critical drop of the pH in the medium.

As a result, the experiments must be reproduced in bioreactors. The main fatty acids are palmitic, linoleic and oleic acids. Protocols are under development to improve the production of TAGs by metabolic engineering in the wild type yeast strains W29 or YB-392.

In the coming months, the final bacteria and yeast strains with the best performance in terms of syngas and acetate fermentation will be selected and the next phase of the project which is the process optimisation at lab scale will begin. ●

"Microbial lipids are molecules similar to vegetable oils or animal fat, and can be further treated by hydrotreatment in a process similar to hydrotreated vegetable oil (HVO) production"

Konstantinos Atsonios is the project coordinator of BioSFerA project and works as a researcher at CERTH (Centre for Research and Technology Hellas and Chemical Process and Energy Resources Institute)

Maarten Van Haute, alternative fuels officer, represents Kuwait Petroleum Research and Technology BV, a partner of the BioSFerA project

For more information:
Visit:biosfera-project.eu

BDI outlines how its retrofitting expertise has proved a success in the biodiesel industry

Eight steps to retrofit success

As a customer-driven and market-focused technology provider in the field of biodiesel, Austrian company BDI has carried out more than 30 retrofit projects worldwide.

In terms of plant operation and installation, BDI understands retrofitting to be the improvement and optimisation of existing biodiesel installations, for example, with regard to feedstock flexibility, increase of production capacity and product quality, safety upgrades and other important needs of its customers.

Retrofit projects

The first example dealt with a successful de-bottlenecking of an existing production plant. Although only a small project, this example revealed that sometimes simple new solutions can be found.

The design capacity of the plant had been exceeded on some occasions, but further increases were prevented by a single machine, thanks to the high level of expertise and experience of the plant staff. An upgrade to a bigger machine would have been too large an investment. During a plant inspection by BDI experts, the media streams leading to that machine were thoroughly evaluated.

It was discovered that by rerouting one particular media stream to another point of the process, the load on the machine could be reduced as a result.

This out-of-the-box idea was further developed and discussed together with the customer on site.

In the next phase, the customer executed some trials designed by BDI to figure out the influence of the intended rerouting on the performance of the machine and on the overall process. The results of the trials were checked and confirmed by analysis and recalculation of the mass balance.

Finally, the solution was implemented by installing new pipelines and additional process control changes. The retrofit resulted in more stable production over the design capacity, achieved with a significantly lower investment compared to replacing a single machine.

Plant modification

The second example concerns the modification of an existing biodiesel plant, which was running on waste-based oils, like used cooking oil.

The plant was increasingly struggling with long downtimes due to the degradation of equipment and blocked pipelines, valves and instruments.

This effect came gradually and at the time, had a big impact on the overall production figures in terms of quantity and quality of the product and by-products.

With more than 25 years of experience in handling waste-based oils for the production of biodiesel and constant monitoring of different qualities of waste oils, BDI noticed that the quality of waste-based feedstock was declining. Therefore, the first approach was to focus on the feedstock quality, which the plant used for its operations.

With the help of laboratory tests developed by BDI, different raw materials from various feedstock suppliers were tested. In addition to these analyses, the settling behaviour was evaluated and the degree of solid impurities was determined.

The results confirmed that all raw materials used had excessive levels of impurities.

To make matters worse, due to the limitations of the feedstock market, it was not possible to change suppliers. For that reason, a solution had to be found to reduce the impurities upfront before entering the production line to avoid fouling and the loss of end-product quality.

Based on its extensive experience, BDI provided the concept of a fat pretreatment unit. Through this process, bad qualities of feedstock are treated by means of heating, washing with a washing agent, separation via centrifugation and final drying.

The customer decided to install this unit and the satisfying result of the retrofit was a robust and stable production mode, less down time and significantly better product quality.

Plant inspection being carried out. Credit: BDI-BioEnergy International

Mixing systems

Retrofit inquiries can often arise at very short notice. The increasing uncertainty of the delivery of a central catalyst mix prompted one of BDI's customers to quickly opt for a mixing system for a potassium methylate catalyst mix system.

Due to the modular, skid mounted design, this retrofit was successfully implemented by BDI within a short time, thereby providing the customer with a safe plant design.

These examples show the wide range of retrofit tasks available in the biodiesel sector. Retrofitting always requires tailor-made solutions and BDI has developed an eight-step concept for retrofit projects that ensures that they are successful.

During the first contact with a potential customer, the special needs and requirements of the customer will be questioned and documented.

Status evaluation

Once the customer's needs have been well understood, the first step in the retrofit programme is an on-site status evaluation of the current installation. This plant inspection usually lasts for two days and is executed by a senior process engineer to gain a good understanding of the current plant operation mode.

To develop possible improvements, it is important to ask the right questions and to use the experience and know-how of the operators working daily on the plant.

Based on the information provided during the plant inspection, the results are summarised in a report, including recommendations for short-term solutions and improvements.

Furthermore, the general approach for the proposed retrofit concept is described in detail, placing the focus on interfaces, influence on existing production, and a rough cost estimation for the implementation of the concept. Sometimes several alternative solutions may be presented and discussed in detail with the customer.

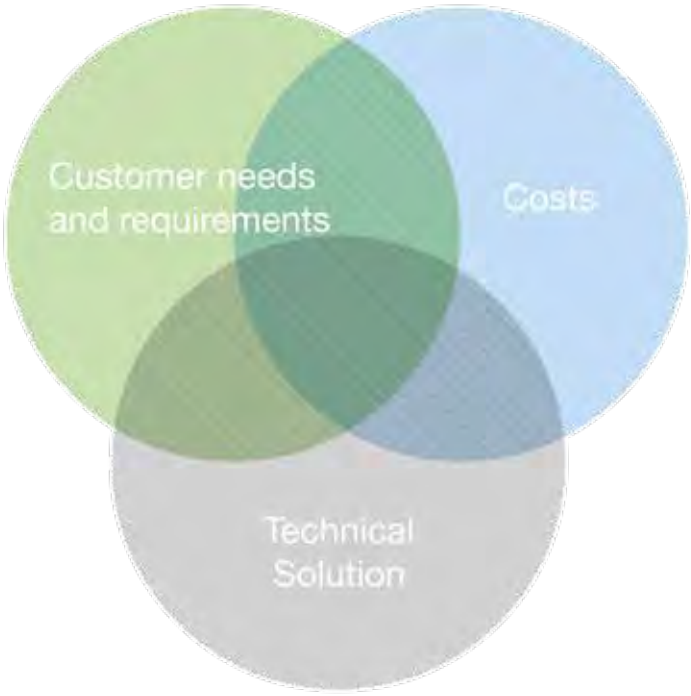
Preengineering

The next step is the pre-engineering execution for the most favourable concept that meets the customers' requirements. This involves a layout of the new units, the interface management and a mass and energy balance to identify open demands, for example, additional cooling capacity and to define the necessary measures to close the loop.

Offer preparation

If the customer decides to advance further, the scope of supply will be defined in detail and an offer will be provided. This offer includes a detailed description of the customer's scope of supply to enable a precise planning of all necessary resources.

BDI's expertise lies in the biodiesel industry



The main driving factors for a successful retrofitting process

Authorisation procedure

Additionally, during the pre-engineering and offer preparation stages, the customer will need technical data including a risk assessment study to be well prepared for the authority procedure; this will be provided during the fourth step of BDI's retrofit programme.

Engineering and delivery,implementation and commissioning

In the course of the project execution, BDI carries out the full engineering and purchasing, which will be coordinated by a nominated project manager, keeping the timeline of the project brief and effective.

An efficient process planning for the installation time and a technical on-site support during the construction is necessary to keep the downtime of the regular operation to a minimum. After finishing the installation, the commissioning is initiated by carrying out the functional plant testing and start-up of the new process part, in combination with the existing plant units.

This is followed by the optimisation of the plant parameters and stabilisation of the processes with the plant personnel and training them on the new units.

Customer service

When the commissioning and the retrofit project is completed, the final step involves extending BDI's support to the entire life of the new process unit. There is a wide range of services like spare part delivery, 24 hour hotline or production support, which can be provided by BDI's customer services department.

For a successful retrofit project it is important to consider three main driving factors - customer´s needs and requirements, the costs of the project and a suitable technical solution. A retrofit project will be a successful if the intersection of these three factors is as large as possible. ●

For more information:
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Crown Iron Works leads the way on the pretreatment of fats and oils for renewable fuels

Crowning glory

Crown Iron Works is paving the way on the pretreatment of fats, oils, and alternative feedstocks for the renewable fuels industry.

While many of these feedstocks have been around for ages, only in recent decades have they been transformed into high quality transportation fuels.

In the early 2000s, biodiesel was gaining popularity. Crown adapted its core oils and fats technology into a simplified pretreatment system specifically for preparing feedstocks for biodiesel production.

This was a natural progression to complement Crown's Biodiesel Transesterification process technology and resulted in dozens of plants built for clients across North and South America and overseas.

Expansion programme

Fast forward 15 years from the peak of the biodiesel gold rush to the next boom – renewable diesel.

While there are some important differences for this next generation biofuel, it is hard to ignore that the biodiesel industry paved the way. Not only in terms of process technology, but also feedstock supply, feedstock quality, federal tax credits, blending regulations, cold weather and fuel system limitations.

While the petroleum industry has been pushed to meet renewable volume obligations, tax incentive programmes like California's Low Carbon Fuel Standard (LCFS) have ignited tremendous demand for renewable fuels, including renewable diesel/HVO and sustainable aviation fuel (SAF).

An aerial rendering of the ECB Group's Omega Green biorefinery in Villeta, Paraguay. Crown Iron Works' RD Ready™ Pretreatment will be an integral part of the facility

The renewable diesel boom is shaping up to be even bigger than biodiesel. As petrochemical companies have become more involved in building and operating their own biofuels facilities, plant design capacities are often now discussed in refining terms – barrels per day, instead of million gallons per year or tonnes per day.

The minimum design capacity is often two-to-three times larger than a typical biodiesel plant.

RD Ready™ Pretreatment System

While Crown has dozens of clients around the world operating pretreatment facilities to process everything from virgin vegetable oils to waste oils, fats and greases, the renewable diesel boom has created some new market dynamics.

While integrating pretreatment into the biofuel production facility is still the most common, there is now significant interest in building standalone pretreatment plants to supply renewable diesel-ready feedstocks.

Crown recently branded its RD Ready™ Pretreatment System, which is a robust solution to handle a wide variety of feedstocks to produce a clean product to put directly into a diesel hydrotreater.

There are many similarities to pretreatment for biodiesel, but additional specifications such as total metals, inorganic and organic chlorides, nitrogen, and sulphur were not on the radar until renewable diesel came into the picture.

Crown's expertise lies in the pretreatment process

Crown took advantage of the opportunity to adapt a robust pretreatment solution to meet the feedstock requirements of any renewable diesel/HVO hydrotreater licensor.

To further support customers, Crown maintains a proprietary database of feedstock specifications and pretreatment results exclusive to renewable diesel.

ECB Group – Omega Green Project

Built on a long history of partnership between Crown and the ECB Group in Brazil (and subsidiary BSBIOS – which has an extensive installation of Crown process equipment across multiple sites), the Omega Green biorefinery project in Paraguay is leading the charge for renewable diesel/HVO and sustainable aviation fuel in South America.

The site will include Crown's RD Ready™ Pretreatment System with a capacity of 20,000 barrels per day and the capability to process multiple feedstocks including vegetable oils and animal fats.

Crown's expertise in pretreatment, coupled with technology that minimises bleaching clay usage, provides the upper hand in processing waste feedstocks while providing the highest product quality in the industry.

In addition, Crown's technology for removing polyethylene from animal fats is another key to ensuring extended catalyst life in their renewable diesel/HVO hydrotreater downstream.

The biorefinery site is located near Villeta, Paraguay, and has several strategic advantages as it sits on a major waterway with a port and terminal, has access to local hydroelectric power, and has the support of the local government.

It also happens to be located near the world's largest dedicated site for growing pongamia trees.

Pongamia will help with reforestation, along with agricultural production which will boost the economy in Paraguay.

"Fast forward 15 years from the peak of the biodiesel gold rush to the next boom – renewable diesel. While there are some important differences for this next generation biofuel, it is hard to ignore that the biodiesel industry paved the way"

It boasts a low carbon footprint along with low indirect land use change (ILUC) and sequesters more CO_2 than any other oil production crop, making it a sustainable feedstock for renewable fuels.

The oil from this relatively new crop is especially important to the biofuels market given a substantial gap in feedstock supply relative to the installed production capacity worldwide.

ECB Group recently signed a contract for the supply of Pongamia oil which will comprise up to a third of the total feedstock used for renewable diesel/HVO production at the site.

Pressure leaf filters

Innovation

As renewable feedstocks trend toward lower quality, additional validation is often sought by processors to ensure the stringent specs of diesel hydrotreaters can be met consistently. This is where Crown leverages its Global Innovation Centre at its headquarters in Blaine, Minnesota, US.

The new flagship facility includes office space, research and development laboratories, three separate pilot plants, an analytical laboratory, and serves customers in all of Crown's market segments.

Aside from pretreatment technology, Crown also offers technology and innovations in crushing and solvent extraction of oilseeds, edible oils, biodiesel, oleochemicals.

In addition, Crown's leadership is being leveraged to develop and scale a broad range of speciality products including plant-based proteins, protein concentrates, hemp/CBD oil, nutraceuticals, and speciality chemicals. ●

For more information:
This article was written by Patrick Harrington, global technical sales manager for the liquids segment at Crown Iron Works. Visit: crowniron.com

Pongamia seeds

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