Bioenergy Insight

JULY/AUGUST 2022
Volume 13 • Issue 4

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Regional focus: Scandinavia & Baltics

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Bioenergy Insight

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Bioenergy Insight
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June summary

2.25K impressions	10 mentions	25 new followers

TOP TWEETS

Top Mention earned 22 engagements

Catax @Catax_Group

We helped Deeside-based Compact Syngas Solutions (CSS) secure £300K from the Department for Business, Energy and Industrial Strategy (BEIS)! Read the full article from @BioenergyInfo here: http://ow.ly/Qauo50JgthM #grants #bioenergy #hydrogenproduction #hydrogen

5 9

Top Tweet earned 235 impressions

Mainstreaming bio-CNG for mobility in Indian cities Extracting clean energy from MSW could solve the dual challenge of disposing of India's ever-growing mounds of garbage and reducing dependence on fossil fuels, says @adnan_wanii of @OlaMobilityInst

4 6

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It's time you were heard

A couple of months ago, over 500 companies involved in the bioenergy value chain put their names to a letter addressed to the European Commission (EC), calling for the increased use of bioenergy, as an answer to Europe's current reliance on Russian fossil fuels.

Organisations including the IPCC, IEA and IEA Bioenergy wanted to emphasise that biomass in particular can play an important role in achieving a net-zero economy by 2050.

Yet in stark contrast, in the REPowerEU proposal, which was presented in March, the European Commission completely ignored the role of sustainable bioenergy.

So is anybody listening? How can the industry make its voice and its (extremely viable) proposals heard?

Bioenergy is readily available and can be implemented quickly, often at low cost. For district heating, for example, the switch from fossil fuels to biomass and waste has resulted in lower costs and emissions for countries across Europe.

For residential and commercial buildings, heating with pellets, briquettes or wood chips offers a clean and efficient alternative to gas and oil.

The industry must find its voice, or a return to coal reliance seems all but inevitable.

Alice Cooke
Editor

Air Liquide to start biomethane activity in China

Air Liquide invested and will operate its first biomethane production unit in China by the end of 2022.

Located in Huai'an City, in the Jiangsu Province, the unit will have a production capacity of 75 GWh per year. This project demonstrates a circular economy and low-carbon approach, in line with the Group's Sustainable Objectives and strategic plan, ADVANCE.

This new unit will produce biogas from agricultural and livestock waste coming from local farms and purify it into biomethane. With a total production capacity of 75 GWh/y, the unit will inject the biomethane into the city gas grid to be used for household consumption and generate electricity for its own consumption and injection into the electrical grid.

The biomethane unit will follow a circular economy approach. The digestate, a by-product material resulting from the biogas production, will be processed to produce bio-fertilisers. These bio-fertilisers will be used in the local agriculture, which, besides food products, will also generate some waste that will be processed in this unit to produce biomethane.

Biomethane has a high potential in China in particular as the Chinese government supports projects promoting the valorisation of waste as part of its financial plans for the development of rural regions.

Air Liquide has developed competencies throughout the whole biomethane value chain, starting with biogas production from waste to its purification into biomethane, liquefaction, storage, and transportation to distribution. Air Liquide now has 21 biomethane operational production units in the world for a yearly production capacity of about 1.4 TWh.

"We are pleased to start this first biomethane project in China, a dynamic market, and to continue expanding this activity with our partners in key countries. Biomethane follows a circular economy approach and contributes to the reduction of CO_2 emissions, thus to the development of a low-carbon society.

"This investment is in line with the priorities of our strategic plan ADVANCE for 2025, which links inseparably growth and sustainable future," said Emilie Mouren-Renouard, member of the Air Liquide executive committee, supervising innovation and development.

Europe's largest biogas producer says EU targets are unachievable

Europe's largest biogas producer has warned that it will take years to significantly boost production despite the EU pushing for a rapid increase in output to reduce reliance on Russian gas.

Biomethane is chemically identical to natural gas but produced through the controlled decomposition of animal and industrial waste. The EU wants output to more than double and contribute to about 3% of a targeted two-thirds reduction in imports of Russian gas by the end of 2022.

However, Ole Hvelplund, chief executive of Danish biomethane producer Nature Energy, said the target was unrealistic because it takes at least two years to secure permits and construct plants. He said: "The main factor of getting more production in place is to build more plants. You don't do that over the summer. It takes some time.

"It will not be doubling on existing plants because you have a lot of physical restraints. In the short run to the next winter, it will be limited what we can do."

With Moscow cutting supplies to Europe, every cubic metre of the EU plan to replace 101.5bn cubic metres of Russian gas this year will matter if the bloc is to avoid blackouts and shutdowns of heavy industry over winter when demand rises.

A European Commission official said the aims for reducing reliance on Russian gas by the end of 2022, including the 3.5 bcm increase in biomethane production, were not binding "but rather estimates of what we believe is possible to achieve."

Biogas is produced primarily using waste from crops, animal manure and industrial activity through "anaerobic digestion", a process by which bacteria break down organic matter in an oxygen-free environment. This is then purified into biomethane by extracting carbon dioxide and can then be treated identically to natural gas in the pipeline network. Proponents say the CO_2 emissions generated during the purification would have been emitted naturally anyway, so the technology saves emissions that would have been released by burning natural gas.

However, the nascent technology has come under fire over its environmental credentials. A recent Imperial College report, for example, found a higher level of leaks of methane — a far more potent greenhouse gas than CO_2 — than previously thought.

The biomethane industry is attempting to transform from a fragmented, cottage industry into industrial-scale operations. Nature, who generated €200mn of revenues in 2021, is leading the charge, but the sector is increasingly drawing the attention of energy majors.

Shell, which signed a long-term deal to buy Nature's biomethane supply in 2020, started its first US biomethane facility in September 2021, while TotalEnergies has partnered with Veolia to produce biomethane from wastewater.

France's Engie and container shipping giant CMA CGM have agreed to co-invest in a biomethane plant. An International Energy Agency report in March 2020 said the average price of biomethane production was $19 per million British thermal units plus additional grid injection costs, versus the current price of gas in Europe at roughly $50/Mbtu.

However, it is less clear whether those economics are incentivising production as industry investment is hard to grasp because of the fragmentation, and small operators can struggle to access financing. Hvelplund said that the industry's future was bright after the EU doubled its biomethane production target to 35 bcm by 2030. But he warned that supportive policy measures including a floor on gas prices would be needed to incentivise new projects.

He said: "We have to find places to build these plants, a quick way to do permitting, easy access to the gas grid, easy access to biowaste in a circle of 25km and a floor price on gas if we get back to gas prices in the past — then it will open up a lot of investment in Europe."

Woodside invests in bioengineering company

Woodside has revealed a $9.9m (€9.8 million) equity investment in an India-based bio-engineering company, String Bio, the developer of a patented process that can recycle greenhouse gases (GHG) into products such as feed for livestock.

Woodside is exploring the potential of String Bio's carbon-to-products technology to support its decarbonisation efforts, targeting abatement of methane emissions at its operational sites.

String Bio's proprietary technology converts methane into a single-cell protein which could provide a sustainable alternative in animal and human nutrition as well as agriculture products, with a focus on improving the sustainability of crops and food production, land, and water use.

Woodside's conditional investment is part of the company's ambitious $5 billion (€4.96 billion) target for investing in new energy products and lower-carbon services by 2030.

"Woodside believes String Bio's technology could eventually be used to recycle methane at Woodside facilities.

"It could also be deployed at third-party sites with available bio methane such as landfill facilities and farms," said Woodside CEO, Meg O'Neill.

Marvel turns three and expands biomethane services to Canada and Europe

Marvel Power Group (Marvel), a woman-owned clean energy advisory firm, is celebrating its third anniversary by expanding its brokerage services to Canada and Europe. In addition to covering new geographies, Marvel will also begin structuring deals for CO_2, sustainable aviation fuel (SAF), carbon offsets and hydrogen.

In Q1 2022 Marvel closed its first term deal with a Canadian counterparty, successfully structuring a 10-year project offtake for carbon-negative green gas. Currently, Marvel holds a significant pipeline of demand from parties seeking renewable natural gas (RNG) for US transportation, Science-Based Targets achievement, Canadian Clean Fuels and European International Sustainability & Carbon Certification (ISCC) programmes.

The RNG market has experienced explosive growth, upward of 250% YoY, with no signs of slowing down. In addition to stable demand from on-road transportation, gas utilities and governments, climate-savvy corporations are procuring RNG to satisfy their environmental commitments and energy security concerns. Low or negative-carbon RNG provides an existing alternative to fossil gas without operational upheaval or burdensome investment.

Drax submits plans for pioneering BECCS project

Energy giant Drax has formally submitted plans for its multi-billion-pound bioenergy with carbon capture and storage (BECCS) project at its North Yorkshire power station.

The company said work to build the flagship BECCS plant — which would be one of the first such facilities anywhere in the world — could start in 2024, if planning approval is granted.

BECCS plants combine biomass power plants with carbon capture and storage capabilities to capture emissions that result from burning biomass feedstocks, such as wood chips. Advocates of the approach maintain that as the trees that produce the wood chips are sourced from sustainably managed forests and soak up CO_2 as they grow, the capturing of the resulting emissions mean the technology can have a negative impact on concentrations of CO_2 in the atmosphere.

Once operational the two new units combined could capture as much as eight million tonnes of CO_2 per year, Drax said, which would make the site the largest carbon capture and storage project in the world.

Drax is planning to invest £2 billion (€2.3 billion) in the 2020s to develop the BECCS units, which it hailed as "a vital new technology needed to address the climate crisis".

"BECCS at Drax will not only permanently remove millions of tonnes of carbon dioxide from the atmosphere every year, but it will also generate the reliable, renewable power this country needs," said Will Gardiner, CEO at Drax Group. "No other technology can do both."

The submission of its application for a Development Consent Order (DCO) to the Planning Inspectorate follows two public consultations, where Drax said it gained input from the public and key stakeholders on its BECCS plans.

The news came as Drax also announced this week that it has partnered with Japanese shipping company MOL Drybulk to reduce the emissions and fuel costs associated with shipping biomass feedstocks by deploying wind power technology on its vessels.

The companies plan to develop wind-powered vessels which will be used to transport bulk cargoes of Drax's wood pellets to its customers in Japan, where the biomass is used to generate renewable energy.

The newly built vessels will be fitted with MOL's wind Challenge hard sail technology, with the first ship expected to be in the water by 2025.

Biomass power remains controversial with some environmental groups, who maintain that soaring demand for wood chips could drive land use change and lead to the sourcing of feedstocks from poorly managed forests that could result in higher-than-expected emissions. However, Drax and other biomass power operators maintain that they are careful to ensure the feedstocks they source are sustainable and that the emergence of BECCS technologies means the sector could play a critical role in delivering negative emissions.

How BRICS can boost cooperation in renewable energy

The world's top five emerging market economies — Brazil, Russia, India, China, and South Africa — are together known as BRICS. A think tank official says that the BRICS nations have made progress in the energy industry over the past several years, with China and the other BRICS members focusing their cooperation on renewable energy.

Yu Guo, president of the CNPC Economics and Technology Research Institute, during the very first BRICS Energy Cooperation Forum session which was held in Beijing on Tuesday June 5, noted that the BRICS countries make a complementary group as they are all both major producers and consumers of fuel.

Coal, oil, and natural gas still make up the majority of the world's energy supply — 71%, 30%, and 22%, respectively — and BRICS nations still rely heavily on these fossil fuels, but Yu noted that the member nations also have a wide range of opportunities for the development of renewable energy.

BRICS have consumed 16% of renewable energy, significantly less than the global fossil fuel averages for countries of 48.1% for coal, 22.2% for oil, and 13.5% for natural gas. However, the BRICS groups' consumption of renewable energy has been increasing year over year, helping to drive the development of lower-carbon economies worldwide.

The institute's research shows that the percentage of electricity produced by renewable sources increased from 19 to 37% between 2010 and 2020, while the percentageof nuclear power doubled over the same period, making up the majority of the increase in global nuclear power.

According to Yu, China has carried out a number of significant joint projects with other BRICS nations in recent years, including those involving renewable energy sources like wind power, solar power, hydropower and biomass energy, in addition to oil and gas projects. For future collaboration, a solid foundation is in place.

The BRICS nations have abundant access to both renewable energy sources and fossil fuels. BRICS hold 40%, 8% and 25% of the world's reserves of coal, crude oil, and natural gas, respectively. In addition, biomass from Brazil, wind energy from China and Russia, and solar energy from South Africa, Brazil, and India all have significant resource advantages in the renewable energy sector.

China and India, the two largest coal producers in the world, produced 50% and 10% of the total global output in 2020, respectively. 12% of the globe's oil and 16% of its natural gas was produced in Russia. Brazil has a large amount of biomass energy resources and in 2020 produced one-fourth of all energy in the world. ●

Essex EfW with Viridor links set for permit change

Tilbury Greenpower Ltd is soon expected to have its plans approved to increase the power output at a proposed 350,000 tonne Energy from Waste (EfW) plant in Tilbury, Essex.

The company already owns and operates a biomass plant adjacent to the EfW site, having acquired the biomass and undeveloped EfW site in July 2021 for £246 million.

In January 2022 it applied to increase the electricity export capacity of the proposed EfW plant from an existing approval of 80MW to 88MW. Both the local authority for Tilbury — Thurrock Council — and the Environment Agency have backed the plans, with the government expected to follow suit.

While the Tilbury Green biomass power plant is well-established, the proposed EfW facility has gone somewhat under-the-radar since it was first approved in 2009. Tilbury Greenpower bought the plant and site for the EfW for £246 million (€290 million) in July 2021. The owners of Tilbury Greenpower are Portugal's biomass specialist GreenVolt (51%) and investment fund and developer Equitix (49%).

Recently, Equitix acquired a 20% stake in ownership of Viridor Energy from investment fund Kohlberg Kravis Roberts (KKR). The Tilbury project has a director in common with Viridor Energy (Investments), with Dr Egan Archer on the board of both businesses.

Viridor is seen as having the UK's largest and most diversified EfW portfolio and they could welcome the opportunity to be involved in the Tilbury facility.

Tilbury Green Power Ltd was first granted planning permission in 2009 to build a waste wood biomass plant alongside a residual waste EfW plant at Tilbury Docks, with a combined capacity of 650,000 tonnes.

The biomass plant was built and came into operation in April 2018, and processes around 270,000 tonnes per year of waste wood, with a 300,000-tonne capacity.

Since 2009 though, the EfW plant has been on hold. However, the operators of the facility have made frequent changes to the permit in this time, including changes to the site layout and removing a limit on waste brought to the plant by road.

Ameresco helps communities harness the potential of energy by building power and cogeneration facilities

Providing solutions that capture 'wasted resources'

Ameresco describes itself as a leading cleantech integrator and renewable energy asset developer, owner and operator. Its portfolio includes energy efficiency, infrastructure upgrades, asset sustainability and renewable energy solutions delivered to clients throughout North America and Europe.

The solutions it offers range from upgrades to facilitys' energy infrastructure to the development, construction and operation of renewable energy plants combined with tailored financial solutions.

It works with customers on both sides of the meter "to reduce operating expenses, upgrade and maintain facilities, stabilise energy costs, improve occupancy comfort levels, increase energy reliability and enhance the environment".

> Create large, utility-scale biomass-to-energy plants, as well as smaller cogeneration and distributed generation plants

Leveraging budget neutral solutions

Including energy savings performance contracts (ESPCs), power purchase agreements (PPAs) and off-balance sheet Energy as a Service (EaaS) contracts — it aims to eliminate the financial barriers that traditionally hamper energy efficiency

and renewable energy projects.

It says: "Ameresco has successfully completed energy saving, environmentally responsible projects with federal, state and local governments, K-12 school districts, college campuses, healthcare institutions, airports, housing authorities, and commercial and industrial customers."

The company was founded in 2000 by George Sakellaris, himself a pioneer in the energy service business. To best serve its wide-ranging clientele, Ameresco has over 60 regional offices located throughout the United States, Canada, the United Kingdom and Europe.

Biogas

Ameresco designs, builds, owns, operates and maintains methane digester facilities and pipelines. It says its independence gives customers full access to the latest technology available for biogas plants, allowing it to provide solutions that capture this wasted resource, use it beneficially to have a positive impact on the bottom line, meet exact budget and power needs, create local jobs and improve the environment.

Biomass

The company says its helps customers and communities harness the potential of biomass energy by building power and cogeneration facilities that cleanly burn renewable waste to fuel specialised engines that generate power and heat.

It can create large, utility-scale biomass-to-energy plants, as well as smaller on-site biomass cogeneration and distributed generation plants that can fulfill a significant portion of a facility's energy needs, reducing energy costs, water consumption and air emissions.

Ameresco has different ways of assisting with financing this technology through power purchase agreements (PPA), owning and operating solutions or an energy savings performance contract (ESPC).

With dedicated energy and business professionals, Ameresco says it offers clients the resources needed to successfully plan, execute and even finance the energy programme that will create real, sustained economic and operating benefits to fulfill their unique requirements.

For more information
Visit: ameresco.com

Uncertainty in Ukraine is having an impact on new investment in the region

Developing new power sources under the shadow of war

by Colin Ley

Surveying the future state of bioenergy in Scandinavia and the Baltics inevitably requires an assessment of what is happening right now in Ukraine and the threat that Russian aggression poses to the longer-term sovereign status of Finland, Sweden, Estonia, Latvia and Lithuania.

While each of those countries remains free and independent in mid-2022, the horrific transformation of personal and economic liberty in Ukraine since Russia's invasion on February 24 casts a shadow over the whole of Scandinavia and the Baltics. Alongside the immediate challenge of soaring energy costs, disrupted supply chains and fractured trade routes, it would be a surprise if the possible future instability of the region did not deflect some investors from committing capital to business developments over the next few years, certainly when compared to what might have been expected prior to the outbreak of war a little over four months ago.

On the upside, Scandinavia and the Baltics have rich bioenergy resources and largely supportive governments. In addition, the EU has ramped up its support for bioenergy over the last few months, potentially creating a secure background for would-be investors. The region is also well equipped to meet rising domestic and international demands for clean energy in general and for non-Russian energy, in particular.

The downside, obviously, is the risk that newly launched energy projects could be hampered by the spreading of Russia's aggression beyond Ukraine, especially with Finland and Sweden pursuing NATO membership and the Baltic Countries having an all-too-recent experience of living under Soviet control.

For the moment, however, the strength of pre-war growth across Scandinavia and the Baltics appears to leave the region supremely equipped to carry the industry forward. This much is clear from various 2021 initiatives, such as the Norwegian parliament's decision in the middle of last year to equalise biogas with electricity and hydrogen in all public policies, a move which was a major boost to the country's bioenergy developers.

Similarly, a steady flow of subsidies granted by the Swedish Environmental Protection Agency over the last few years, up to and including 2021, has given support to no fewer than 62 production facilities for biogas, alongside other developments related to biofuels and hydrogen. Agency funds have also been applied to the creation of 177 renewable fuel filling stations across Sweden, all of which adds up to an impressive display of renewable energy potential. In normal times this would herald a bright future for the bioenergy industry.

Tough judgement call

The difficult judgement to make is how much the war may impact plans and investments from now on, given that the developments we're seeing at present were already in the pipeline long before Russia launched its invasion. In addition, completion dates for current investments can be expected to run well into the future, often taking three or four years to complete.

Scandinavian Biogas, for example, which holds a leading position in renewable energy and biogas production in the Nordic region, recently announced the award of a SEK 154 million grant from the Swedish Environmental Protection Agency. The funding will support of a liquid biogas (Bio-LNG) development in Örkelljunga, south of Stockholm.

The timescale for this project, however, envisages a production launch in mid-2025, with the venture not scheduled to contribute to Scandinavian Biogas' profitability until 2026. This is a pretty standard development timeline, of course. Nevertheless, four years from now is a long time when you consider what has happened in the past four months.

When *Bioenergy Insight* put this point to Scandinavian Biogas CEO, Matti Vikkula, he accepted that green field projects, such as the one in Örkelljunga, always need a lot of time from conception

to delivery. For him, however, there is still greater commercial comfort to be drawn from the EU's doubling of its Bio-LNG and biomethane targets since the war began.

"As a result, we see EU attitudes as now being more favourable than previously, more supportive and with more attention being given to our sector's opportunities," he said. "Although this change will take time to anchor itself in member states, I believe it will impact positively on investors in due course. In addition, while Finland and Sweden are pursuing NATO membership for reasons of national security, this could also make them more secure business investment targets in the future."

Moving on from the immediate pressures of the war environment, Mr Vikkula said that the whole Northern European Bio-LNG and biomethane market had been 'very encouraging' over the last 12 months, driven by rising demand and the strong development of new opportunities.

As for Sweden, specifically, he added that bioenergy leaders welcomed the approval last autumn of the Government's new regulatory framework for the sector. This included a new production subsidy, a move which had been 'on the drawing board for several years'. Despite an implementation postponement which delayed the release of the subsidy until July 1, it was good to have finally reached the end of the framework chapter.

Biomethane potential in Sweden and Finland

Further confirmation that there is plenty of scope for bioenergy growth across the Scandinavian countries comes in the latest Gas for Climate (GfC) consortium update on biomethane production potentials in EU Member States.

Looking at the EU's ambition to accelerate biomethane production, in line with advancements in technology, the GfC report identifies the highest 2030 and 2050 potentials as being in France, Germany, Italy, Spain and Poland. Close behind, however, is both Sweden and Finland, who look set to 'contribute significant potential' to the 2050 target, largely driven by their major 'gasification potential' in the years ahead.

"Biomethane can play an important role in meeting the EU's 2030 GHG reduction target and the achieving of net-zero emissions by 2050," added GfC. "Additionally, biomethane can increase European energy security by reducing the dependency on Russian natural gas and can alleviate part of the energy cost pressures on households and companies. To achieve this, however, a significant scaling up is required both in the short- and long-term."

This returns the debate to how much Russia's aggression towards its neighbours inhibits such development and investment. Left alone, all these countries appear ready, able and committed to achieve bioenergy growth patterns which are fully in tune with the EU's GHG reduction goals. The question that remains is how much they will actually be left alone to manage their own affairs in the years ahead.

Ironically, the current threat posed by Russia, while potentially inhibiting immediate progress across Scandinavia and the Baltic Countries, is also a major driving force behind the development of new sustainable sources of energy in all the at-risk countries, each of whom merely want to be free to create, process and use their own energy, under their own control and without any external interference.

Rising biomass share in Lithuania

Turning to renewables in Lithuanian, *Bioenergy Insight* spoke to Vilma Baturo, director of the Lithuanian biomass energy association, LITBIOMA. She was upbeat about the progress being made by the country's biomass sector in both the domestic and district heating sectors, but keenly aware of the need for the bioenergy industry to fight for its share of renewable sector investments alongside higher profile wind and solar projects.

"Currently about 80% of private household heating in Lithuanian is based on biomass with district heating on around 75%," she said. "In addition, a new co-generation plant is being built in Vilnius (Lithuania's capital) for completion in the first quarter of next year, which should advance the district heating share to 85% biomass power."

These figures represent strong recent growth from a base of about 60% market share four or five years ago, advancing the role of biomass as the main strategic fuel for heating in Lithuania.

"There again, wind and solar are very popular energy sources at present, especially with the energy supply changes being created by the war in Ukraine," said Ms Baturo. "Our Government, for example, in seeking to cease taking Russian oil and gas, is focusing most of its new programmes on wind and solar initiatives. We therefore face a challenge as a biomass industry to prove that we need to maintain the status quo of bioenergy resources. There are still towns, for example, where we could establish co-generation systems, plus there is a need to modernise some of our existing biomass plants, the oldest of which have been running for 15-20 years.

"A modernisation programme is promised but, so far, we do not have the results. So, while our general story is successful, we still have challenges to face."

In looking at the war-based disruption caused to previous biomass supply chains into Lithuania, from Russia and Belarus, Ms Baturo pointed out that LITBIOMA had warned against Lithuanian plants becoming up to 40% dependant on imported supplies.

"Actually, this high level of supply from Belarus stopped even before the war began, while supplies from Russia ended once the war started," she said. "Now, of course, we're having to work through the process of restoring our own domestic biomass supplies to the levels we need to satisfy current demands.

"Although we're warning people to prepare for a difficult heating season this winter, however, we are confident that the market will return to a more balanced and relaxed position in 2023."

Plant update

Anaergia

Alternative fuel: Biogas
Location: Lecce, Italy
Date: June 2022
Feedstock: Organic waste
Development: Biomethane facility

Anaergia has announced it has officially commissioned a new biomethane facility in Italy, the Calimera Bio plant in the Province of Lecce. The facility is the second of seven facilities Anaergia is building which together will form one of the largest food waste to biomethane platforms in Europe. The Calimera Bio facility has the capacity to anaerobically digest 24,000 tonnes of landfill-diverted food scraps and other organic waste each year, and to convert this waste into 2,190,000 cubic metres of renewable natural gas (RNG) that will be injected into the region's natural gas pipelines. The new plant will also treat the digestate that remains after the anaerobic digestion process to create 9,000 tonnes per year of high-quality natural fertiliser.

Aemetis

Alternative fuel: Biogas
Location: California, USA
Date: June 2022
Development: Pipeline

Aemetis, a renewable natural gas and renewable fuels company focused on below zero carbon intensity products, has announced the completion of 20 miles of biogas pipeline and approval for construction of the remaining biogas pipeline in Merced County, California. Construction of the 39-mile main biogas pipeline is on schedule for completion in Q4 2022. This project milestone allows the installation of biogas pipeline in Merced County for construction of a pipeline for a total of 39 miles from the Aemetis ethanol plant in Keyes, California, to dairies in Stanislaus County and Merced counties. The pressurised pipeline conveys conditioned, pressurised biogas from dairies to the company's centralised gas clean-up facility and the Pacific Gas & Electric (PG&E) interconnection system to inject renewable natural gas (RNG) into the gas utility pipeline.

LG Chem

Location: South Korea
Date: 2025
Feedstock: Wood
Development: Biomass power plant

LG Chem has announced that it has signed a Letter of Intent (LOI) with GS EPS, South Korea's leading green energy supplier, to collaborate on a biomass-based eco-friendly energy project. Under the agreement, both partners will review their business strategies toward constructing a joint biomass power plant at Yeosu Complex on the southern coast of Korea to produce industrial steam and electricity with waste woods by 2025. The agreement also includes cooperating on the establishment of a Power Purchase Agreement (PPA) for renewable energy in collaboration with Korea Power Exchange, the agency under the Ministry of Trade, Industry and Energy responsible for the nation's electric power system.

Green Valley Energie

Alternative fuel: Biomass
Location: Norske Skog Golbey, France
Date: September 2024
Feedstock: Paper products
Development: Biomass boiler

Norske Skog's 10%-owned Green Valley Energie joint venture is ready to start the construction of a biomass boiler at the mill site of Norske Skog Golbey in France. The biomass energy plant will produce electricity and heat from waste and residue materials. The steam will be used by the Norwegian paper products manufacturer's Golbey mill and the electricity will be sold through a feed-in tariff contract. The plant will be commissioned in September 2024. It will produce more than 200 gigawatt-hours of electricity and more than 700 gigawatt-hours of renewable heat.

Alfred H Knight

Alternative fuel: Biomass
Location: Kilmarnock, Scotland
Date: June 2022
Feedstock: Coal and waste
Development: Sample preparation facility

The site, located in the Olympic Business Park, Kilmarnock, is now fully operational and receiving samples. It is a result of significant investment and expansion of Alfred H Knight's operations in Scotland, and will now be home to all of the energy services' sample preparation operations for biomass, coal and waste in Scotland. At over 14,000 sq ft, the new sample preparation facility is the largest of its kind in the country and boasts dedicated, separate sample preparation areas for biomass, coal and waste. The site will be the hub for receiving samples, which will then be prepared for the laboratory, which offers a full suite of analytical services.

JAPEX

Alternative fuel: Biomass
Location: Ozu, Japan
Date: August 2024
Feedstock: Wood pellets
Development: Biomass power plant

Japan Petroleum Exploration Company, also known as JAPEX, has broken ground on a 50-MW biomass project in Japan's Ehime prefecture. The Ozu Biomass Power Plant will be located in a 25,700 sq m (276,632 sq ft) area in the industrial park of Ozu city. It is expected to be fully operational in August 2024. Ozu Biomass will use imported wood pellets as fuel. Once complete, the plant will be capable of generating around 350 GWh per year. Local utility supplier Shikoku Electric Power Transmission & Distribution Company will be the sole off-taker of Ozu's output based on a feed-in tariff (FIT) scheme.

*This list is based on information made available to *Bioenergy Insight* at the time of printing. If you would like to update the list with additional plants for future issues, email alice@woodcotemedia.com

Simon Dawkins BEc, director, Oil Mallee Association, on the future of bioenergy in Western Australia

Bioenergy 'could soon be booming' in Western Australia

Western Australia (WA) is a the largest of the Australian States and has a 20-million-hectare wheatbelt. Most of the grain is exported including a million tonnes of canola to Europe for biofuel. However, it is the recent promotion of lignocellulosic biomass to produce second generation biofuels that is creating significant attention. A principal source of this biomass is to come from endemic dryland mallee eucalyptus species. The 'mallee' once covered much of the wheatbelt and proved to be a challenge when clearing land due to its deep-rooted structure and large below ground root mass. It is, however, this particular organic structure that provides a very helpful characteristic that enables multiple harvesting or more accurately — coppicing. This characteristic was demonstrated over many years by farmers growing the trees for eucalyptus oil and is being exploited today by long term and new operators.

The origin of this move to the idea of growing mallee eucalypts for biomass feedstock came about from an enterprising farmer with forestry training and the CEO of the State Government forestry department. The former was looking for a way to protect the completely cleared land from salinity and wind erosion and the latter was seeking a new forestry crop to add to the already established pine and eucalyptus plantations in the higher rainfall areas. Bioenergy seemed to be the logical way to exploit this particularly resilient timber and high cineol content foliage.

Ashley Wiese addressing his audience

This joint interest coincided with a large federal government funding scheme that enabled around 15,000 hectares of mallees to be planted in belts across 1,000 properties in small and large estates in less than the decade following the year 2000. Many of these trees are still in place and a significant amount of research has been undertaken over subsequent years. The research investigated the capacity of the trees to reduce the water table, to attract beneficial species of insects and animals, the suitability for conversion to biofuels and the best way to harvest this woody crop — including the design and building of a continuous biomass harvester.

The Oil Mallee Association (OMA) has been in existence for over 20 years and facilitated the growing of thousands of hectares of mallee around the time that WA was developing the Carbon Rights Bill (2001) and subsequently the Act in 2003. However, most plantings have not officially generated ACCUs as subsequent legislation establishing methodologies to create ACCUs did not acknowledge prior action even when based on the genuine prospect of carbon credit creation. This constituted a failure to recognise 'early mover' efforts despite mallee plantings being a model for carbon sequestration legislation in WA in 2001 and later in the Federal legislation.

These mature trees are now available for harvesting and the various proponents have been negotiating with the OMA to secure access to these trees from their database prior to encouraging the planting of many thousands of hectares into the future.

Now, or at least starting in 2020, the interest in this approach to sustainable feedstock for bioenergy, principally biofuel, has risen considerably with several proponents seeking to engage with farmers to access their existing stands of trees and exercise the opportunity to grow more.

The three leading consortia proposing to produce biofuel using mallee eucalypts as a principal feedstock are:

1. ANZ Bank/INPEX/Qantas — to produce biofuels including sustainable aviation fuel (SAF)
2. Future Energy Australia (FEA) (a joint venture between Future Impact Group and Carnarvon Energy) — proposing to make renewable diesel as a 'drop in' fuel, and
3. Renergi at Collie headed by professor Chun Zhu Li who has been researching pyrolysis technology for biomass to biofuels conversion for many years at Curtin University.

The first two consortia have announced their intentions. They both envisage many thousands of hectares of mallee plantings being initially required, and eventually there being hundreds of thousands of hectares under trees. They both anticipate several regional processing plants across the wheatbelt. At this stage they anticipate adopting an 'Integrated agroforestry' approach and to demonstrate that a viable compatible land use is possible, ensuring that this system can benefit the whole farming enterprise. They also express a desire that many community and regional benefits are produced alongside the potential for farmers to use the projects

as a means of creating carbon neutral crops and livestock. These projects create the opportunity for displacement of fossil fuels and greater fuel security and the creation of biochar which can be used in its physical form for improving soils and sold as a "draw down" or negative carbon asset through the carbon credit methodologies created by pura.earth and others.

There are other proponents, including an international proposal to produce torrefied wood pellets and another early-stage proposal to produce hydrogen from biomass.

The common process being identified to produce biofuels from biomass is pyrolysis, where the biomass is heated in the absence of oxygen to a very high temperature and the cellulose and lignin are converted to liquid fuel. Biochar is a bi-product. The biomass is not 'burnt' (due to the absence of oxygen) and significant levels of carbon are captured as gases, liquids and solids phases. The gas can be used to heat the plant, the liquid for biofuels and the solids as biochar. Bioenergy created from sustainably grown biomass is generally recognised as a carbon neutral process as the emissions are sequestered in future growth of feedstock. This point requires continuous clarification as some commentators are critical of bioenergy as a pathway to mitigation. The 'climate effect' of bioenergy (as identified by the IEA) is an important additional feature of this process as it results in the displacement of fossil fuels as well as being carbon neutral.

However, this prospective mallee biomass-driven industry is lacking a policy approach by the Federal and State Governments that will incentivise the production of sustainable biofuels and bioenergy and reduce barriers to adoption. A recent review of carbon crediting (the King Review) proposed that the displacement of fossil fuels be considered as a methodology for creating carbon credits rather than renewable energy credits. This proposal was endorsed by the Federal Government but there has been no action as yet to implement the change in approach. Hopefully the newly elected national government will consider this move.

The timetable for biofuel production by these companies is likely to be at least 12-24 months away but they are undertaking significant feasibility studies and the FEA group has secured land in Narrogin for their first production facility and launched their project there recently.

Existing case study of bioenergy developed in regional WA: Rainbow BeeEater (RBE) is a firm with its roots in Kalannie (near in the larger WA Wheatbelt town of Dalwallinu) which has developed their own pyrolysis process which is now being used in a large South Australian greenhouse to produce heat, power and biochar. This patented process may at some stage use mallee biomass, the fuel around which it was originally developed. Ian Stanley, a farmer in the region and the Chair of the Oil Mallee Association, is a founder of RBE.

At the end of this article are links to media statements by the projects mentioned above. These projects offer a real new level of scale while contributing to emissions reduction, better agricultural practices, and fuel security.

The economic and environmental foundations of the mallee project

The initial move to establish a profitable tree crop on WA wheatbelt farmland assumed that income from the tree plantings, whether for carbon or biomass (or both), would at least match the cropping or grazing it displaced. Most mallee have been planted in an alley farming configuration with narrow belts of mallee (typically 2 to 4 rows) integrated into "alleys" (typically 40 to 120 m wide) of traditional cropping/grazing agriculture. This configuration maximises their productivity compared to block planting by reducing the between-rows mallee competition, especially for water. The alley farming system also increased mallee growth rates in areas compromised by salinity, although mallee growth is impeded by moderate levels of salinity. By maximising growth rates, the alley planting system reduces the area of land foregone to agriculture and helps manage a rising water table (brought about by the initial removal of trees) and reduce wind erosion. In total more than 20,000 hectares of mallees were planted with modest government support in the late 1990s and early 2000s.

As a purposeful carbon and biomass crop, mallee have been well researched since Alan Barton in the 1980s first realised the potential of leaf cineole which is in high concentrations in certain mallee species. Subsequently, a major programme was mounted as part of the Salinity CRC (Cooperative

Research Centre), then the Future Farm Industries CRC, and this extended to the engagement of many other agencies including the CSIRO (Commonwealth Scientific and Industrial Research Organisation).

These agencies consolidated the mounting evidence of a potential bioenergy or biofuels industry based on this feedstock. The State Government of Western Australia created a dedicated unit to outline the benefits, explore opportunities and encourage participation. This research has been instrumental in steering the more recent private sector proponents towards mallee derived biofuels. One research project indicated that an integrated approach to biomass planting had the potential to moderate the impact of regular drought events on income from cropping programs in low rainfall seasons.

Leigh Ballard, Shire and Narrogin

A key feature of the mallee project is the sustainable nature of the process from growing to conversion into biofuels. Not only does the regular coppicing avoid the need for significant continuous inputs or replanting, but the environmental benefits and ecosystem services (including increased biodiversity) potentially contribute to the improvement of farming practices. As a 'second generation' feedstock, mallee biomass ensures that the sustainability of the biofuels is recognised from the outset.

Potential scale of the mallee project

Many farmers have cleared the trees on the farms due to the lack of action on carbon policy and but mainly because there was not market for biomass. Notwithstanding the impact of this clearing, recent investigations using satellite imaging indicates that up to 20,000 hectares of integrated planting are likely to exist, including plantings not associated with the OMA and other species. Estimates of existing mallee biomass vary considerably but at the lower end there is likely to be over 1 million tonnes of standing biomass (equivalent to about 4,000 hectares), but it is possible that it could be many times that amount. Verification of the remaining stands of mallee plantings is in progress.

Looking at the potential scale of biomass to bioenergy focused on mallee the following estimates can be made. If a total of 5% of the Wheatbelt was planted to mallees there would be 1 million hectares of trees which would produce an average of 5 tonnes of biomass per hectare per year i.e., 5 million dry tonnes per year. This is achieved through a regular coppicing regime of 3 to 4 years depending on location, soil and rainfall. If a dry tonne can be processed to make 300 litres of renewable diesel, then each year there will be 1.5 billion litres of fuel. This has been estimated to be equivalent to a considerable amount of the diesel consumed in WA each year.

However, it is possible that even up to 10% can be utilised for integrated agroforestry and this would be unlikely to impact the total volume of cropping and pasture-based agriculture. The trend of destocking of the wheatbelt, which is likely to continue with increased pressure to net-zero agriculture, will likely increase the area available for biofuel crops. Also limitations have been in place on the use of farm land for carbon planting, the State Planning Commission has a policy whereby a maximum threshold of 10% of a farm can be dedicated to tree planting without seeking planning approval.

This development of this prospective and important industry will transform the energy use in WA and will also potentially contribute to the production of SAF (Sustainable Aviation Fuel). If developed at scale, it will provide access to offset carbon credits for the resources sector in the State and provide additional, much needed, fuel security. In addition, it will make a big difference to the agriculture sector and bring benefits in reduce the impact of increasingly uncertain rainfall and the general drying climate across the southwest of the state.

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Maurizio Cocchi (Eta Florence), Luigi Pari and Simone Bergonzoli (CREAT-IT), on the sustainable solution offered by bio-based fuels

Tapping the potential of wheat chaff and corn cob

Windrow made by straw and chaff after harvesting with the Thievin system

The deployment of sustainable bioenergy is urgently needed to reach our climate targets, as set out in the Paris Agreement. According to *IEA Renewables 2021* report biofuel demand must nearly double to align with the 2050 Net Zero Scenario drawn by IEA.

The latest IPCC Working Group 3 contribution to the 6th Assessment Report, which was released in April confirmed that when sourced sustainably and with low-GHG emissions feedstocks, bio-based fuels, blended or unblended with fossil fuels, can provide mitigation benefits, particularly in the short- and medium-term.

However, the mobilisation of large volumes of biomass is required to deploy the full potential of bioenergy. So how can we achieve this sustainably and at competitive costs, while preserving our environment and without reducing the agricultural land required for food?

These are the main research questions that inspired and guided the work of BECOOL, a Horizon 2020 project to develop sustainable lignocellulosic biomass value chains for advanced biofuels.

During five years between June 2017 and May 2022 an international team coordinated by the University of Bologna in Italy carried out a range of research and demonstration activities which led to significant findings on multiple aspects of lignocellulosic biomass: from the production of non-food crops to biomass logistics and harvesting, the production of bioenergy intermediates and end products, and a full environmental and socio-economic assessment of their large-scale deployment.

Although the project's focus was on advanced biofuels, several of those results are relevant to sustainable biomass value chains for multiple end-uses, including bioenergy, biogas and bio-based products.

Harvesting agricultural residues

An example of this is the work conducted by Italian partner CREA-IT (Council for Agricultural Research and Economics, Research Centre for Engineering and Agro-Food Processing) to define the best logistical solutions for the harvesting of a wide range of agricultural residues. Residues from traditional agricultural crops are an abundant and widely available resource, however a well-organised and multi-step supply chain is required to efficiently harvest, collect and transport the biomass to the processing plants.

Since the quantities of feedstock required by industrial-sized plants are in the range of tens or hundreds of thousand tons per year, harvesting operations and logistics of supply are important factors that can affect the final cost and the environmental performance of

View of the Harcob system tested in October 2018. Source CREA-IT

both bioenergy and advanced biofuels. In BECOOL, CREA-IT performed harvesting tests of a range of feedstock including almost untapped types of agricultural residues such as wheat chaff and maize cobs.

Maize cob

Cob is a by-product of maize crops with low nutritional value as a fodder, that is normally left unharvested on the ground. The cob is the central core of an ear of maize on which the corn kernel grows. It can be used in a range of applications including as a feedstock for energy and biofuels, as a substrate for animal bedding or in hydroponics, to produce activated charcoal, and as an abrasive material for metal or wood sanding or grinding.

EUROSTAT data indicate that in 2019 more than 9 million hectares of grain maize were cultivated in EU27 and UK. Considering an average yield of 1 t ha-1 of cob, a potential of more than 9 million tons per year of maize cob is available in Europe.

In October 2018, field tests of cob harvesting were conducted by CREA-IT using the HARCOB patented system developed by Italian company Agricinque, a device that can be mounted on traditional axial flow combine harvesters to harvest cob and grain simultaneously. The system separates the cob from the other residues (leaves, stem, culm, etc.) and collect it in an additional tank.

The test was conducted in a dairy farm located in the Cuneo Province in Northern Italy, which also runs a 250 kWe biogas plant fed with cow manure, litter and maize residues (cob and stalks). Because of its high moisture content after harvesting (32.1% on average), the maize cob can be considered an appropriate biomass to be fed directly into a biogas power plant. Depending on the final use of the product, the system can modulate the amount of the different residues collected. Inside the tank the material is chopped in particles whose size can be modulated by the operator, the simultaneous unloading of both grains and cobs from the tank is carried out by an innovative auger system that ensures no blocking problems, in around three minutes. The combine can still be used for grain harvesting, by manually disconnecting the main drive belt.

	Seeds		Cobs	
	Mean	St Dev	Mean	St dev
Theoretical Field capacity ha h-1	1.89	+- 0.29		
Effective field capacity ha h-1	1.36	+- 0.18		
Seed yield t ha-1	13.12	+- 0.28		
Material ca-pacity seeds (t h-1)	18.58	+- 0.13		
Yield cobs (t ha-1)			1.72	+- 0.23
Material ca-pacity cobs (t ha-1)			2.31	+- 0.09
Fuel consump-tion (l h-1)	27.10	+-4.02		
Cob losses (t ha-1)			0.58	+- 0.23

Table 1 — results of the harvesting tests of maize cob and seeds

Unloading of grain and cob tanks at the same time. Source: CREA-IT

The test was performed during maize grain harvesting by using a combine harvester machine Axial Flow 7140, equipped with the HARCOB system, and they aimed at collecting data on the machine's operating performance and on the quality of the resulting biomass.

The average amount of biomass in the trial fields was 50.7 t ha-1, the combine harvester machine equipped with the HARCOB system collected 13.12 t ha-1 of grain and 1.72 t ha-1 of maize cob, with a bulk density of 132 kg m-3. During the tests the average effective field capacity was 1.36 ha h-1, the cob losses were 0.58 t ha-1 around 25% of the total cob potentially available.

Wheat chaff

Wheat chaff also attracted increasing interest in the last few years thanks to its wide availability and its properties that make it suitable for use both as an energy feedstock and for animal feeding. The chaff is composed by the seed glumes, the husk and the rachis, and represents around 7% in weight of the threshed product (40% seeds, 48% straw, 5% stubble).

The collection of chaff can also reduce the soil weed stock, however during cereal harvesting with traditional combine harvesters, the chaff is generally left on the ground and covered by the straw, therefore it cannot be collected in the following baling operations. CREA-IT tested an innovative solution based on a commercial combine harvester machine equipped with a Thievin Turbopaille system. This device spreads the chaff on the windrow of straw that is afterwards baled and it can be switched on an off on during the harvesting operations of cereals.

The harvesting tests of wheat chaff were conducted near the city of Nantes (France) during wheat grain harvesting in July 2018.

Results showed that the performance of the combine harvester in terms of field capacity (ha h-1), biomass yield and material capacity (t h-1) was not affected by the

Thievin system during operation. Source: CREA-IT

functioning of the Turbopaille, while the subsequent baling operations were conducted with a slightly lower field capacity when baling straw and chaff together, compared to traditional baling of straw only. The higher field capacity of the baling operations in the plots harvested with the Turbopaille off can be probably explained by the higher forward speed of the harvester and the lower biomass quantity in the windrow. Eventually by using the Thievin system, it was possible to harvest 19% more biomass per hectare than with a traditional combine harvester system, without reducing the capacity of grain harvesting, and with only a slight reduction in field capacity during baling, although with no additional fuel consumption.

Both of these examples offer solutions towards the development of a circular bioeconomy, by tapping the potential of crop residues that are widely available in Europe, using available technologies and traditional farm machines, without affecting the performance of grain harvesting, and increasing the amount of biomass collected per unit of land.

This work was carried out as part of the project BECOOL – Brazil EU Cooperation of the development of Advanced Lignocellulosic Biofuels. The project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 744821.

For more information:
Visit: becoolproject.eu

System	Turbopaille ON				Turbopaille ON			
	Comb. harvester		Baler		Comb. harvester		Baler	
	Mean	St Dev	Mean	St Dev	Mean	St Dev	Mean	St Dev
Theoretical field capacity (ha h-1)	2.57	+-0.13	5.23	+-0.65	2.71	+-0.09	5.99	+-0.16
Effective field (ha h-1) capacity	2.24	+-0.11	3.46*	+-0.28	2.41	+-0.10	4.05*	+-0.16
Yield (t ha-1)	6.26	+-0.24	6.02*	+-0.28	6.04	+-0.24	4.63*	+-0.63
Material ca-pacity (t h-1)	13.98	+-0.13	20.79*	+-0.79	14.39	+-0.13	18.73*	+-0.79
Fuel con-sumption (l h-1)			4.65	+-0.91			4.66	+-0.11
Biomass loss (t ha-1)			1.4	+-1.3			2.8	+-2.5

significantly different values (p<0.05)

Table 2 - Results of harvesting tests of wheat chaff

Industrial scaling of the Nordic's most effective biogas technology

Accelerating towards a renewable future

Norwegian Prime Minister, Jonas Gahr Støre, inaugurated RENEVO's new biogas plant in Stord, Western Norway, on 24 May.

It is the first of its kind in Norway and marks the start of a Western Norway energy adventure that produces the equivalent of renewable energy that 4,000 households consume per year.

At the plant's core is a unique piece of Norwegian technology: 10 Antec Bio-converters, which are a game-changer in the field of anaerobic digestion.

The new plant is the largest commercial biogas plant in Western Norway, producing liquefied biogas, liquid CO_2 and high-quality bio-fertilisers from raw organic materials from local fisheries (fish silage) and the local aquacultural and agricultural sectors.

The solution for upgrading and liquefaction of biogas and CO_2 is delivered by a French partner of RENEVO — CryoPur. A second project with RENEVO is already in the pipeline and will be double the size of the first plant, featuring twice as many Antec Bio-converters.

"The technology we use produces more gas and is up to five times faster than conventional biogas technology. It is the first time this technology has been used on such a large scale. Because of our scalable and modular solution, we can build close to waste resources, avoiding high logistics costs. This is the beginning of our renewable future where Stord is leading the way for the rest of the world," commented Eirik Gundersen, CEO of Antec.

Each of the 10 reactors installed at Stord can treat about 5,500 tons of organic waste annually, and the 60Gwh plant, treating 55,000 tons of waste, can produce enough energy for 4,000 households per year.

RENEVO's Renewable Energy plant in Stord. Photo credit: RENEVO

Similarly, it can supply trucks with enough fuel for a range of about 15 million kilometers per year — or 375 times around the world.

Uncover the value of waste

Antec's technology has demonstrated that the size of the digestion tank does not determine the economic effectiveness of anaerobic digestion.

Antec is a viable and reliable renewable energy solution thanks to its scalability, efficiency, and profitability. Rather than favoring feedstocks, such as energy crops, Antec uses the world's global waste abundance to build a circular solution.

The planet generates 2.2 billion tons of municipal solid waste every year, with organic waste representing about half.

Conservative estimates indicate that at least 33% of that is not managed in an environmentally safe manner.

Recent research has estimated that by 2030, the planet will be generating at least five billion tons of organic human and animal waste each year — ineffective disposal of organic waste results in air and water pollution.

As a result, policies are introduced to replace landfills with AD facilities to solve the growing global waste problem.

In addition, farmers and industries worldwide are increasingly confronted with stricter environmental regulations to protect the soil, avoid watershed pollution, and reduce greenhouse emissions. Anaerobic digestion helps farmers and industries to uncover the value of organic human and animal waste while contributing to sustainable solutions that will safeguard the future of their businesses and the planet.

The world craves clean energy. Europe is backing the renewable biogas industry with REPowerEU to rapidly reduce its dependence on Russian fossil fuels and fast forward the green transition. More efficient, performant technologies like Antec's are needed to expand Europe's biomethane capacity — rapidly. Businesses only need to extract it from the waste that the world produces.

Stacked tanks showcases the company's scalability and design

Circular technology

Antec's Bio-converters are odourless and self-cleaning, so there is no need for long maintenance downtime periods, which enables a constant and fast flow of substrates and thus more outputs.

Running a biogas plant without stopping it to clean the CSTRs for sedimentation has never been possible before.

Now, Antec is changing this while improving project economics over the life cycle of the future renewable biogas plants.

"We have been working hard to industrialise our solution to build a renewable future of energy. The high efficiency, modularity, and scalability make it a customisable solution that fits industrial players as well as farmers and communities. Antec gives users complete control over their renewable energy generation. With our technology, we can achieve the optimal locally resourced biomass mix to generate high gas yields that outperform uncontrolled substrate feed from stirring solutions," added Eirik Gundersen, CEO of Antec.

Instead of using large traditional CSTRs, modern biogas plant developers can rely on Antec's modular reactors, designed with the principle of plug-flow, to operate safely and efficiently.

The Bio-Converters contain several chambers creating a vast interior surface with bacterial biofilm and give full control of temperature and substrate feed — all these unique patented features allow for a five-fold reduction in retention time compared to traditional systems.

To further optimise the technology, Antec's R&D team is experimenting with hydrogen injection into the reactor for methanation to boost the quantity and quality of the biomethane.

Antec's circular technology was recognised at the AD & Biogas Industry Award 2022. The company won in the "AD Pacesetter: Below 1Mwe" category with its unique small-scale renewable biogas plant in Liholmen, northern Norway.

The jury of the World Biogas Association described the plant as the perfect example of collaboration between different organic waste producers to ensure circularity at the local level and said it was a showcase for innovation and adaptability to the surrounding environment.

Waste water potential

Sludge treatment in wastewater treatment plants (WWTPs) is another area of interest for Antec.

Sludge from the treatment process is an 'excellent' substrate for Bio-converters, which are fed with biomass containing up to 15% dry matter.

However, today, the sludge is often dewatered, transferred to a composting site, and disposed of in a landfill or incinerated. The process is costly and wastes valuable resources.

Today large WWTPs generating biogas, equipped with CSTRs require a lot of space, advanced planning, and huge investments heavily reliant on government subsidies.

Antec's solutions require a limited amount of space, and the technology's efficiency enhances treatment facilities' revenue model by saving costs associated with drying, transporting, and disposing of sludge. The solution is also fully circular as the energy or heat from municipal sludge can be used to heat homes or run local public transport.

Antec successfully trialled its technology at the Southern Follo Waste Water Treatment Plant, just outside Oslo. Plugging Antec's technology into the plant resulted in a 68% increase in gas production and greatly reduced the amount of sludge, otherwise transported for disposal.

The newly established commercial project is being expanded to treat higher volumes of sludge and will be up and running in early 2023. Successful trial results also reached Spain, where there is the intention to install first Antec Bio-Converter at the smaller WWTP. This also means that now WWTPs of all sizes can be equipped with the Anaerobic digestion units.

Re-powering existing biogas plants

As the demand for biomethane grows, there is an increasing trend in Europe of optimising existing electricity-generating CHP-based facilities with biogas upgraders to deliver precious molecules. Higher biogas capacity is required to justify the additional cost of upgrading- and liquefaction systems.

The same is true for inefficient biogas plants. Installing extra CSTRs to process additional feedstock may not always make economic sense or is not feasible due to footprint constraints.

Antec is in discussion with several European plant owners about using its technology to "re-power" facilities that need more biogas capacity by adding a few smaller Bio-converters at an optimal investment cost and minimal footprint. As a result, the plant produces more energy, which helps in fulfilling the growing demand for biomethane while also increasing the plant's profitability.

Ambitions

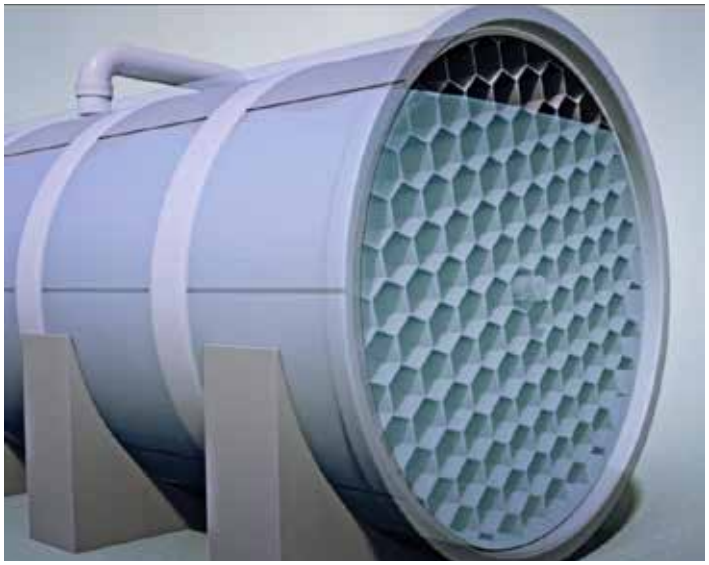
With an increasingly strong track record in clean energy production, the renewable energy plant in Stord as the most recent achievement, and a growing need for sustainable energy production globally, the Antec team is confident in deploying its solution abroad to help drive the green transition in Europe and beyond.

The company has experienced a great response from the industry internationally.

It is developing relations with forward-thinking partners interested in applying Antec's cutting-edge technology in future renewable biogas installations.

With projects currently in the works for China, France, the United Kingdom and Spain, Antec is delivering on its international ambitions.

For more information:
Visit: antecbiogas.com



Fast gas production in Bio-Converters is achieved in multi-chambers containing large biofilm surface

The advantages of a transformer gas monitor include continuous data and a reduced requirement for periodic oil sampling

Protecting a key power station transformer at Eneco

As part of an initiative to safeguard reliable power output and reduce risk, a biomass power plant in the north of the Netherlands has installed a continuous transformer monitor. The Vaisala MHT410 continuously measures three key parameters in transformer oil — moisture, hydrogen and temperature.

Owned and operated by energy company Eneco, the Bio Golden Raand plant produces steam for local industry as well as power, with a capacity of approximately 135 MW thermal and 49.9 MW electrical.

The possible implications

Transformer materials can deteriorate over time, resulting in the potential for costly faults, repairs and downtime. However, the development of transformer faults results in the accumulation of dissolved gases in the transformer oil, so this oil is routinely tested as part of a preventative maintenance programme. Eneco's transformer gas monitor was installed to provide continuous data and reduce the requirement for periodic oil sampling and laboratory analysis.

"We discussed our requirement for the early detection of potential issues with our local service provider, Flux Transformer Services," explains Laurens Freriksen, a project manager and maintenance specialist for Eneco. "They suggested that we should consider using one of Vaisala's online monitors to support the planning and optimisation of preventive maintenance; to extend the lifespan of our transformer and reduce the risk of unexpected and costly outages."

Vaisala's Andreas Hilgers then visited the site to demonstrate two options; the MHT410 which monitors a single gas (hydrogen), and the OPT100 which is a multi-gas DGA (dissolved gas analysis) monitor.

Subsequently, the MHT410 instrument was installed by Flux TS, and as Freriksen puts it: "We have benefited from online measurements for around a year now, and it has been very reassuring to see low hydrogen levels in the transformer oil, irrespective of the transformer load."

Bio Golden Raand

Biomass is used as a feedstock at the Bio Golden Raand plant to generate energy from wood waste. This form of power generation helps to reduce the consumption of fossil fuels. The plant uses non-hazardous Grade B waste wood. This type of waste may contain Grade A wood (mainly from packaging waste, scrap pallets, packing cases and cable drums, and process off-cuts) together with other waste wood sourced from construction and demolition activities, transfer stations, civic amenity sites and the manufacture of furniture from solid wood.

Every year, the plant processes approximately 300,000 tons of waste wood that arrives in Delfzijl by ship and truck from the Netherlands and surrounding countries. The wood is passed to a boiler fitted with a circulating fluidized bed furnace operating at 900°C. Flue gases from the furnace pass through three heat exchangers to a water steam circuit, where steam at 90 bar with a temperature of 520°C is produced. This steam can

be delivered directly to local industry, or it can be used to drive a steam turbine, which in turn drives a generator that produces electricity.

Generator step-up transformers provide the critical link between a power station and the transmission network. These transformers step up the voltage from generator level to the transmission voltage level, which steps down the current and thereby reduces the loss of energy as heat and ensures efficient power transmission over long distances. Typically, generator transformers operate continuously 24/7 so they need to be extremely reliable.

Transformer oil

Generator transformers are generally oil-filled to provide insulation and cooling. The transformer at Bio Golden Raand, for example, contains around 20 tonnes of oil. A special mineral oil is used for its chemical properties and dielectric strength, and this is routinely tested as part of an effective preventative maintenance program for the transformer.

Oil degradation occurs when its molecules break down under the influence of thermal and electrical stresses due to transformer faults such as discharges or hot spots, for example. This degradation raises the levels of hydrogen, carbon oxides and hydrocarbon gases in the oil. Hydrogen concentration increases with all fault types, but the ratio of hydrocarbons depends on the fault type.

Testing and monitoring transformer oil

Traditionally, transformer oil samples are collected once or twice per year and sent for laboratory analysis to determine the level of gases. This spot sampling method provides an indication of dissolved gases and oil quality at one moment in time. The main advantages of continuous monitors, therefore, are that they are able to reveal trends so that users can correlate gas levels with transformer load, for example. Importantly, by measuring continuously, DGA monitors can provide early warnings of faults.

The levels and trends of dissolved gases can be used for fault identification, and this is the subject of a Cigré Technical Brochure (Ref.783) on *DGA Monitoring Systems*. This document describes the different types of DGA monitors and includes an impressive performance evaluation of monitors including Vaisala's OPT100.

In addition to hydrogen, the MHT410 also measures temperature, which is a key indicator of faults. Moisture in oil is also measured by the device because moisture decreases the dielectric strength, accelerates cellulose (insulation) decomposition, and increases the risk of bubble formation at high temperatures.

DGA monitoring at Bio Golden Raand

Explaining the reasoning behind the installation of the Vaisala MHT410, Freriksen says: "A power plant transformer is one of the most valuable assets in a power network — ours is around ten-years-old and operates continuously. However, there is no redundancy, so it is important for us to be able to monitor its condition and performance closely.

"We chose the MHT410 because it offered an opportunity for the early identification of potential problems, which is an important risk reduction measure. Early fault identification enables timely corrective measures such as transformer service, oil change, repairs and possibly transformer load management through customer engagement. If the transformer indicates a fault through increased hydrogen levels, it may also be necessary to deploy a multigas monitor such as the OPT100, in order to obtain a full fault diagnosis."

Data from the MHT410 continuously feeds into the

Eneco digital control system, which Freriksen is able to access from his laptop. This means, for example, that he is able to track transformer load on the same screen as the MHT410 measurements. "The digitalisation of assets is an important issue for our industry, and this is a good example," Laurens adds. "Remote access to live data informs decision making, lowers risk and was an enormous benefit during the Covid lockdown, because it meant that we could check the transformer at any time, from anywhere."

The MHT410 has been set to raise a high-level alarm at 100ppm hydrogen and a very high level alarm at 150ppm. In addition, an alarm will be issued if there is a sudden increase in the readings for hydrogen, moisture or temperature. However, Freriksen says he is pleased to confirm that during the first year of operation there were no alarms, with hydrogen readings typically ranging between 2 and 15ppm, with no significant effects during periods of high load.

Vaisala MHT410

Designed for quick and easy installation with almost no maintenance requirement, the MHT410 has a low cost of ownership. "This is important," explains Andreas Hilgers. "However, the cost of DGA monitors is negligible in comparison with the value of the assets that they help protect, or in comparison with the cost of outages.

"One of the main advantages of digitisation is a reduction in the need for unnecessary site visits, so it makes sense to install a Vaisala monitor that does not incur an extra service requirement. "Frans van Hofwegen from Flux TS agrees. He says: "This is a good example of cooperation between Vaisala, Flux and the end-user; combining knowledge and experience to achieve the desired goals. As the first MHT410 that we have installed in the Netherlands, the device at Bio Golden Raand represents a great start to our relationship."

The MHT410 takes measurements with an in-situ probe, so there is no requirement for pumps or membranes. With no consumables or moving parts that could fail, the instrument is encased in an IP66-rated metal housing equipped with a weather shield. Every unit is individually tested for a pressure of at least 10 bar and also withstands vacuum conditions. Special attention has been given to EMC tolerance; for example, all electrical connections are isolated. In addition, the MHT410 has been designed to tolerate short-term power outages.

Summary

For Eneco, the installation of the Vaisala monitor is essentially a risk reduction measure, but as Laurens explains: "It is very reassuring to have constant visibility of the transformer's condition. However, the key advantage is that it buys us time — time to plan an effective strategy if oil conditions deteriorate — to optimise the performance of the transformer and to extend its working life.

"We are proud to be leading the way in the Netherlands with this form of digitisation, and since the MHT410 was installed, we have received a great deal of interest from our colleagues in other sectors, such as wind power."

For more information:
Visit eneco.co.uk

Biogas: the crucial puzzle piece to achieving EU energy security and enabling a green future

Fundamental changes' with biogas at the heart

Achieving EU ambitious target of 55% CO_2 emission reductions by 2030 will require fundamental changes to the energy sector. It is of paramount importance to promote all sustainable fuels and their infrastructure. Biogas is a flexible, reliable and renewable energy carrier, an enabler of significant CO_2 emissions reductions and carbon removals.

Bioenergy Europe recently released its *2022 Statistical Report Biogas* in collaboration with the European Biogas Association (EBA), which dives into the recent trends of consumption and production of biogas in Europe. The accompanying Policy Brief presents "the most relevant legislative recommendations to promote the biogas sector as key player in EU's energy transition".

The biogas market grew steadily over the last few years, with a growth rate of 4% in 2019-2020. However, according to the most recent data, the EU still heavily relies on fossil gas. Latest trends show a persistent increase of use of natural gas since 2014. In 2020 natural gas was 22,21 times the amount of biogas used. These findings urge for a radical shift in policy design and investments to promote the penetration of renewables alternatives such as biogas and biomethane (also known as upgraded biogas) offering a stable and viable substitute to fossil fuels.

This was also recognised in the RePowerEU Plan — the European Commission's response to the energy market disruption caused by Russia's invasion of Ukraine. According to the strategy, not only must Europe correct its trajectory in order to become climate neutral by 2050, but it must also disentangle itself from imports from unreliable partners. Despite these positive steps forward in the recognition of the bioenergy

sector, the EC strategy still lacks a clear target for solid biomass on top of those for biogas and biomethane. Given the current situation, the increasing energy prices and the EU's higher ambition to get away from fossil fuels, bioenergy as a whole must be recognised as one of the key solutions in order to increase EU energy security and promote a just transition.

Compared to EU fossil fuels, biogas can save up to 240% of GHG emissions and biomethane up to 202% because powerful greenhouse gases, such as methane, that would have been emitted through uncontrolled fermentation of organic waste and agricultural residues are eliminated. Waste and agriculture are the two most important sources of methane emissions today.

Biomethane production has more than doubled in the past five years, and last year grew at an annualised rate of 25%.

To reach the 35bcm target as presented in RePowerEU Plan, 5,000 new plants should start operating in the next eight years and the annual growth should be stable at 28%. More should be done to promote biogas and biomethane consumption, to complement renewable electricity and capitalise on saved emissions.

Feedstock utilised in biogas generation varies greatly by country, with new plants increasingly employing manure and other residues, food waste, wastewater and sewage sludge. Starting in 2023, the EU will mandate separate collection of biowaste, which will increase the amount of food waste available for biogas generation. Member States must implement separate bio-waste collection as soon as possible and reinforce their strategies aimed at energy and materials recovery in their waste treatment. Higher quality waste streams will allow for increasing circularity in the bioeconomy, with environmental and socioeconomic benefits.

"The EU should avoid retroactive changes in the Renewable Energy Directive sustainability criteria, allowing for legal certainty for operators," says Jean-Marc Jossart, Secretary General of Bioenergy Europe. "All EU policies should be aligned in the Fit for 55 Package to equally promote all sustainable fuels and their respective infrastructure."

Giulia Cancian, Secretary General of the European Biogas Association, also stressed that "the European biogas market continues to scale up, with biomethane production growing by 25% in 2020. To reach our energy goals, we should anchor the 35bcm biomethane target to binding EU legislation, along with national indicative targets, and facilitate the injection of biomethane into existing gas networks."

Torsten Fischer of Krieg + Fischer Ingenieure discusses an investigation related to deficiencies of several solid input devices (solid feeders) at two biogas plants in central Germany

First-person sleuthing, investigation of a silage plate

Torsten Fischer, founder and managing director at Krieg + Fischer Ingenieure, has been an expert legal witness for more than 15 years, covering 130 cases, and wrote his first report about a biogas plant accident more than 20 years ago. In this personal account, Torsten discusses a dispute between an operator and his insurer, exclusively for *Bioenergy Insight*.

Setting

Two fairly big biogas plants, both with energy crops, mostly corn silage, as input substrate, operated by the same operator. Both plants were built in 2012/2013 by an EPC contractor, start-ups in 2013/2014. Each biogas plant has two digester tanks with a solid input device (SID) in front of each of the tanks. Over a period of six years the operator experienced nearly 200 minor and major repairs done by third parties, not counting the repairs done by his own staff, and finally, completely frustrated, decided to substitute the old SIDs with new ones. He approached his insurer and requested insurance cover for at least part of the costs for the new machines. No agreement was found but both agreed to ask an independent expert to write a report about the damage between 2014 and 2020.

My reaction

What a mess. A SID is always one of the main bottlenecks in a biogas operation. Such a machine has to work but without a stable feeding process the digester tank cannot be operated properly.

The job

With the order, I received several invoices and accident reports. It took a young engineer and me a few weeks to sort them and get an idea what happened over the past six years period. Some damage could be repaired while proceeding with feeding the digester tanks, some needed operations to be interrupted, while the worst ones required the disassembly of the aggregate, before trucking it to the factory and repairing it there. How were we going to compare such different types of damage? We decided to approach this statistically.

First visit and report

My first visit in summer 2020 gave me an impression about the general situation on site. At that time the four old SIDs had already been replaced. Figure 1 shows SIDs 1 and 2, already discarded.

The statistical investigation was done for eight different independent damage parameters such as conveyors, hydraulic system, steel works, moving floor, wear and tear and others. Each invoice and each accident report was allocated to (at least) one of the damage parameters. Partly, due to poor text descriptions on the invoices we could not allocate invoices to a certain aggregate but only to the site.

What was clear was that wear and tear were not included in the insurance cover and we discovered that we had — in between inspecting other damages — typical wear and tear costs were really high. And while we clearly stated in the report that wear and tear on its own was not relevant, the overall costs for wear and tear were very high over the past six years.

Figure 2 showed an example for the 'steel works'. The

Figure 1

Figure 2

Figure 3

steel works included the addition of stiffeners and exchange of corrosive steel plates. Figures 3 and 4 provided an example of the problems the operator faced inside the containers. On the bottom of the container is a moving floor that shifts the silage. In order to keep the moving floor adjusted, there are guide rails on both sides. Over the time silage was collected in the gap between the wall and the guide rail, which compacted and bent the guide rail. This finally led to breaks in the steel construction of the moving floor and partly destroyed the hydraulic system. An example of the massive damage of the hydraulic system is shown in figure 5.

Interestingly enough, the value of the cumulated damage per SID did not differ too much but ended up between €85,000 and €105,000. However, the type of damage (damage category) differed significantly. On site 1 (SIDs 1 and 2), moving floors, steel construction and wear and tear. On site 2 most of the costs were the result of the moving floors and, additionally from the beginning by wear and tear. Distribution of invoices over the years did not follow any pattern. The highest number of invoices were produced on site 1, SID 2, in 2017, and had to do with problems with the hydraulic system. This was the same on site 2 and was closely followed by a number of invoices for the moving floor.

The report comprehensively investigated the damage categories and values of damages as well as distribution of damages over the years. In this publication it can only be shown as an excerpt.

Conclusion

There is no official statistic about damage to solid input devices. Nevertheless, based on my general experience, I assume that even under hard working conditions, the investigated four SIDs showed more than double as much damage as could have been anticipated. And the damage found was significant. It is obvious construction was of poor quality here.

Each one of the SIDs showed significant damage. But for SID 1 it was merely the hydraulic system, for SIDs 2 and 4 the moving floor and for SID 3 nothing specific at all. One of the results of this investigation was that it had not been predictable for the operator what type of damage at what SID, could happen next. What was clear was that the machines were of good working order, but the overall performance was not acceptable. A third result was that the aggregates in principle could fulfil the required function — there was no principle design fault. As a result, only three results together were the basis for the insurer to pay.

The fine print

First solid input devices were developed back in 2001. In the first five years or so they were mostly constructed in mild steel and thin steel plates. Lifetime expectation used to be up to five years. Over the years more and more hot dip galvanised as well as stainless steel constructions became standard. Internal, substrate exposed parts of the steel construction that

Figure 4

Figure 5

nowadays are covered with PE or stainless steel plates. Over the past 20 years there has been a significant rise in quality … as well as in price. Lifetime expectation for good SIDs is more than 10 years.

The supplier of the investigated SIDs used to be an experienced biogas company with a long track record.

Lessons learned

For me this was the most comprehensive report I have ever written. My young engineer fought his way through all the hundreds of documents we received. The operator learnt that a more thorough investigation at the very beginning would have eased the problems significantly. The original supplier went bust, and cannot deliver his poor-quality machines to others anymore.

Finally, the situation was typical in one aspect. It is not possible to "perfectly" describe in the insurance cover certain conditions. There are grey areas. The report I wrote was part of the "negotiations" between the operator and the insurer. In this case, finally, an agreement was reached.

Please note: not all details have been presented in full in this article and some elements have been simplified.

Fischer is happy to receive questions at fischer@kriegfischer.de

For more information:
Visit kriegfischer.de/en/biogas-plants/services/expert-opinions-and-studies

EQTEC CEO David Palumbo on the key challenges that lie ahead, which can be answered with gasification

The role for gasification and anaerobic digestion in the net zero future

David Palumbo

Recent events in Eastern Europe have placed a renewed focus on our energy security and pushed the issue into the public consciousness like never before.

In the United Kingdom, the prime minister, Boris Johnson unveiled his government's Energy Security Strategy in response. This is a strategy that sets out clear ambitions for hydrogen, offshore wind, solar and nuclear energy as the UK not only looks to meet its net zero targets, but also improve the UK's energy security by boosting domestic production.

What stood out to me most in reviewing the strategy was the need to harness not only our natural advantages, such as shallow seabeds and high winds, but equally target investment into the UK's innovation capabilities to produce alternative fuels like green hydrogen, and build modern infrastructure for energy storage and renewables.

In my view, carbon-negative baseload power solutions to balance the intermittency of traditional renewables, is a sector which remains underinvested, yet one that will attract significant capital in the coming years. I firmly believe we need to apply innovative thinking in the search of harnessing all possible resources to create clean, local energy to end our reliance on fossil fuels and propel us towards net zero.

There are two key challenges that any society in any country needs to address. The first being the increasing amounts of waste we generate, and the second is the need to transition away from fossil fuels and move to a clean, secure supply of energy.

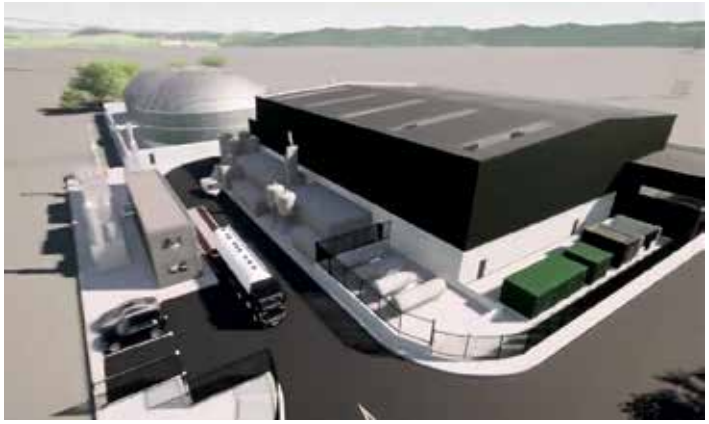
In 2012, the UK generated 200 million tonnes of waste. Just six years later, this figure jumped to 222.2 million tonnes. Public support for exporting waste to countries such as Turkey is low, as is support for landfill. There is also increasing opposition to energy from waste plants that incinerate waste — Wales has introduced a moratorium on new energy from waste plants over 10MW and the Scottish government is currently undertaking a review into incineration.

Yet waste levels will continue to rise dramatically and the UK needs to look more seriously at how it deals with this waste — reconsidering its resource value to the GDP and the need to make use of it as a valuable commodity. If we as a nation reframe our view of waste and begin to treat it as a resource rather than a hindrance, I believe we can effectively deal with the two challenges we currently face.

Not only will our levels of waste increase in the coming years, the way in which our waste is collected is also set to change. Plans unveiled by the government in May 2021 proposed that every UK household will receive a separate food waste collection, on a weekly basis. This move will help to reduce contamination in waste streams and push up recycling, but we also need to have the right infrastructure in place to extract as much value from this waste as possible.

It is my view that anaerobic digestion plants, combined with advanced gasification facilities can be something of a silver bullet as we look to deal with the dual challenge of transitioning to a net zero future, and ensuring we maximise the value of our waste and truly begin to see it as a resource.

EQTEC is the co-developer and gasification technology provider for a project in Deeside, Flintshire, Wales. The site currently has planning permission for a waste recycling facility and an anaerobic digestion facility, where we will work



An artist's impression of the site

> "Anaerobic digestion plants combined with advanced gasification facilities can be something of a silver bullet"

in partnership with recovery technologies specialists Anaergia, with a council resolution secured to grant planning consent for the advanced gasification facility. With EQTEC's and Anaergia combined technologies, the plant will create the first enhanced integrated waste to energy solution of its type.

We estimate that the project in total will have the capacity to convert 182,000 tonnes per year of non-recyclable everyday household and commercial waste, otherwise destined for landfill or incineration, into green electricity — enough to power 37,500 homes.

The same is true for our project just across the border in Southport, Merseyside. The site currently has planning permission for a waste recycling facility, converting waste through anaerobic digestion into six million cubic metres of biomethane, which in turn would output 9MWe.

The Phase 2 of the project is being conceived as an RDF-to-hydrogen plant and EQTEC is currently working with other technology partners to design an integrated solution for the production of hydrogen from waste. We anticipate this plant will be the first of its type in the UK.

Also in Deeside, we have been conducting design feasibility studies for the production of hydrogen on site, both the planning and environmental studies have suggested that this is viable from a planning perspective. Strong local industrial offtake has also been validated, with Toyota being the main customer.

While our Billingham, Teesside project will not co-locate with an anaerobic digestion plant, it will have a key role to play in the local power and biofuel needs for the local industrial businesses adjacent to it.

Hydrogen will undoubtedly play a key role in our move to a net-zero economy, however, the overriding challenge for producing hydrogen is cost, as currently only electrolysers are the prevalent technology for green hydrogen.

If you can produce high quality syngas to a specification, as we do, then extracting the hydrogen through water gas shift is possible. We believe this could be much more cost efficient for certain applications than electrolysis. Further, if the source feedstock of this syngas is (for example) organic and not derived from fossil fuels, the resulting hydrogen could be certified as green, with low or negative carbon emissions.

Whilst the big-ticket items such as new nuclear plants, or aiming to become 'the Saudi Arabia of wind power', will undoubtedly grab media headlines, I believe smaller, carbon-negative baseload plants which take local waste, support local firms and generate distributed energy and biofuels, provide just as much of an exciting opportunity for delivering the UK's ambitions. These plants will not only help us deal with our ever-growing waste issue but build our energy resilience and drive us further towards reaching net zero targets. ●

For more information:
Visit: eqtec.com

Director describes how the bioenergy sector has enormous potential

David Pitt, director of Enertecgreen, on the small actions that can make a huge difference

What first drew you to the bioenergy industry?
On a philosophical level it was the opportunity to participate in an energy revolution that would address the needs of the planet to combat climate change. From a business perspective it had enormous appeal in terms of growth and potential returns. I started my career as an engineer in the oil industry and then moved into software technologies related to energy asset management and trading so it felt like a natural next step for me.

What is the best thing about your job?
The challenge of pulling together all the disparate threads that make a new project venture successful. Developing a business case for deploying our technology and then shaping that to achieve a solution that meets investor needs is the start of the journey. This is then followed by the completion of all the various commercial agreements, planning and regulatory requirements needed to secure funding and be in a position to move forward. Every project is a new journey and there are many twists, turns and dead ends on the way so when you finally cross the finishing line it is immensely rewarding.

What advice would you give to someone wanting to follow in your footsteps?
Understand your strengths and weaknesses and set your career goals to major on your strengths.

What do you like to do when you're not working?
I love having time with my family and grandchildren, playing as much golf as I'm allowed to, indulging my passion for music and supporting Spurs.

What is your proudest moment to date?
Having our technology selected by a major UK water company for a ground breaking project to convert waste biosolids to renewable gas, power and heat. It was an enormous endorsement of our technology and the belief of a large corporation that was prepared to take the risk of investing in us.

If you could give one piece of advice to your younger self, what would that be?
Understand where the biggest gap in your competence is and address it early. For me I had limited financial knowledge having been educated as an engineer spending my early career in technical design. I gained my financial experience as a consequence of starting my own business but I'm sure that I made any mistakes during that time that I would not have made with the benefit of some formal business education.

Who inspires you?
People who achieve the impossible as this requires not only extraordinary talent but the determination, stamina and complete self-belief to sacrifice everything to achieve their goal


David Pitt

What do you look for when hiring a new member of the team?
As a small company we look for talented individuals who are passionate about our technology and willing to work in a fairly unconventional business environment.

What makes the company stand out from its competitors?
We have a unique gasification process that converts bio and municipal waste into extremely clean syngas suitable for conversion to power, heat and liquid biofuels.

We are able to address the growing concerns over microplastics, forever chemicals and nutrient run off from the spreading of agricultural waste and sewage sludge to land by using these materials as feedstocks for our process. We are also able to process MSW and in so doing recycle plastics into renewable energy thereby addressing the challenges of plastics pollution.

What's next for the company?
We are developing collaborations that can deliver a fleet of distributed bioenergy plants utilising MSW and biosolids to produce a range of energy products. We are currently focusing on our first bioethanol plant as we are increasingly convinced that this is and ideally suited for production on a distributed basis. ●

For more information:
Visit: enertecgreen.com



25 YEARS OF WOOD PELLETING

A Review by AMANDUS KAHL

More than a quarter of a century ago, well-known companies started pelleting waste wood, demolition wood and wood dust. The centre of the first tests was in and around Austria. In the mid-1990s, wood pelleting was still in its infancy – numerous methods were tested until today's standards and qualities could be achieved.

First Steps in Austria

Wood is one of the most used raw materials worldwide. The raw material is the basis for countless manufacturing processes – be it the production of furniture or the construction of houses. The resulting demolition wood, wood shavings or wood dusts were hardly used until the 1990s – until the topic of "pelleting" came up.

The centre piece of this compaction was the pelleting press. It had already been used successfully in the compound feed industry. Renowned press manufacturers in Austria quickly entered the race with their established compound feed presses. They were followed by large sawmills that wanted to pellet their by-products, mainly softwood. This created a second market: the sale of wood pellets as an alternative fuel. The focus was on the production of pellets from softwood, as softwood or coniferous wood (wood with an oven-dry density of 400 to 550 kg/m. Using the simplest of methods, these by-products were first compacted in compound feed presses. The plant design was analogous to feed pelleting: proportioning, conditioning, pelleting and cooling.

Process Engineering Findings and Setbacks

The pelleting presses used had been designed specifically for feed mixtures, but the raw material "wood" had different requirements. The design of the respective die posed the least problem. It showed that the energy input for wood pelleting is between 55 and 75 kW/t, whereas feed pelleting requires only 12 to 18 kW/t, depending on the type of feed. As a result, press manufacturers were forced to design new technical constructions. Supported by the willingness to innovate and the patience of the sawmill owners at that time, suitable machines were manufactured by and by, bearings reinforced, pan grinder track widths reduced and much more.

Today – More Than 25 Years Later

More than a quarter of a century later, the pelleting of wood is an established process technology on the market. Around 35 million tons of wood pellets are produced in this way worldwide. In addition to sawmills and other wood-working industries, large-scale plants designed specifically for this purpose now also produce wood pellets to the highest standards.

The portfolio of wood species to be processed has also been extended: Meanwhile hardwood is also used for compaction. These are woods with an oven-dry density of more than 550 kg/m³ such as beech, oak or ash. For almost all types of wood, there are professional solutions for successful pelleting with the highest quality.

Today, AMANDUS KAHL manufactures the press type 65–1500 with a capacity of 8 to 12 t/h – depending on the type of wood. However, even the smaller press types, which cover a capacity range from 2 to 5 t/h, are now state of the art and provide the necessary high-power technology to ensure high quality. Through innovation and flexibility, the company and its customers always find the optimal way to implement projects and make visions come true. "Energy efficiency", "cost reduction" and "control optimisation" – challenges that concern all industries and for which AMANDUS KAHL has provided solutions for more than 140 years.

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