JANUARY/FEBRUARY 2022

ISSN 2515-2238

Plastics Recycling WORLD

PVC RECYCLING SPREADS AROUND THE WORLD

FLEXIBLE PACKAGING: RECYCLING MOMENTUM

PELLETISERS: AUTOMATIC APPROACH TO QUALITY

AMI

Bringing the plastics industry together

GET THE FREE APP

Plastics Recycling WORLD

Plastics Recycling World magazine is now available free-of-charge on iPads, iPhones and a huge range of Android-based tablets and smartphones.

Our dedicated *Plastics Recycling World* app is easy to use and provides completely free access to the latest edition of the magazine plus more than 20 free-to-read back issues.

Once you have downloaded an issue, you can read it offline, there's no need for an internet or data connection. AMI's other magazine apps – *Compounding World*, *Injection World*, *Film and Sheet Extrusion* and *Pipe and Profile Extrusion* – have been downloaded more than 67,000 times by readers around the globe. Why not try it yourself? The Plastics Recycling World app is available in Apple's App Store and Google Play. Just search for 'AMI Plastics', or simply click on the relevant button below.

Download on the App Store

GET IT ON Google Play

Plastics Recycling WORLD

COMING NEXT ISSUE

› PET Recycling › Melt Filtration › Additives

CONTACT US

CLICK HERE TO MAKE SURE YOU GET YOUR COPY

AMI

Third Floor, One Brunswick Square,
Bristol, BS2 8PE, United Kingdom
Tel:+44 (0)117 924 9442
Fax:+44 (0)117 311 1534
www.amiplastics.com
www.twitter.com/plasticsworld
Registered in England No: 2140318

DOWNLOAD MEDIA DATA

EDITORIAL

Editor-in-Chief: Chris Smith
cs@amiplastics.com

Editor: David Eldridge
de@amiplastics.com

Technology Editor: Peter Mapleston
editorial@plasticsrecyclingworld.com

Contributing Editor (UK): Mark Holmes
editorial@plasticsrecyclingworld.com

Events and Magazines Director: Andy Beevers
abe@amiplastics.com

ADVERTISING

Advertisement Manager: Claire Bishop
cb@amiplastics.com T/ +44 (0)7905 848744

Head of Business Development: Paul Beckley
pb@amiplastics.com T/ +44 (0) 117 311 1529

Advertising Sales (China/Hong Kong): Maggie Liu
maggieliu@ringiertrade.com T/ +86 13602785446

Advertising Sales (Taiwan): Ms Sydney Lai
sydneylai@ringier.com.hk T/ +886-913625628

Erema ramps up second machinery site in Austria

Machinery group Erema has increased utilisation of a second facility in Austria due to growing demand for its products. The site in St. Marien, close to its headquarters in Ansfelden, allows Erema to increase production capacity by 60%.

The group took over the premises of Gruber & Kaja in St. Marien as a reserve site in January 2021, investing €20m in the purchase. "When this site came up for sale, it only took us a few days to decide to buy the 40,000m² plot, including the workshop hall, which has an area of 15,000m²," said Manfred Hackl, CEO of Erema Group.

The group did not expect to be using the site so intensively as it now is, because at the end of 2020 it was just completing the expansion of its HQ facility, involving an investment of around €17m. By the time the new site is completed, the total number of new jobs will be up to 150.

IMAGE: EREMA

L-R: Walter Lazelsberger (Mayor of St. Marien), Michael Heitzinger (Erema), Markus Stölnberger (UMAC), Markus Achleitner (Upper Austria´s Minister for the Economy), Markus Huber-Lindinger (Erema) and Manfred Hackl (Erema)

The fast ramp-up is a response to high demand for the group's plastics recycling technologies and the trend towards ever-larger recycling plants. "Just in December, we delivered a Vacurema system to Brazil that will produce up to 40,000 metric tonnes of recycled PET per year. That is equivalent to recycling around 1.1bn 1.5-litre PET bottles. This site provides the perfect conditions for building this scale of machine," said Hackl.

Since January 2021, part of the existing office and hall space at Kunststoffstraße 1, as the site's address is now called, has been occupied by companies and departments of the Erema Group. UMAC, a subsidiary specialising in servicing and trading previously owned recycling machines, which was severely short of space at its main location in Styria, moved its entire production and administration to St. Marien. Large areas of hall storage space were adapted for both UMAC and the Erema brand technology.

The paint shop was also relocated from Ansfelden to St. Marien, and another hall was equipped for building large-scale Vacurema systems, which are used to recycle PET bottles.

› **www.erema.com**

AMUT wins contract for PE recycling facility in Australia

AMUT's Ecotech division has been awarded a contract to design and supply plastics recycling plant for the largest post-consumer PE facility being built in Australia. It will be the turnkey supplier for Pact Group and Cleanaway's project which includes a new packaging waste recycling plant in Victoria, converting locally collected kerbside materials into high quality food-grade rHDPE and rPP.

The facility will treat a stream of mixed plastic bottles in different polymers and colours, pots, trays and non-packaging plastics, ferrous and non-ferrous materials. Plastics that will be sorted include natural colour HDPE containers, coloured HDPE containers and PP containers.

These materials will be automatically dosed to two AMUT Ecotech washing lines, the first one with an output of 2,000 kg/h dedicated to natural colour HDPE containers and the second one with the same output dedicated to colour HDPE or PP containers. Both washing lines are capable of processing natural colour HDPE for food-grade applications.

The plant, which is scheduled to be operational by the end of 2022, will process 20,000-24,000 tpa of materials.

› **www.amut.it**

Alpla and Coca-Cola in new JV

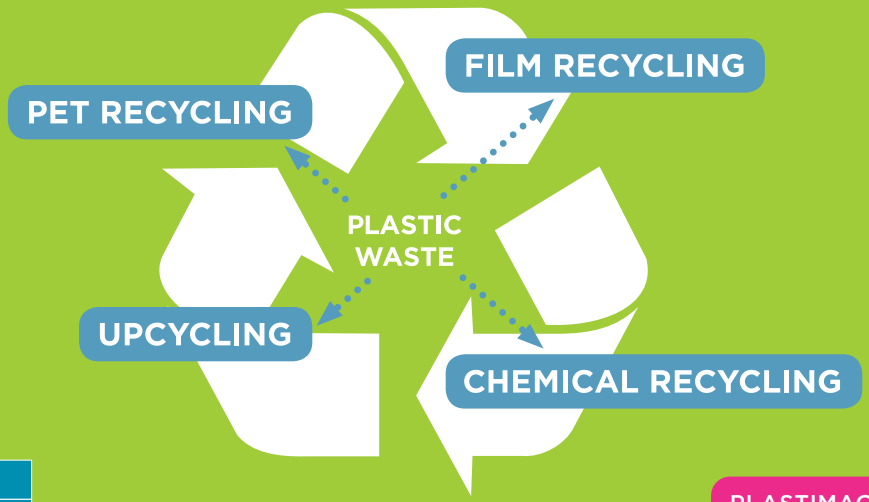
A joint venture between Alpla and Coca-Cola FEMSA has started construction of Planeta PET recycling plant in State of Tabasco, Mexico. It will have the capacity to process 50,000 tpa of post-consumer PET bottles and produce 35,000 tpa of rPET material.

The two firms also have a JV rPET plant in the state of Mexico.

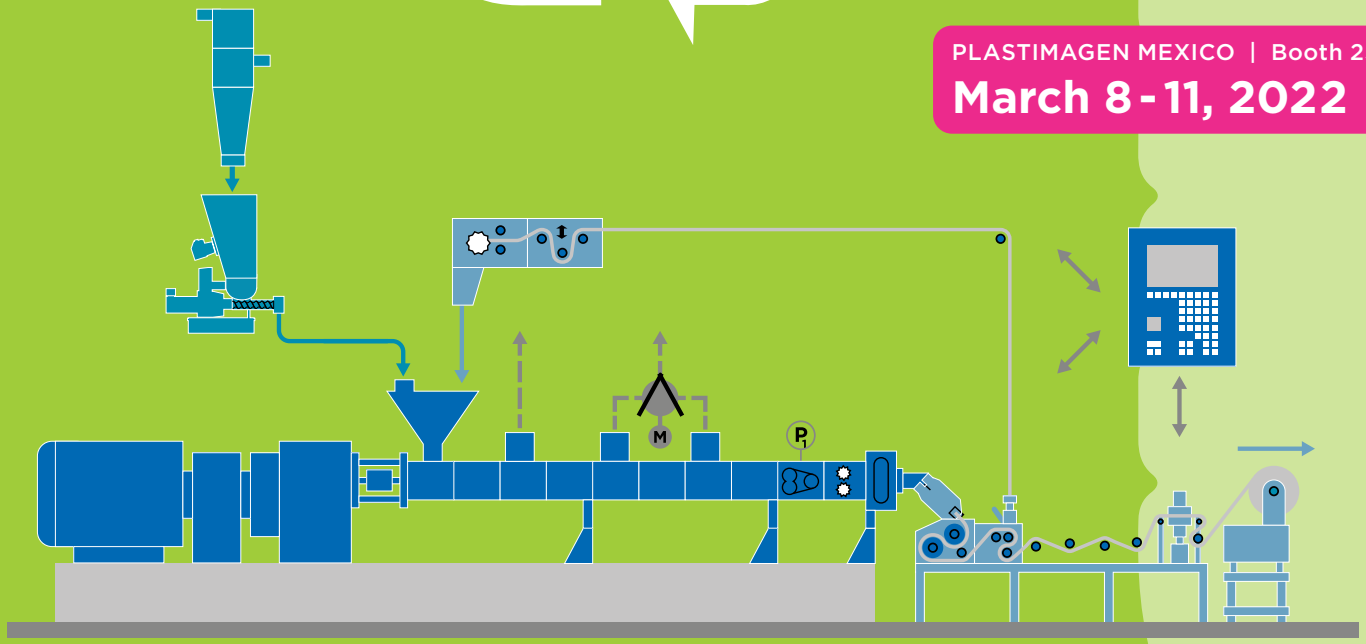
› **www.alpla.com**

COPERION PLASTICS RECYCLING TECHNOLOGY. EFFICIENT. SUSTAINABLE. RESPONSIBLE.

Discover our first-class technology solutions:
+ for compounding, extrusion, feeding, conveying and bulk material handling
+ fulfilling highest quality standards and maximum reliability



PLASTIMAGEN MEXICO | Booth 2330
March 8 - 11, 2022



coperion k-TRON

Join us on the responsible path to a successful future. Benefit from our comprehensive know-how and first-class technology solutions for various plastics recycling processes.
www.coperion.com/recycling

coperion
confidence through partnership

Honeywell forms joint ventures

Honeywell and Avangard Innovative have formed a joint venture to build a chemical recycling plant in Waller, Texas, US. The planned facility is expected to have the capacity to recycle 30,000 tpa of mixed plastics waste.

The facility will use Honeywell's new UpCycle Process Technology to reprocess plastic waste into feedstock for new plastics production. Production is set to begin in 2023.

The UpCycle Process Technology combines pyrolysis and contaminants management technology.

Honeywell's process is also the centre of a joint venture project with Sacyr in Spain. This plans to build a facility to recycle 30,000 tpa of mixed waste plastics.

Honeywell has also signed an agreement with TotalEnergies to supply the French group with feedstock from the plant when it starts up in 2023.

› **www.honeywell.com**

IMAGE: EVERGREEN

Above: The bale yard at Evergreen's facility in Clyde, Ohio

Evergreen pushes rPET capacity even higher

US PET recycler Evergreen is expanding its operation in Clyde, Ohio, adding a 54,000 sq-foot building to its existing 238,000 sq-foot facility. The new building will house four additional high-volume, food grade rPET lines.

The expansion is expected to be completed in June and will increase Evergreen's annual rPET capacity to 217m lbs. This is a rapid rise from the company's 40m lbs capacity a year ago when the Clyde facility was its only location. Since then it has acquired three facilities and now claims to be among the three largest producers of food-grade rPET in North America.

Evergreen Riverside in California was acquired from CarbonLite in May 2021. Evergreen Albany in New York (formerly UltrePET) and Evergreen Amherst in Canada (formerly Novapet) were acquired from WTE Corp in November 2021.

Evergreen President and CEO Omar Abuaita said: "We would not have invested some $200m in this business if we did not feel strongly about market demand and our integrated value proposition. We have invested massively, and it is our intention to continue to invest and grow Evergreen."

Evergreen says it has also increased the number of post-consumer PET bottles it collects and recycles. In January 2021, the company recycled about 2bn PET bottles a year and the number is now 11.6bn.

The company has invested in AI-enabled robots that sort PET bottles from moving streams of waste at speeds up to three times faster and at higher accuracy than manual sorting, it says. "We don't want any recyclable bottles to get past us," said Greg Johnson, GM.

› **www.evergreentogether.com**

KP Films to add rPET capacity in N America

Films group Klöckner Pentaplast has announced an expansion to its capacity to produce post-consumer recycled content PET in North America. The expansion will add an extrusion line and two thermoforming lines adding a total of 15,000 tpa of new rPET/PET capacity.

KP has not yet decided on the location for the expansion, which will be situated next to one of its six North American plants. It is targeted to be fully operational in the first quarter of 2024.

The extrusion line will support production of sustainable product lines such as kpNext recyclable pharmaceutical blister films, and Smartcycle recyclable label and consumer packaging films. The thermoformers will produce kp Elite mono-material protein trays which are made using up to 100% recycled PET.

KP says that more than 20% of its product volumes are made using PCR material.

The expansion responds to strong demand for sustainable options among food packaging, pharmaceutical, consumer and label film customers.

› **www.kpfilms.com**

PLASTICS RECYCLING WORLD EXPO

November 9-10, 2022

CLEVELAND, OHIO, USA

Gather new leads in a cost-effective and time-efficient way

Highlights from the 2021 co-located expos:

3,000+
attendees

220+
exhibitors

44
states represented

55%
of attendees have an annual budget of over $1M

BOOK YOUR PERFECT BOOTH:

Levent Tounjer, Exhibition Sales Manager
levent.tounjer@ami.international
+1 484 258 2787

Brought to you by: AMI

Colocated with: COMPOUNDING WORLD EXPO, PLASTICS RECYCLING WORLD EXPO, POLYMER TESTING WORLD EXPO

Proudly supported by: Plastics Recycling WORLD

Recycled plastics data record is launched

The PolyREC initiative has started the RecoTrace data system to record European recycled plastics data. The system will enable PolyREC to report on the progress of the European plastics value chain towards meeting the Circular Plastics Alliance target of 10m tonnes of recycled plastics use by 2025.

PolyREC said that companies can register to use the RecoTrace system here: https://recotrace.com/auth/login

Ton Emans, President of Plastics Recyclers Europe, said: "PolyREC is calling on all plastic recyclers and converters to register their recycled plastic data into RecoTrace and, in doing so, ensure transparency of the circular movement of European polymers. Understanding the size and dynamics of the European recycled plastics market will help inform future legislation and investment decisions that accelerate the transition to a circular economy."

RecoTrace provides recyclers and converters with a free-to-use online platform to track progress against individual pledges to produce or use recycled content and helping to demonstrate commitment towards circularity.

The system builds on the data collection experience and expertise of Recovinyl which tracks PVC recycling data in Europe. In RecoTrace, the Recovinyl system has been expanded to include all main polymers: polyolefins, PET, PVC, PS, EPS, XPS, PA, ABS and PC.

› **www.polyrec.eu**

Averda gets investment loan

International Development Finance Corp (DFC) in the US has approved a $45m investment loan to waste management group Averda for plastics recycling facilities in Africa and India.

Averda's CEO Malek Sukkar said the investment support will accelerate the company's plans to build plastics recycling capacity in markets which need it most.

DFC included these Averda projects in the latest round of quarterly investments which total more than $1.1bn it is investing towards innovative development projects around the world.

› **www.averda.com**

RecyClass issues PS protocol

The RecyClass initiative in Europe has published its Recyclability Evaluation Protocol for Polystyrene Containers, covering post-consumer PS pots used for yogurt and other types of food and beverage product.

The protocol aims to guarantee the mechanical recyclability of PS packaging, while maintaining protection properties, ensuring PS recycling process efficiency, and also to encourage innovation.

RecyClass said the document details laboratory testing methodology and represents as accurately as possible how the PS mechanical recycling process should work at an industrial scale to allow PS containers to get recycled into applications which have a higher value.

› **https://recyclass.eu**

Tetra Pak invests in four recycling projects

Tetra Pak has co-invested €11.5m with recyclers and industry players in carton recycling projects in Turkey, Saudi Arabia, Ukraine and Australia. The projects will be able to process up to an additional 45,000 tonnes of used carton packages, which the company says will increase global carton package recycling to more than 50bn cartons per year.


IMAGE: TETRA PAK

In Turkey, Tetra Pak and Kahramanmaraş Paper opened a €4m plant in 2021 which enables the recycling of all components of Tetra Pak cartons, with an annual recycling capacity of 18,000 tonnes of cartons. The PE and aluminium components are reprocessed into a hybrid material called Polyal used for durable items.

In Saudi Arabia, Tetra Pak is a partner in the RIYcycle project with recycling companies, Obeikan Paper Industries and Saudi Top Plastic Factory (pictured). The project includes a plant to produce PolyAl with a capacity of around 4,000 tonnes per year.

In Ukraine, Zmievskaya Paper Factory, in a project with Tetra Pak, will add a 4,000 tpa PolyAl plant to its carton fibre recycling operation.

› **www.tetrapak.com**

AMI | Events

Plastics Recycling Technology

13-15 September 2022 | Vienna, Austria

Exploring the future of plastics recycling - new ways to boost productivity, quality and profitability

Save €300* - Book your place today!

Sponsored by: erema group, Starlinger Recycling Technology

Media supporter: Plastics Recycling World

*Discounts cannot be used in conjunction with other offers. Offer valid until 11 March 2022. Price may be subject to VAT.

DEVELOP YOUR KNOWLEDGE

Themes for 2022:

- **Innovation** in machinery and processing for increased recyclet quality and throughput
- **Traceability** as a key to high value and quality supply chains
- **Compounding and additives** for recycling
- The impacts of changing **legislation and regulation**
- **Feedstock security** as a growing industry challenge

Chemical Recycling

March 29-30, 2022
Hilton Houston Post Oak by the Galleria
Houston, TX, USA

Headline sponsor:

American Chemistry Council

Explore the advances in chemical recycling technologies and their integration into the North American recycling supply chain

- **Discover** the potential of chemical recycling
- **Learn** about processing and application challenges
- **Discuss** the various technologies and outputs available
- **Gain** real business insight
- **Network** with industry experts

Book your place today

Industry-leading speakers include:

Hanne Jones
Business Unit Manager
AMI Consulting

Craig Cookson
Senior Director,
Plastics Sustainability,
American Chemistry Council

Dr Mario Reyes
CTO
GSF

Marcus Trygstad
Chief Technology Officer
Aduro Clean Technologies

Dr Christoph Koffler
Technical Director Americas,
Sustainability Consulting
Sphera Solutions

Maurizio Longhi
Principal Engineer, Materials Technology - Global Materials Regulatory SME
Whirlpool

Also sponsored by:

GSF AVEVA MURA TECHNOLOGY erema group

Media supporter:

Plastics Recycling WORLD

AMI

www.ami.ltd/attend-chem-recycling-usa

Business calls for global UN treaty on plastics pollution

A group of multinational businesses has given support to a global treaty to tackle plastic pollution, which is set to be discussed at a meeting of the United Nations Environment Assembly (UNEA) in Kenya.

"A new UN treaty is crucial to set a high common standard of action for all countries to abide by, and to drive the transition to a circular economy for plastics globally and at scale," said the group, which includes polymer producer Borealis and several plastics packaging converters: Alpla, Amcor, Berry Global, Evertis, Flexfilm, Greiner, Minipak, Mondi and Selenis.

At the UNEA 5.2 meeting, due to take place in Nairobi in Kenya from 28 February to 2 March, an Intergovernmental Negotiating Committee is scheduled to discuss treaty proposals from various UN member states.

Left: Tim Grabiel from EIA (bottom right) discussed the proposed UNEA global plastics treaty with representatives from OPLA, Zero Plastic Oceans and Amcor at AMI's Ocean Plastic Virtual Summit in January

A resolution from Peru seeks a treaty encompassing circular economy objectives, while another to be tabled by Japan focuses on a treaty covering plastic pollution and waste management.

Information about UNEA 5.2 proposals was presented by Tim Grabiel from UK-based NGO Environmental Investigation Agency (EIA) at AMI's Plastics Recycling Technology conference in October. He said he was optimistic there would be enough support for a treaty to move ahead.

› **www.plasticpollutiontreaty.org**

Agricultural Film

28-30 March 2022

World Trade Center
Barcelona, Spain

Maximising crop yields with an effective use of silage, mulch and greenhouse films to feed the growing global population

What to look forward to:

- 3 days | 20+ Speakers | 7 Sessions
- Live presentations showcasing the future of the global agricultural film market
- Networking opportunities including evening reception, coffee breaks and lunches
- Meeting in person in an exciting location
- Delegate pack including all presentations

Speakers include:

Andrés Garcia de Tuñon
Corporate Sustainability Manager
GRUPO ARMANDO ALVAREZ

Robert Ferrigno
Director
LUMINA CONSULT (ECBPI Secretariat)

Michael Martin Gatius
EMEAF Polymers Customer Development
EXXON MOBIL

Kristin Taylor
CEO
RADICAL PLASTICS

Jan Bauer
Managing Director
RIGK

Jo van Horrick
Sales Director
DUO PLAST

Book your place today

Organised by: AMI

Sponsored by: DAVIS-STANDARD SML

Media supporter: Film and Sheet EXTRUSION

Vecoplan lays foundation for growth with record orders

IMAGE: VECOPLAN

Vecoplan VIZ 1300 plastics shredder

Shredding technology company Vecoplan increased sales in 2021 by almost 60% to approximately €180m, with incoming orders reaching a record level. It is a subsidiary of MAX Automation in Germany.

Werner Berens, CEO of the Vecoplan Group, said: "In 2021, we had the highest level of orders received in our history as well as the highest earnings. Our profitable growth was the result of a product campaign that focused on customers and a clear business strategy in recent years."

The aim of the strategy was to optimise and strengthen the company's production facilities, divisional sales departments, marketing and corporate development and to continue investing in them. "As a result, Vecoplan is growing faster than the market and a foundation is being laid for continued growth in the years ahead," said the company.

The company has a globalisation strategy and has opened new sales and service centres around the world.

It said it is putting a strong emphasis on training its employees, and on occupational health. An example is Vecoplan's Covid-19 vaccination campaign, in which employees and their family members were given early opportunities to get first and second vaccinations and later a booster dose.

Michael Lambert, CFO, said: "In 2022, we will be putting the spotlight on our digitalisation strategy and investing several million euros in software and hardware."

› **https://vecoplan.com**

AMI Plastics World Expos
NORTH AMERICA

November 9-10, 2022 // **CLEVELAND, OHIO, USA**

2022 exhibitors already include:

Q-LAB
Reifenhäuser EXTRUSION SYSTEMS
PerkinElmer For the Better
Vecoplan
ThermoFisher SCIENTIFIC
TPEI Technical Process & Engineering Inc. Customer Service, Compounded Daily
ECON
brabender TECHNOLOGIE
WINDMOELLER & HOELSCHER
WACKER
NGR PLASTIC RECYCLING TECHNOLOGIES
coperion confidence through partnership
PTI
Sanitized Swiss antimicrobial expertise since 1935
AZO
NETZSCH Proven Excellence.
GEON Performance Solutions
EREMA PLASTIC RECYCLING SYSTEMS
KraussMaffei Pioneering Plastics
DAVIS-STANDARD Where your ideas take shape.
cumberland
CDS
Milliken
BASF We create chemistry
DOVER Chemical Corporation
MACRO ADVANCED EXTRUSION SYSTEMS
struktol
COLLIN LAB & PILOT SOLUTIONS
CLOEREN INCORPORATED
BÄRLOCHER
Chroma Color Corporation
MAAG Group a DOVER company
NFM
BYK
FB Balzanelli
ENTEK
CPM EXTRUSION GROUP Local Service Global Reach
AMERICAN CUTTING EDGE Industrial Blades & Knives A division of CB Manufacturing
GEFRAN BEYOND TECHNOLOGY
Barentz.
BUSS excellence in compounding
ECM
KRONES
GÖTTFERT THIS IS RHEOLOGY
chemigon
CEM
MECO SEALS An Employee Owned Company
Dynisco
MAG
Leistritz EXTRUSION TECHNOLOGY
orion ENGINEERED CARBONS Focused. Innovative. Responsive.
MIXACO MASCHINENBAU
BRITAS FILTRATION SYSTEMS
CIMBAR PERFORMANCE MINERALS
kaneka
GENOX USA
REDWAVE
MODIX PLASTIQUE INC.
NDC TECHNOLOGIES
plasmec Excellence in Mixing
LAB TECH ENGINEERING COMPANY LTD
ENTEC
PROMIX Solutions
Midwestern INDUSTRIES, INC.
Trendelkamp
SIKORA Technology To Perfection
Budenheim
POLYSCOPE fresh thinking, great products
UNIBROM CORP

Proudly supported by:

Compounding WORLD | Film and Sheet EXTRUSION | Pipe and Profile EXTRUSION | Plastics Recycling WORLD

Co-located exhibitions:

COMPOUNDING WORLD EXPO

POLYMER TESTING WORLD EXPO

PLASTICS EXTRUSION WORLD EXPO

PLASTICS RECYCLING WORLD EXPO

BOOK YOUR BOOTH HERE

Experience Addex · ZEPPELIN WE CREATE SOLUTIONS · pinfa North America · STEER AMERICA · sesotec · SHAMROCK · APEX

OXFORD INSTRUMENTS · BREAK Polymer • Filtering · PSI POLYMER SYSTEMS INC. · Gehring-Montgomery, Inc. · TER GROUP · ARTEC MACHINE SYSTEMS · APPLIED OPTIX

TROY The Gold Standard for Performance · BODEN SPECIALTY SERVICES · ALTECH · BERGEN International · HOSOKAWA MICRON · HOSOKAWA POLYMER SYSTEMS · Re-cre Recycling · PIXARGUS AUTOMATION BY VISION

ADITYA BIRLA · BIRLA CARBON · BPM BAY PLASTICS MACHINERY · SonicAire · BEKAERT better together · AVIAN Granulator · Una-Dyn Piovan Group · Silike Technology

PrintSafe Marking and Coding Solutions · NORAC ADDITIVES · TCF Precision Machining · American Industrial Products · PRODUX Nylon Processing · KUHNE GROUP

COMBILIFT LIFTING INNOVATION · STAR PLASTICS · exxel polymers inc. · DREYTEK · ALOK · VAC-U-MAX · ecopuro GLOBAL SOLUTIONS

Royce GLOBAL · PALMAROLE AG Trading & Marketing Consultants · ORLEN Unipetrol · Cardinal Recycling Company · schenck process · Southeast Machinery

get recycling · ZERMA · HERBOLD MECKESHEIM USA · iD Additives · TOYOTA TSUSHO AMERICA, INC. · POWDER KING · IMPERIAL INDUSTRIES INC

J-TEC MATERIAL HANDLING · POLYSTAR · LINDNER · PROGNOST Intelligence on Duty · 株式会社テクノベル TECHNOVEL CORPORATION · Otsuka Otsuka Chemical America, Inc.

MDV MODERN DISPERSIONS, INC. · sāco AEI polymers · METTLE FILTRATION PRODUCTS, LLC · Bronkhorst USA · Since 1950 union OFFICINE MECCANICHE · NASCA ELASTOMERS · Helluva CONTAINER A Balcon Enterprises Inc. Company

NATIONAL BULK EQUIPMENT AN NBE COMPANY · pmc · RAVIZZA PACKAGING USA · TOYOTA TSUSHO AMERICA, INC. · SCIENCES COMPUTERS CONSULTANTS · Orbetron · USE EXTRUDERS · enercon

Brought to you by:

AMI

www.ami.international/exhibitions

NEW

AMI | Market Reports

Mechanical Plastics Recycling European Market 2022

Published February 2022

Get the latest comprehensive analysis of the whole waste plastics value chain including:

- Operating environment
- Feedstock supply chain
- Enchanced market analysis
- Virgin resin vs. recyclate demand
- Technology overview
- Country profiles
- Largest recyclers information

GET YOUR FREE SAMPLE REPORT

www.ami.ltd/plastics-recycling

IMAGE: SHUTTERSTOCK

The VinylPlus initiative has overseen the build-up of PVC recycling in Europe for many years, leading to similar schemes being established in other countries and regions. Peter Mapleston reports on their progress

PVC recycling on the rise around the world

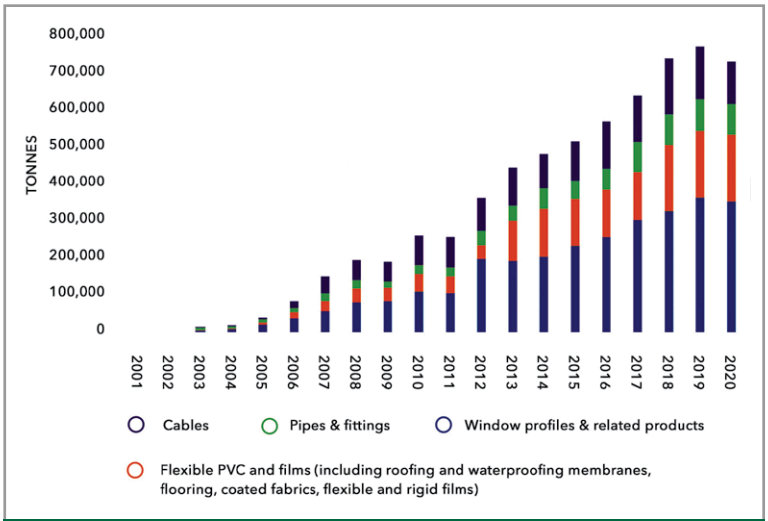
Recycling rates for PVC recovered from end-of-life industrial and consumer applications continues to rise, even in times of Covid. Growing interest in environmental issues is putting pressure on the construction sector to move towards a circular economy with greater emphasis on the sustainable recovery of waste materials. In the construction sector, what happens to many products at end-of-life is typically not considered due to their longer lifespans and the need for them to meet strict technical performance criteria. But sooner or later, the issue of recycling needs to be addressed. Fortunately, this is happening, all around the world.

VinylPlus, the European PVC industry's commitment to sustainable development, says that over the past 20 years, many advances have been made in PVC recycling, with the set-up of collection and recycling schemes that were virtually non-existent at the beginning of the century. "In 2020, and despite the Covid-19 pandemic, VinylPlus still achieved a great result, reaching more than 730,000 tonnes of PVC recycled and re-used into new products," it says. There are currently more than 100 operations in Europe which recycle PVC pipes, profiles, flooring, coated fabrics and membranes.

ESWA, the European Single-ply Waterproofing Association, has been recycling PVC in Europe for over 20 years. A formal programme called Roofcollect recovered 16,500 tonnes of roofing and waterproofing membranes for recycling in 2018.

VinylPlus established Recovinyl, a platform of recyclers and converters to facilitate PVC waste collection and recycling, close to 20 years ago. "Through these efforts, 6.5m tonnes of PVC have been recycled into new products [through 2020], preventing the release of nearly 13m tonnes of CO_2 into the atmosphere," it says. In 2020, recycled material represented about 27.5% of the estimated PVC available waste in the EU-27 plus

Main image: End-of-life PVC windows provide a waste stream for PVC recycling



PVC recycled within the VinylPlus framework through 2020
Source: VinylPlus

Norway, Switzerland and the UK. With 353,443 tonnes recycled in 2020, window profiles and related building products accounted for 48% of the total PVC recycled in the VinylPlus framework (see bar chart).

Recovinyl ensures transparency by providing certified recycling figures annually and monitors material's quality and safety through a system of traceability throughout the recycling chain. To further enhance Recovinyl's recording and tracing system, VinylPlus last year introduced RecoTrace, the first system to comply with the European Commission's Circular Plastics Alliance (CPA)'s monitoring requirements.

"VinylPlus confirms its commitment to recycle 900,000 tonnes and 1m tonnes of PVC per year in new products by 2025 and 2030, respectively, in line with the ambitions of the CPA and EU policy initiatives to encourage recovery, recycling and reuse of plastics," says the organisation.

In 2020, EPPA (the trade association representing the manufacturers of PVC window systems and related building products in Europe) and Recovinyl joined forces to develop a common approach to boost the recycling of window profiles to attain the VinylPlus 2025 targets. The action plan will focus on Germany, France and Poland, which have been identified as the countries with the highest potential for post-consumer window recycling. Rewindo, the German recycling initiative for PVC windows, roller shutters and related products, estimates that two-thirds of the approximately 300 million windows currently in use are made of PVC. As they come to the end of their useful lives in the coming years, there will be considerable potential for further expanding the recycling of PVC windows in the country.

In France, government ecological transition agency Ademe is providing financial support to help companies move to the circular economy. One challenge it is addressing is to find sources of post-use PVC to be recycled. One company taking advantage of the support is **Benvic Group** subsidiary **Ereplast**. This recycling company is using resources at Benvic headquarters in Chevigny to help create business for PVC compounds with recycled content that can be used in the original application. Benvic acquired Ereplast in October 2019 and has since refocussed its operations solely on the recovery of PVC. "This was already its main activity and thanks to Ademe's help, the business will now be able to speed up its investment schedule to produce more material," says Benvic.

"The future challenge for recyclers is not so much to sell, but to find correctly sorted and identified materials to recycle. One of the strategies pursued by Benvic is to identify all likely PVC deposits to be recycled – either production scraps or end-of-life products – and then to find suitable recycling processes."

Benvic says it is particularly interested in PVC products falling within the Extended Producer Responsibility framework which is being implemented in new sectors such as construction, DIY, and sports/leisure. It says relations are being established not only with product manufacturers but also eco-organisations. Prospecting work is underway in areas as diverse as inflatable mattresses, bank cards, traffic cones, and decorative films for industrial applications.

The company is also incentivising recovery of post-consumer PVC. At a sorting centre near Chevigny, end-of-life PVC building products such as windows, roller shutters, and cable ducts can be dropped off free of charge. Waste reception centre employees trained by Benvic assess what can be recycled. Benvic hopes to repeat the operation elsewhere in France.

In the UK, **CNC Recycling**, headquartered in Middlesbrough and with several locations in England and Scotland, is a uPVC window recycling specialist. Sales and Purchasing Director Ian Ward says one barrier to cost-effective recycling of post-consumer window frames is the ability to retrieve meaningful quantities to support a recycling scheme with input feedstock.

"CNC Recycling has grown from a single North-East operation to a nationwide uPVC window recycling specialist company committed to offering a sustainable alternative to landfill for old windows and doors for the fenestration industry," he says. "UPVC windows can be re-used and repurposed

PLASTICS RECYCLING WORLD EXPO EUROPE

BOOK YOUR STAND

14-15 June 2023
ESSEN, GERMANY

"These are not just visitors who are just coming to do window shopping. These are people who come with aims and objectives and are people with authority."

Ebbo Botwe, GPMA

Present your products to key decision makers at this focused exhibition

Book your stand, contact us today:

Levent Tounjer,
Exhibition Sales Manager
levent.tounjer@ami.international
+44 (0) 117 3111 518

Brought to you by: AMI

Proudly supported by: Plastics Recycling WORLD

Co-located with: COMPOUNDING WORLD EXPO, POLYMER TESTING WORLD EXPO

up to ten times which can potentially give them a 150-year lifespan." The company last year collected and recycled almost 15,000 tonnes of uPVC from old window frames.

Once collected, the frames from windows (and doors), as well as offcuts from fabrication of new frames, are re-processed, separating the PVC from the metal reinforcements to eventually produce a recycled compound pellet for re-use.

Ward says that as a result of the increase in demand, CNC Recycling made several "significant" investments throughout 2021 in plant and machinery. He says householders are changing their windows either to upgrade the thermal efficiency of their properties or in response to changes in fashion (with new colours for example).

In the UK at least, almost 85% of old windows are being replaced with uPVC, he says. "As members of the Recovinyl scheme this allows us to report volumes of recycling, meaning the industry can accurately track how much material is being processed and reused in new products. This allows for effective lobby and engagement with government to help safeguard the future of the very successful PVC recycling industry."

There have been significant investments made by the large profile houses into uPVC recycling facilities and infrastructure within the UK, Ward says. He also points out that two years ago, the UK's Glass & Glazing Federation partnered with CNC Recycling to launch a new uPVC recycling scheme for installers and manufacturers.

Rehau is one of the world's largest extruders of uPVC window profiles. With its UK base in Runcorn, its subsidiary **PVCR** is the largest uPVC recycler in North West England, processing over 13,200 tonnes of post-consumer window and door frames every year. General Manager Ceri Davies says: "The Recovinyl scheme has been hugely influential in inspiring best practice across the European PVC value chain. Specifically, the quantifiable data it provides on PVC waste and PVC recyclate uptake is an invaluable barometer for our operations. The information we receive through the Recovinyl scheme has definitely informed our future ambitions. This includes our objective to recycle 100% more waste by 2024 – the equivalent of salvaging and processing 24,000 metric tonnes of old window frames every year."

IMAGE: CNC RECYCLING

Above: PVC window frames are increasingly recycled in the UK

Rehau is also looking to increase the amount of the highest graded PVC material to be reintroduced to new product lines. Rehau's colour demands for recycled PVC are unequivocal, says Davies, in order to ensure no further colouring inorganic chemicals are used. It is extremely important that PVCR ensures all recycled frames re-entering the company's supply chain meet this requirement.

"That is why we are looking to further improve our filtration processes – currently, around 50% of salvaged frames are recovered as the highest-grade PVC, with 35% of the by-product created through shredding and granulation being sold to other businesses. We are looking to improve this to 70%."

Since its 2009 inception, another UK scheme,

Recycling PVC from cooling towers

BM Technology Tech has created something of a niche for itself with recovery, cleaning, chopping and milling of rigid PVC parts from refurbished and decommissioned power station cooling towers in the UK. Each cooling tower can contain as much as 400 tonnes of recyclable PVC, in the form of honeycomb sheets, which until now has been going to landfill.

By the end of their first useful lives, the honeycombs are heavily contaminated, typically with limescale and silt from the cooling water. The honeycomb sheets are much lighter than compact sheet, and so more expensive to transport to any recycling facility. For this reason, BM Technology Tech has developed a mobile compactor that enables it to carry out preliminary size reduction on-site. "We are saving transport costs and carbon emissions with this innovation," says Business Manager James Morley, brother of company founder Ben Morley.

IMAGE: BM TECH

Left: BM Technology Tech in the UK recovers, cleans and chops rigid PVC

The company sells the regrind for recompounding into pellets which can be processed into products such as gutters, window frames and pipes.

BM Technology Tech also has a growing business in recovery of uPVC from when cooling towers or water treatment plants are refurbished; elements need replacing after 10 to 20 years, depending on local conditions. A 15 m radius trickle filter bed with 3.6 m depth of filter media contains around 2,500 m^3 of plastic, weighing close to 65 tonnes. "We are continually finding more places where honeycomb PVC has been used and is in need of recycling," Morley says.

Recofloor, has diverted more than 6,000 tonnes of waste vinyl flooring from landfill. The material is recycled back into new flooring, as well as traffic calming products. Latest data for 2021 shows that a total of 578 tonnes of waste vinyl flooring was collected through Recofloor.

Carla Eslava, Manager of the scheme, says the construction industry is the UK's biggest consumer of natural resources. Government statistics indicate around 65 million tonnes of non-hazardous construction and demolition waste has been produced annually in the UK in recent years. Recovery rates are well over 90%, but nearly 5m tonnes is landfilled.

Below: The UK's Recofloor scheme has diverted more than 6,000 tonnes of waste vinyl flooring from landfill since 2009

IMAGE: RECOFLOOR

"While many materials, such as PVC and metals, are recyclable, the construction sector is a challenging diverse environment for waste management and requires a heavy reliance on engaging with contractors to collect these recoverable resources."

More work will be needed in the future to establish effective recycling techniques for end-of-life material, and end markets for the recyclates, Eslava says.

For installation waste, he says, Recofloor is a great example of "circular construction," offering a sustainable collection service for commercial waste vinyl flooring generated from refurbishment and new build projects, including live project sites. The scheme accepts both installation offcuts and uplifted smooth and loose lay vinyl, as well as Luxury Vinyl Tiles (LVTs) and safety offcuts and roll-ends.

Moving towards circular construction principles still presents many challenges, such as the collection of materials on a busy site with lots of different contractors, transportation, a lack of sorting

Save €200* when you book before 8 April 2022

AMI | Events

Compounding World Congress

7-8 June 2022 | Cologne, Germany

Identifying new business strategies, innovative additives and process optimisation for thermoplastics compounders

Confirmed speakers include:

Dr. Walter Ramirez
CEO & Founder
Innventik

Thorsten Hilgers
Project Manager Plastics
Quarzwerke HPF The Mineral Engineers

Nicolas Schlutig
Technical Manager
Sumika Polymer Compounds

Dr. Leo Wu
General Manager
Kingfa

Sponsored by:

Media supporter:

*This discount cannot be used in conjunction with other offers. Offer ends 8 April 2022.

SECURE YOUR PLACE TODAY

INJECTION MOLDING & DESIGN EXPO

MAY 25-26, 2022
DETROIT, MI, USA

Hear from expert speakers including:

Thierry Fabozzi
President & CEO
Plastic Technologies Inc. (PTI)

Katie Roco
Customer Engineering Director
Faurecia Interiors

Henrik Palokangas
Application Development – Sustainability Specialist
Polykemi

David Clark
Vice President, Sustainability
Amcor

Alper Kiziltas
Technical Expert, Sustainability and Emerging Materials
Ford Motor Company

Diane Marret
Sustainability Manager, Consumer Packaging North America
Berry Global

FREE CONFERENCE PROGRAM OUT NOW!

REGISTER FOR FREE HERE

Headline sponsor:
MHolland

Brought to you by:
Plastics News Injection WORLD

Organized by:
AMI CRAIN COMMUNICATIONS GLOBAL POLYMER GROUP

infrastructure and limited end markets, Eslava notes. "For example, Recofloor relies on the efforts of individual contractors to help return the vinyl flooring for recycling. Without effective communication and their willingness to participate, it would not be possible."

Richard McKinlay, Head of Consulting at resource recovery specialist **Axion**, says installation waste "is where we really need to focus our efforts initially to get the material coming back. If you build up that system, then you start to build infrastructure which could then allow end-of-life material to enter it eventually."

In Italy, **PVC Forum Italia** and VinylPlus launched WREP (Waste REcycling Project) in 2016 to evaluate the potential for improving PVC recycling and promote the development of pilot schemes for the collection and recycling of PVC waste and increase the quantity and quality of PVC recycled from urban waste (construction and demolition). In 2018, the Veritas Group, the multi-utility of the Venice and Treviso area, and DAE, the regional representative of Recovinyl, were involved in the first pilot project.

During the experimental phase, around 135 tonnes were collected in one year, of which 89% was transformed into recycled PVC. PVC Forum Italia trained the operators of the supply chain to recognise, select and manage PVC applications at the end of their life. In the meantime, the WREP project has been extended into other areas in Northwest Italy and also Tuscany.

PVC Forum Italia says the total of the waste managed through the various initiatives of the WREP project is equal to about 42,000 tonnes. "Of these, 549 tonnes of PVC have been selected and separated, and made available to recyclers, who have produced 502 tonnes of quality recycled PVC, equivalent to 1,000 tonnes of CO_2 emissions saved compared to virgin PVC. Based on these preliminary data, the availability of PVC waste can be estimated at more than 10,000 tons/year nationwide. The initiative, adapting to different territorial needs, can be replicated everywhere."

IMAGE: VINYLPLUS ITALIA

Above: PVC pipe waste collected in Italy

Last year, Padua-based optical instrument and systems maker Phoenix was commissioned to design and build a simple handheld device for use by operators sorting PVC from other plastics. "Even if still at the prototype level, the sorting system proved to be robust, reliable and responsive to the proposed requirement," says Carlo Ciotti, Chairman of VinylPlus Italia and PVC Forum Italia.

It is not just in Europe that industry bodies have been moving ahead with PVC recycling initiatives. For example, the **Vinyl Council of Australia** has been facilitating the growth in recycling PVC waste in Australia since 1998.

Using 2020 modelling data on where the greatest volumes of available PVC waste would likely be generated, VCA estimates about 157,000 tonnes of PVC waste may be generated annually across 10 key application areas. This equates to about 4.5% of total plastics consumption annually in Australia; the current recovery/recycling rate for PVC in Australia is only about 5%.

The Australian industry's voluntary PVC Stewardship Program (PSP), managed by VCA, has over 50 companies signed up from across the PVC value chain. In 2020, four out of five PSP signatories putting products on the market used recycled PVC. Over 1,400 tonnes of recycled PVC was used by signatory local converters in products including building profiles, flooring, and pipe.

Research projects conducted by VCA, its members and collaborators into economically feasible infrastructure and technology for PVC recycling include the TexBack project, exploring reprocessing and recycling of composite materials such as PVC coated textiles and flooring. A pilot

IMAGE: VINYL COUNCIL OF AUSTRALIA

Left: PVC recyclate from pool liners in Australia

plant is being planned for the PVC separation technology and design and development of a business model for a product stewardship scheme for PVC coated textiles. If successful, it will divert up to 20,000 tonnes of PVC and polyester annually from landfill, to be reprocessed and recycled into quality new products.

Australia has also been in the vanguard of recycling PVC hospital waste. In 2013, the VCA, with members Baxter Healthcare and Welvic Australia, launched the PVC Recycling in Hospitals scheme, which collects and recycles high volume PVC products such as IV bags, oxygen masks and tubing into useful new products.

Through 265 participating hospitals around Australia, the program has collected over 500 tonnes of PVC medical waste, equivalent to 25m IV fluid bags. Following its success, the VCA has inspired similar PVC medical recycling schemes in Europe, UK, South Africa, Canada, and Thailand.

The **Vinyl Institute of Canada**, for example, launched the PVC 123 Medical PVC Recycling Pilot partnership in Canada in September 2020. At the time, it said hospital operating rooms, which produce the highest volume of IV bags, oxygen mask, and oxygen tubing waste, would be the first point of collection, after which, collected materials will be remanufactured into new products. Several hospitals across the country are now involved in the project.

In North America, the Washington, DC-based Vinyls Council says that of the approximate 1.25m tonnes of vinyl materials that it estimates is available to be landfilled (from industrial or post-consumer material streams), around 500,000 tonnes are captured and recycled annually in the US and Canada; these comprise 435,000 tonnes of pre-consumer vinyl materials and 65,000 tonnes of predominately non-packaging post-consumer vinyl materials (essentially construction materials).

IMAGE: SIKA SARNAFIL

The original 43,000m² PVC roof on the Rogers Centre in Toronto needed to be replaced after storm damage. The complex structure was replaced by another PVC system developed by Sika Sarnafil. This company administers a roof take-back program through which roofing contractors can help the manufacturer reclaim used PVC material that will find new life in roof membranes or walkways. The program has recycled more than 36,000 tonnes of processed material

The **Vinyl Sustainability Council**, which is composed of members from throughout the US vinyl value chain, is focused on increasing recycling of post-consumer vinyl recycling. It is working with the Chemical Fabrics and Film association on a vinyl roofing recycling pilot program; and the Vinyl Siding Institute on a vinyl siding pilot program in Northeast Ohio.

The Vinyl Roofing Division of the **Chemical Fabrics and Film Association** (CFFA), in Cleveland, Ohio, is composed of the leading manufacturers of PVC roofing membranes in North America. In the US, post-consumer PVC roof recycling has been predominantly dependent on individual company initiatives. As a result, recycled volumes are significantly less than in Europe, says the CFFA's Jenny Oblock.

"Nonetheless, the technical feasibility of post-consumer PVC roof recycling has been proven by several US roofing companies." One of the examples she cites is the Rogers Centre, home of Major League Baseball's Toronto Blue Jays (see photo). "Collectively, the member manufacturers of the CFFA Vinyl Roofing Division recycled a combined nearly 1m pounds [approx 450 tonnes] of PVC roofing membranes at the end of their service lives in 2020," she says.

"The CFFA Vinyl Roofing Division is evaluating a path to transition the roofing pilot program to a national program by building a business case for investment needed to increase post-consumer recycling of PVC roofs."

Since late 2020, the **Vinyl Siding Institute** in Alexandria, Virginia, has been working on a fact-finding mission to develop a recycling program model that may be replicated throughout North America. Last September, several prominent players created an alliance in the geographic heart of the industry that they say will make a strong impact on polymeric siding's recycling program development. This is the Northeast Ohio Vinyl Siding Recycling Coalition (NEOH-VSRC), serving Cuyahoga County (metro Cleveland) and surrounding areas.

The objective is to set recycling standards and coordinate consumers, contractors, distributors, waste collectors, transportation groups, cleaners/recyclers, manufacturers and other relevant

Save €200* if you book before 18 March 2022

AMI | Events

Chemical Recycling

14-15 June 2022 | Cologne, Germany

Discover the developments in advanced recycling and its integration into the European recycling supply chain

Agenda out now! Speakers include:

Hanne Jones
Business Unit Manager
AMI

John Sewell
Secretary General,
Chemical Recycling
Europe

Patrick Child
Deputy Director
General
European Commission-
DG Environment

Dr. Richard von Goetze
Head of Chemical
Recycling,
Alba Group

Other speaking companies include: P&G, Audi, Clariter, CEFLEX, SABIC and European Chemical Industry Council - CEFIC

BOOK YOUR PLACE

Sponsored by:

Pryme making plastics circular

GSF The Upcycling Leap!

MURA TECHNOLOGY

erema group

Media supporters:

Plastics Recycling WORLD

*this discount cannot be used in conjunction with other offers. Offer ends 18 March 2022.

IMAGE: BAUSANO

Above: Bausano says its MD Plus and MD Nextmover twin-screw extrusion lines are suitable for recycling processes

Bausano highlights twin-screw extruders for PVC

Extrusion equipment maker **Bausano** says there are benefits to using its twin-screw extruders to produce granules from rigid and flexible PVC process scrap. "The recycling of post-industrial PVC residues reaps a double benefit," comments Alessandro Ruotolo, Extrusion Test Manager at Bausano.

"On the one hand, environmental protection, reducing both the consumption of the energy required to produce the same amount of new PVC and greenhouse gas emissions. On the other hand, granulation reduces company expenses owing to the disposal of PVC waste to a minimum, creating a closed loop process that converts a management cost into a profit."

The extrusion process of residues or waste, to be treated with additives, fillers and fibres, requires high performance, especially in the mixing and degassing stages, Ruotolo says, as he highlights the Bausano extruders.. "This is why the use of twin-screw machines for re-extrusion into granules offers concrete advantages, in terms of greater flexibility in the formulation to reach the required result. Furthermore, the presence of contaminants, which represents one of the primary difficulties in the regeneration of the PVC, can be stopped by a specifically designed filter change system."

He says Bausano's MD Plus and MD Nextmover twin-screw extrusion lines are suitable for recycling processes as they are able to process and remove impurities of plastic materials from scraps or post-consumer waste.

stakeholders to increase the amount of post-consumer recycling in the area. Goals include creating a solution that works directly with dealers, contractors and mill shops to collect, return and recycle scrap PVC from fabrication shops, construction sites and remodelling projects.

Last October, David Foell, President & CEO at Return Polymers, a coalition member, said the Coalition had recycled over 18 tonnes of vinyl siding since they started organising in mid-August. "Return Polymers has been doing recycling for 30 years," Foell said. "Thanks to the latest product innovations and improved technologies, recyclers like us can now use post-consumer materials to make top-quality products."

Medical pressure

Last June, NGO Health Care Without Harm (HCWH Europe) issued a paper on the complexity of health and environmental issues associated with the entire life cycle of PVC. HCWH Europe said: "All current evidence supports the simple proposition that PVC is problematic and that it presents significant, often avoidable health issues." The NGO is calling on policymakers to develop a strategy for a PVC phase-out in Europe.

Members of the PVC medical industry, via PVCMed Alliance, have responded, saying the position adopted in the paper can hamper circular plastic initiatives in hospitals. PVCMed Alliance is The European Council of Vinyl Manufacturers' value chain platform to raise awareness and promote informed decisions about the use of PVC in healthcare.

Ole Grøndahl Hansen, PVCMed Alliance Project Manager, says: "The paper contains so many errors that we must urge European policymakers and hospitals to disregard it. Many hospitals around Europe are currently investigating how to implement circular initiatives for their plastic waste. Paradoxically, if they decide to follow the recommendations from NGOs, hospitals will do more harm than good for the environment."

He says: "The NGO paper claims PVC is unrecyclable, can easily be substituted and contains chemical substances that are detrimental to health and environment. These and several other unfounded allegations are all thoroughly disproved in [our] critical review."

Currently, more than 300 hospitals around the world collect PVC-based medical devices for recycling.

To accelerate the green transition of European healthcare, VinylPlus Med last October launched a pilot scheme in Belgium that it says will later be

implemented elsewhere in Europe.

Launching the Belgian scheme, PVCMed Alliance said that adequate sorting and recycling of non-infectious plastic waste can significantly reduce the environmental impact of hospitals and their operational costs. The recycling scheme for single-use PVC medical devices is designed to help Belgian hospitals sort their PVC medical waste stream. The scheme focuses on clean and REACH-compliant PVC waste that can be recycled into a wide range of value products marketed across Europe.

The project brings together Brussels-based hospital group Europe Hospitals, Renewi (headquartered in the UK but operating mostly in the Benelux region) as the waste management company, Raff Plastics (Houthulst, Belgium) as the recycler, and VinylPlus.

PVC is the single most used material for plastics-based medical devices with a market share of nearly 30%. A survey commissioned by PVC Information Council Denmark concluded that it is expected to retain its number one position in the years to come.

Addressing the HCWH (and other NGOs) discussion of the problem in recycling PVC containing lead stabilisers, PVCMed Alliance says a voluntary replacement of lead-based stabilisers was completed by the PVC industry in the EU in 2015. It says: "Recycling of lead-containing PVC is currently being discussed in the EU. According to ECHA recycling in applications such as middle-layer in three-layer sewer pipes or window frames is preferable to incineration or landfilling. The NGOs are against recycling of lead-containing PVC; however they do not propose any sustainable solution on handling such wastes."

IMAGE: VINYLPLUS MED

Above: VinylPlus Med has initiated a medical PVC recycling pilot scheme at hospitals in Belgium

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.vinylplus.eu**
- **www.benvic.com**
- **www.ereplast.fr**
- **www.upvc-recycling.co.uk**
- **www.rehau.com**
- **www.pvcr.co.uk**
- **www.recofloor.org**
- **https://axiongroup.co.uk**
- **www.pvcforum.it**
- **www.vinyl.org.au**
- **www.vinylinstituteofcanada.com**
- **https://vantagevinyl.com**
- **www.chemicalfabricsandfilm.com**
- **www.vinylsiding.org**
- **https://pvcmed.org**
- **https://bmtechrecycling.com**
- **www.bausano.com**

INJECTION MOLDING & DESIGN EXPO

FROM CONCEPT TO DELIVERY

MAY, 25-26 2022
DETROIT, MI, USA

REGISTER AS A FREE VISITOR HERE

Companies already confirmed to exhibit include:

MILACRON
CONAIR
tederic SMART INJECTION
mastip hot runner solutions
VIVE Marketing for Manufacturers
Frigel
Wittmann Battenfeld
AMPACET Plastics Reimagined
iMFLUX FEARLESS INNOVATION
VEM
StackTeck
Chroma Color Corporation
ACCEDE
Cavalier Tool & MANUFACTURING LTD.
RJG MOLD SMART
PCS COMPANY Turn To The Industry Experts
Sumitomo SHI DEMAG
YIZUMI 伊之密 WE WALK ALONGSIDE THE WORLD
Moldex3D MOLDING INNOVATION
NU★ICE
EAS CHANGE SYSTEMS
ACS GROUP
DME
ALPHALASER
STAR PLASTICS Navigating Custom Compounds
Krauss Maffei Pioneering Plastics
GP GENERAL POLYMERS THERMOPLASTIC MATERIALS
CAE AUTODESK. Reseller
ChasePlastics Redefining Resin Distribution
benpac packaging
cumberland
aec
PROGRESSIVE COMPONENTS
STERLING

Brought to you by:
Plastics News
Injection WORLD

Organized by:
AMI
CRAIN GLOBAL POLYMER GROUP

Headline sponsor:
MHolland

MEET YOUR BUSINESS GOALS AT NORTH AMERICA'S FOCUSED MEETING PLACE FOR THE INJECTION MOLDING INDUSTRY

CPT CINCINNATI PROCESS TECHNOLOGIES

Beaumont Revolutionizing Injection Molding

DIJET

BAUER COMPRESSORS PLASTICS TECHNOLOGY GROUP

POLYMAX TPE

Routsis Training Hands-on. Online. Ongoing.

ZEIGER Industries

MHolland

Beacon INDUSTRIES World Class Manufacturing

sāco AEI polymers

Purgex Purging Compounds

SIGMASOFT Virtual Molding

polykemi BRINGS OUT THE BEST IN PLASTICS

Shibaura Machine

2R AUTOMATION

ASS Automations-Systeme

Filtroil

iD iD Additives

EPS FloTek Plastic Flow Analysis Services and Software

ABS ADVANCED BLENDING SOLUTIONS LLC

ESM EQUIPMENT SOLUTIONS OF MICHIGAN

LENZKES Clamping Tools

CLEAN PLAST PURGE FAST

Spark Industries

ACTION MOLD & MACHINING

DOMO caring is our formula

intouch i4 cloud

CRÉATIONS foam Inc. CREATIONS

MATSUI

INCOE HOT RUNNER SYSTEMS

and many more...

CLICK HERE TO FIND OUT MORE ABOUT EXHIBITING

www.injectionmoldingexpo.com

AMI | Events

Stretch and Shrink Film

12-14 April 2022 | Barcelona, Spain

AGENDA RELEASED

Optimising brand owners' marketing and transit operations

Discover the most recent stretch and shrink film advancements that are impacting the market, including safety and sustainability requirements in the value chain.

- **Discover** the most recent market trends
- **Learn** about the latest safety and sustainability requirements
- **Discuss** the various advances in materials and technology
- **Gain** real business insight
- **Network** with industry experts

Secure your place today

Sponsored by:

DAVIS-STANDARD

SML
EXTRUSION LINES – ENGINEERED TO PERFORM

Media supporter:

Film and Sheet EXTRUSION

Industry-leading speakers include:

Hans Wels
Business Director
Trioworld

Luke Venechuk,
Director
Packaging Engineering
Highlight Industries

Erich Steiner
CEO
Duoplast

David Ang
General Manager
Thong Guan Industries

David Finnemore
Senior Technical Consultant
Windmöller & Hölscher

Ed Thorne
Head of Business Development
Loop Europe

*discounts cannot be used in conjunction with other offers

VIEW THE AGENDA TODAY AT www.ami.ltd/attend-stretch

Automatic approach to quality pellets

IMAGE: MAAG GROUP

Compounders worldwide are looking to pelletiser automation to improve quality, efficiency, flexibility, and safety, as well as deal with a shortage of skilled workers. Jennifer Markarian reports

Today's plastics industry, including compounders and recyclers producing pelletised materials, is responding to a new operating environment characterised by the challenges of fluctuation in the economy, availability of employees, and material supply. Current supply-chain issues are making production planning more difficult and are driving an increasing need for flexibility in operations, which must be supported by both personnel and machinery.

Faced with such challenges, compounders should consider taking a holistic view of downstream equipment with a focus on systems providing easy changeover, cleanability, accessibility and flexibility, according to Alexander Helm, Product Manager Dry Cut at **Maag Group**. In addition, and he says this is especially important given personnel shortages, automated machines should be sought to help minimise operator attendance.

Recent Maag Group pelletiser developments include completing the combination of the Automatik-Scheer product line into a new generation of strand pelletisers, as well as the introduction of its Zero-Gap system for cutting very fine fibres on strand pelletisers. The latter is being used, for example, for a specialty PP fibre used as reinforcement in construction materials.

"In traditional strand pelletising applications, a minimal cutting gap must be maintained between the rotating cutting rotor and the fixed cutting bar. The Zero-Gap system allows the cutting rotor to touch the fixed knife during operation, with the result that even very thin fibres can be cut accurately," says Helm.

Maag has also further optimised its Pearlo underwater pelletiser technology, which is designed to process spherical pellets at high capacities of up to 36,000 kg/hr (79,200 lbs/hr). This flexible system can be used to pelletise virgin materials, compounds, masterbatches, engineering plastics, wood and natural fibre-filled polymer composites, and thermoplastic elastomers, as well as for varied recycling applications.

Helm says the Pearlo pelletiser integrates moveable and flexible components on one frame to ensure increased uptime. "The combination of

Main image: Fast product changeover, flexible operation, and automated setup and operation are becoming priority requirements in pelletiser selection

IMAGE: MAAG GROUP

Right: A P-JSG400 dry cut strand pelletising system from Maag

die design and turbine style cutter hub allows one cutter hub to be used for multiple jobs, resulting in a cost advantage of up to a factor of eight, while operator safety has improved and operational duration doubled," he says.

"Thermally, this combination widens the operational window, while heat losses have been reduced by 25%. In combination with the Heat Flux die plate design, the production window is further enlarged and operation improved for many sensitive materials." The Pearlo system is available with either manual or automated blade-advance capabilities. In the fully automated Pearlo-EAC version, the blade advances during operation.

Also new from Maag is the eXso centrifugal pellet dryer, which is claimed to offer higher throughputs in a more compact and easier to clean format. The eXso pellet dryer is suitable for use with both underwater and wet cut pelletisers and has been tested at production rates up to 8,200 kg/hr.

A key feature of the eXso design is the three-door housing, which is said to allow improved access and visibility to the interior of the unit to provide faster and more effective cleaning to minimise risk of cross-contamination. The design reduces floor space requirements by around 20% and is quieter in operation (down to 80dB depending on the selected option).

Digital solutions

Helm says the company is also seeing growing demand for digital pelletising solutions. "Our technology is focused on machine condition and wear monitoring, communication between the individual functional units of the system, and comprehensive documentation," he says.

Combining Maag's XANTEC controls with systems to analyse data in real-time provides in-line pellet quality features, while the application of artificial intelligence results in improved procedural insight that can be used to optimise pelletising lines. "We are making progress towards our customers having more stable and transparent processes," Helm says.

Automation is a key requirement for pelletising systems used in almost all application areas, according to **Coperion**, whether that be high performance compound production or pelletising of recycled polymers. Frank Lechner, General Manager Process Technology and Research & Development in the Polymer Division at the company, cites automatic strand conveying as one example, providing the ability for safe start-up of the pelletising process without the need to touch or pull the strands.

"A high degree of automation in [strand] pelletising results in no unnecessary production interruptions due to strand breaks. This increases the efficiency of the entire compounding system," Lechner says.

Coperion recently commissioned a turnkey system for Lanxess constructed around the company's high-performance ZSK 92 Mc^{18} twin screw extruder equipped with an SK92 die head and automated ASC strand conveying system from its Coperion Pelletising Technology division. The combination of the die technology with a high level of pelletising process automation is said to have enabled Lanxess to achieve higher throughputs in production of its polyamide compounds.

Lechner says the SK92 die head incorporates an intelligent heating/cooling concept, which results in a homogeneous temperature distribution that ensures strands discharge uniformly across the entire width of the die head, even at high throughput rates. Optimised flow geometry in the die head further improves compound quality by reducing stress in the melt.

The fully automatic strand conveying system takes the strands from the die head and guides them

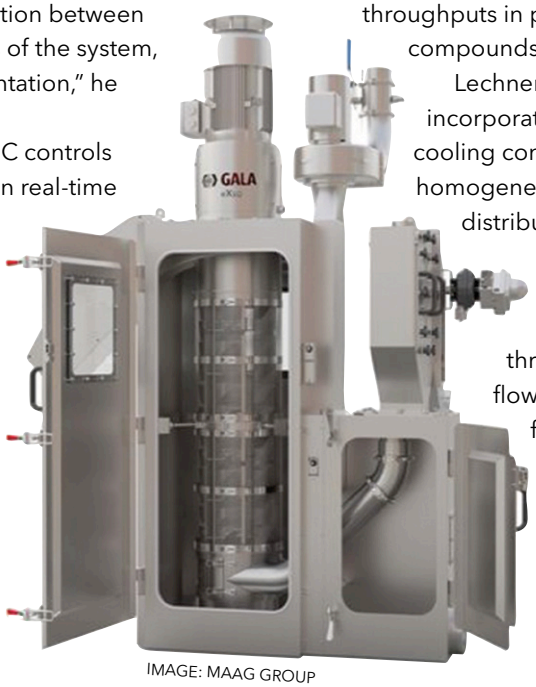


IMAGE: MAAG GROUP

Right: Maag Group's new eXso pellet dryer is designed to save space and be easy to clean

AMI | Events

Agricultural Film

August 16-17, 2022 | San Diego, CA, USA

Maximizing crop yields with an effective use of silage, mulch, and greenhouse films to feed the growing global population

SAVE $300*
by booking before
May 20, 2022

MEET YOUR INDUSTRY!

- Learn about the agricultural film trends in the American market
- Discover ways to increase efficiency and sustainability of your agricultural and farming business
- Find out about key global technological developments in silage, mulch and greenhouse films
- Explore opportunities for film waste reduction through recycling and biodegradable technologies

Book your place

CONTACT US

Chris Chisman
Conference Sales Executive

T +1 (484) 258 2897
E chris.chisman@ami.international

Media supporter:

Film and Sheet EXTRUSION

*Discounts valid off the full price and cannot be used in conjunction with any other offers.

Coperion's fully automatic ASC strand pelletising system reduces product loss and downtime

IMAGE: COPERION

over a cooling water chute and downstream conveyor belt to the SP 700 HD strand pelletiser's intake. Startup is fully automatic, as is conveying and rethreading of any broken strands. As a result, Lechner says there is no product loss or production interruptions.

Streamlining trend

The growing interest in automated production equipment is also identified as a significant trend at US-based pelletising systems maker **Bay Plastics Machinery**. "Companies are trying to streamline their existing process with the goal of reducing the number of operators. This includes automation of repetitive tasks to where a single operator can be responsible for multiple pelletising lines without being overwhelmed," says Vice-President of Sales James Forgash.

However, he sees pelletising system automation offering more, citing improved safety through the elimination of the need for operators to interact with hazardous pieces of equipment as well as gains in efficiency and quality. Automation combined with measurement and data collection, for example, opens potential for improved process control and tighter adherence to quality specifications. Such an approach could include monitoring the melt upstream of the die (in the case of an underwater pelletiser) or the strands coming out of the die (in the case of a strand pelletiser), as well as in-line measurement of pellets.

Forgash says BPM is working with several partners to develop vision systems that will allow more autonomous pelletising lines. "The systems would monitor and control strands coming out of the die to determine if several key quality issues are being maintained (strand diameter, temperature, strand separation, dropped strands, etc). This system will detect quality issues as they are happening and make adjustments or signal alarms to prevent or reduce scrap downstream," he says.

Data collection is another key step to improved control. Forgash says BPM is working to give equipment users the ability to store product recipes or to enter a pellet-per-gram requirement that the system can then use to automatically adjust pelletising line variables to achieve target specifications.

Tackling dust

One of the latest BPM equipment developments aims to provide a solution to the long-standing issue of dust created during pelletising. "Whether the pellets were fractured at the time of cutting or sharp corners are 'knocked off' during conveying, this dust is a potential problem with downstream operations and needs to be removed efficiently," says Forgash.

The company's pellet evacuation system transfers cut pellets from the cutting chamber, which initially reduces the amount of dust generated by preventing pellets from being cut twice. "A double cut generates a pellet that is now a fraction of the intended size and out of spec. Evacuating the pellet immediately reduces the

IMAGE: BAY PLASTICS MACHINERY

Above: Dust is commonly produced during pellet cutting and conveying (left). BPM's pellet evacuation system and dedusting cyclone results in a marked reduction (right)

JOIN US NEXT MONTH!

Single-Serve Capsules
VIRTUAL SUMMIT

29-31 March 2022

Identifying opportunities and overcoming obstacles in the single-serve capsules industry

Five reasons to attend:

- **Gain** insight into the latest industry trends and product innovations
- **Discover** dynamic new applications from food companies
- **Network** with key stakeholders from the supply chain from the comfort of your own home or office
- **Learn** about the latest developments in recycling opportunities for single-serve capsules
- **Explore** different approaches to sustainability from material innovations to end-of-life choices

If you are a brand-owner, roaster or capsule filler, you are invited to attend this virtual summit free of charge*! Please contact Agata Swietek to secure your free place.

BOOK YOUR PLACE HERE

Sponsored by:

IMA COFFEE Coffee Processing & Packaging Solutions

AluSense Aluminium Capsule Solutions

cama GROUP Innovation meets Experience

CODAGROUP

GOLDEN COMPOUND

MENSHEN

NatureWorks

Media supporters:

Injection WORLD

Film and Sheet EXTRUSION

Speakers include:

Jason Farrell
Mother Parkers Tea & Coffee

Pablo Flores
Café Señor K

Eileen Gordon-Laity
European Coffee Federation

*AMI will check that applications for free places meet its criteria and reserves the right to refuse free admission

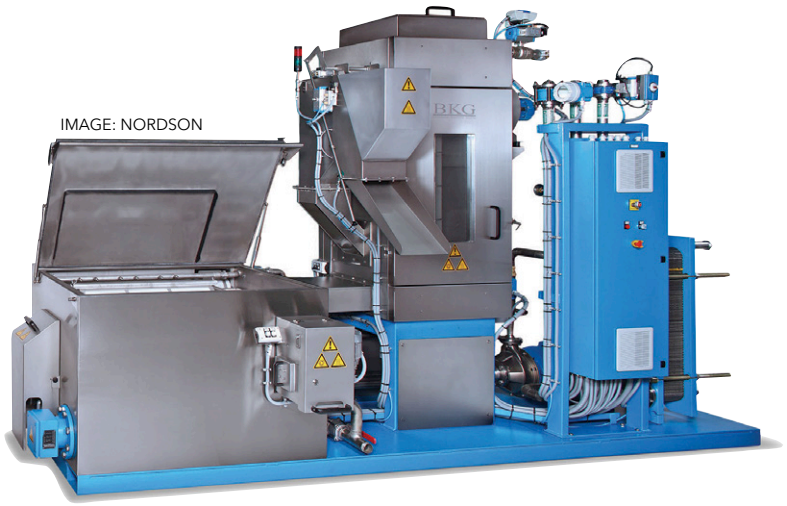


IMAGE: NORDSON

Above: Nordson's BKG Optigon water filtration system eliminates fines from underwater pelletising systems

chance that it could bounce around the cutting chamber and be cut twice," explains Forgash.

Pellets are then conveyed to a separate area where any remaining dust, or any dust generated after the cut, can be removed with a secondary dedusting cyclone. "This cyclone uses a proprietary ratio of counterflow air in the right areas to remove a controllable amount of unwanted materials sizes from the end product as it is spread thinly in the dedust phase," he says.

Fines are also a concern in underwater pelletising. "Significant fines generation decreases the end-product quality and increases maintenance efforts," says Ralf Simon, Director, Special Projects at **Nordson**. The company addresses this issue with its BKG Optigon automated water filtration system, which incorporates a self-cleaning Polygon filter that is cleaned automatically depending on the differential pressure in the water tank.

Another challenge for compounders is handling materials with high residual moisture. Nordson offers multiple solutions for this challenge, including high efficiency dryer designs to achieve the desired moisture levels, die plates with optimised insulation, flexible bypass systems that can control residence time, and automated control of key process parameters, says Business Development Manager Frank Asmuss.

Highly filled compounds can lead to high pressures that are also challenging for the pelletising process. Nordson offers its BKG melt pumps, which feature adapted clearances for pressure build-up, and carefully designed die plates with precise and material-adapted borings to overcome this challenge, according to Asmuss.

Fillers and other abrasive additives cause wear, which can be managed using protective coatings and metallurgy at the die plate. Another solution is automatic blade adjustment, which provides constant compensation for wear, as well as inline grinding tools that provide automated grinding of the die plate to increase the lifetime of plate and blades.

Recycling demands

Processing of reyclates is becoming increasingly commonplace. It places additional demands on the compounding and pelletising process as the incoming material tends to be more variable and more contaminated than virgin polymer. Asmuss says Nordson's BKG HiCon V-Type 3G system melt filter uses a power-backflush technology that provides an effective backflush with minimal losses.

"Even with an efficient backflush screen changer, the screens will be quickly blocked with contaminants so screen changes are required more often than in other applications. As every screen change comes together with a pressure loss, even if it is a slight one, a booster pump might be required between screen changer and pelletiser," he says. "Nordson's BKG gear pumps ensure a constant process pressure so that the melt stream that is fed into the pelletising system is even and smooth, which is key to a high-quality end-product."

Austrian pelletiser maker **Econ** is also focusing on high level automation. Its ECONia fully

AMI | Events

Polymers in Flooring

5-6 April 2022 | Berlin, Germany

Discovering the latest trends and innovations in polymer flooring, improving materials, production and design to open new markets

www.ami.ltd/attend-flooring

UPDATE YOUR KNOWLEDGE

- **Explore** innovative developments in materials and additives for resilient flooring
- **Discover** new ways to optimise production and to add value with innovative designs
- **Understand** how designers and architects select flooring for large-scale projects
- **Network** with major players from throughout the international polymer flooring supply chain
- **Learn** about key market trends and new opportunities

BOOK YOUR PLACE

Media supporters:

Film and Sheet EXTRUSION

Plastics Recycling WORLD

Compounding WORLD

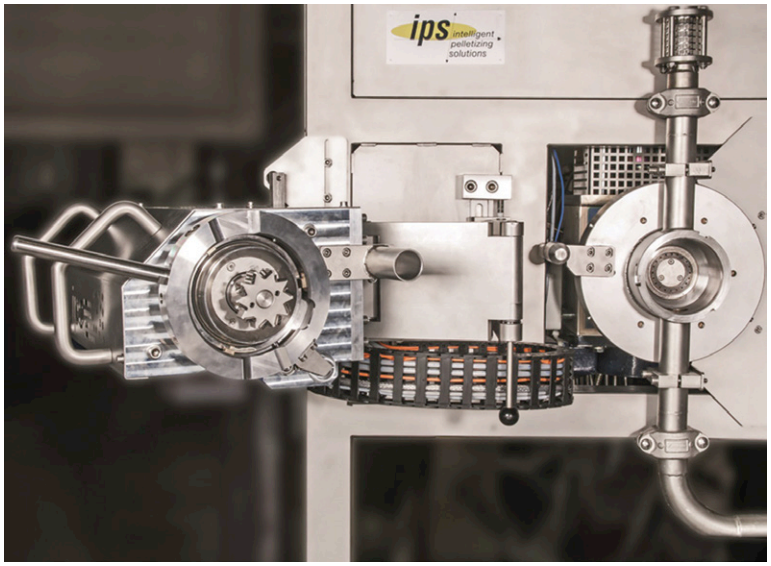
Industry experts include:

Thorsten Beinke
Tarkett

Claudine Bloyaert
INOVYN

Jane Gardner
ERFMI

IMAGE: INTELLIGENT PELLETIZING SOLUTIONS



Above: A UWG 75 S underwater pelletiser from IPS is being used at bioplastics compounder Tecnaro

automated underwater pelletiser is equipped with its Pellet Vision system to monitor the pellets and, where deviations are detected, automatically adjusts process parameters. The company says the system reduces off-spec material and results in high process stability.

The ECONia line also features an integrated robot that eliminates manual start-up processes and manual knife changes, which Econ says is safer for the operator and reduces production downtimes. The company claims that one operator can efficiently operate and control up to 10 lines from a central control.

Early last year, Germany's **IPS** (Intelligent Pelletising Solutions) supplied both an SG 220/2 strand pelletising plant and ips-UWG 75 S underwater pelletising system to bioplastic producer Tecnaro. The new equipment is part of an expansion of Tecnaro's biopolymer production, which includes bioplastic and biocomposite compounds for markets such as automotive, construction, solar, packaging, and furniture.

The UWG 75 S underwater system is said to be particularly suitable for production of spherical pellets and, due to its modular design, can be tailored specifically to the applications and requirements of the customer. In this case, IPS optimised the system to Tecnaro's sustainable material portfolio. This included a specially-adapted perforated die plate that allows bioplastics reinforced with natural fibres to be pelletised without damage.

According to IPS, the UWG 75 S provides a throughput of up to 700 kg/h. It is equipped with a frequency-controlled process water pump that allows energy-efficient setting of the volume of process water. Water temperature is regulated by means of a plate heat exchanger.

Pellet inspection

In-line inspection of pellets is increasingly being used for quality control purposes, especially in areas such as medical and HV power cables, according to Germany-based **Sikora**. Its Purity Scanner Advanced system uses both optical cameras to detect and sort contaminants or discoloration (including black specks) on the pellet surface and X-ray technology to detect metal impurities on the surface or inside the pellet in-line. "We see a strong demand for highest material purity among all plastic manufacturers and processors worldwide, as well as in compounding," says Ralf Kulenkampff, Head of Sales at the company.

Sikora also offers two offline laboratory systems, the Purity Concept X with an X-ray camera and the Purity Concept V with an optical camera. These are typically used for quality control, incoming inspection, or for material release before delivery.

Israel-based **Inspection Technologies** also offers systems to detect and identify pellet quality problems - including contamination, size and shape change, or colour shift - in real time during pellet production. "Most pelletising lines, in either compounding or recycling, are not using in-line pellet inspection systems," says Gilad Roter, Business Development Manager at the company. "More often, producers take samples to a lab for evaluation of contamination, size and shape. If a problem is detected, troubleshooting can be delayed. Taking inspection into the production line enables an immediate change to be made if a problem is found."

Another potential concern when using sampling and off-line testing is that the sample may not represent the entire production flow, so problems

IMAGE: INSPECTION TECHNOLOGIES

Right: Inspection Technologies offers an inline system for monitoring and classifying pellet quality

AMI

Be part of our story as the leading provider of information, market intelligence and events for the global plastics industry

We are looking to fill several posts at various levels of seniority and experience:

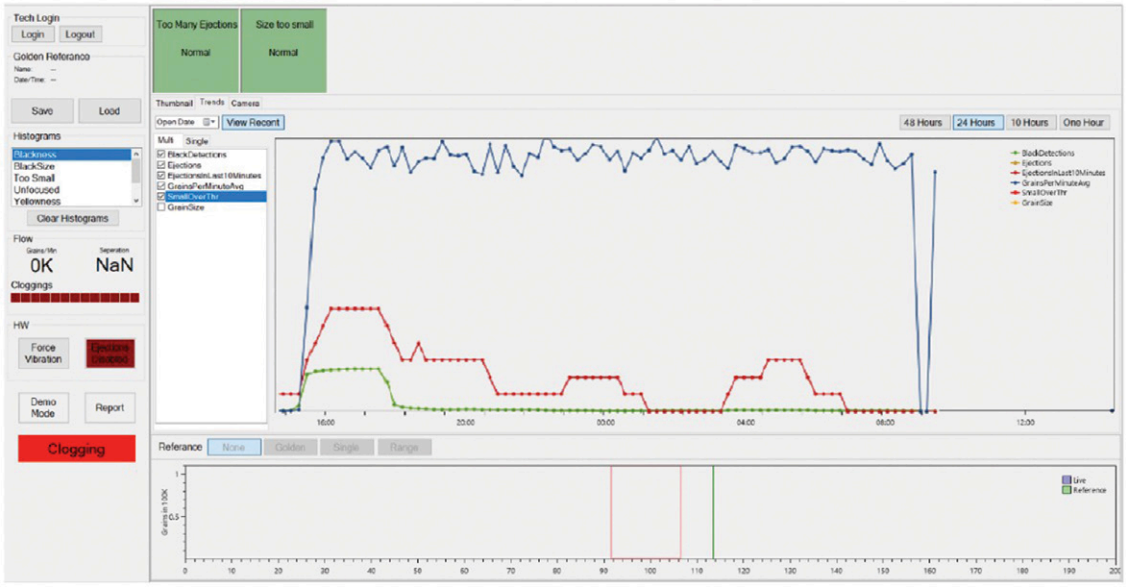
>> **Consultant/Senior Consultant** Recycling and Sustainability

>> **Consultant/Senior Consultant** Energy and Infrastructure

>> **Data Analyst** Market Intelligence

>> **Senior Staff Writer** Digital Magazines

www.ami.international/jobs



The Inspection Technologies system software provides comprehensive trending analysis

Image: Inspection Technologies

can be missed, according to the company. Continuous in line monitoring, by contrast, gives an immediate alert of any problems.

Roter says Israeli compounders such as Tofrat, Kafrit and Polyram have implemented the company's technology in some of their operations in Israel and several major global compounders started implementing the system in their production lines in Europe and in the Far East during 2021.

Recycling variation

The inline inspection system is also beneficial for pelletising recyclate, which is more prone to contamination, according to Nadav Leshem, founder and CEO of Inspection Technologies. "A major constraint of using recycled material is quality of product and variability of quality; online inspection systems can help narrow down the quality variation," he says.

The Inspection Technologies vision system is designed to withstand the harsh environments of plastics production, which can include high temperatures, dust from antiblock additives, and abrasive or corrosive materials such as glass-filled masterbatches and coupling agents.

The equipment uses area cameras (rather than linescan cameras). These incorporate a matrix, rather than a line, of pixels that allows different illumination to be used in different parts of the image frame. "You can have several inspection tasks in one frame with different illumination types in the upper and lower parts," says Leshem. "For example, for size you need to see good contour, so you need a high contrast with the background. For impurities such as black specks detection, the system will use a different type of illumination."

The smallest system is designed for a throughput of 1,000 kg/hr but the company has customers using the technology at up to 2.8 tonnes/hr. A system offering twice that capacity is also available, with equipment capable of three times that capacity available soon.

Aside from impurities detection, the system also analyses pellet size and pellet contour to detect improper cuts such as 'tails'. "The system shows the distribution of size and shape, and it indicates if this distribution is changing. You can see immediately if you're beginning to get angel hairs or tails, and you can set up a real-time alert if a control limit is exceeded," says Roter. When inspection tasks related to pellet colour are needed, colour cameras can be added to the system.

In addition to in-line continuous monitoring, a sorting unit can be added to sort out poor quality pellets. Leshem says that application of both monitoring and off-line sorting can be used to help better plan and implement maintenance. "You don't need to do preventive maintenance at predefined time, but instead you can do it if and when the monitoring gives you a heads up that there is a problem," he says.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.maag.com**
- **www.coperion.com**
- **www.bayplasticsmachinery.com**
- **www.nordson.com**
- **www.econ.eu**
- **www.pelletizing.de (IPS)**
- **https://sikora.net/en/**
- **https://inspec.tech**

Making recycling the norm for flexible packaging

New momentum in recycling plastic films and flexible packaging is coming from the need to meet recycled content targets and the technical developments of companies and partnerships. By David Eldridge

IMAGE: REVOLUTION

Main image: Innovation is enabling the use of more recyclate in new packaging

There is an untapped potential in the recycling of post-consumer waste film and flexible packaging. Much of this plastics waste does not get recycled due to obstacles such as restricted collection, mixed waste streams and undeveloped end markets. Yet a new momentum is building for flexible packaging to include more recyclate. And producers, users and recyclers of flexible packaging have an appetite to improve post-consumer film recycling by overcoming technical problems and addressing structural issues. The impetus is coming from collaborative projects, sustainability programmes by individual companies and technology developments.

In January, **PepsiCo Europe** announced a major sustainability initiative for the film-based packaging of its crisp and chip packets. The snacks and drinks giant said it plans to eliminate virgin plastics in all of its packets by 2030 and replace them with 100% recycled or renewable materials. This applies to brands including Walkers, Doritos, and Lay's.

Silviu Popovici, CEO of PepsiCo Europe, says: "Flexible packaging recycling should be the norm across Europe. We see a future where our bags will be free of virgin fossil-based plastic. They will be part of a thriving circular economy where flexible packaging is valued and can be recycled as a new packet. We're investing with our partners to build technological capacity to do that. We now need an appropriate regulatory landscape in place so that packaging never becomes waste."

The company is starting consumer trials of the new packaging in European markets this year, beginning with France and UK. PepsiCo estimates it could achieve up to 40% reduction in greenhouse gas emissions per ton of packaging material by switching to virgin fossil-free material. The estimate is based on a Cradle to Grave Lifecycle Assessment provided by Franklin Associates using cut-off methodology, a mix of data provided by suppliers and industry, and an estimated 2030 end-of-life scenario. The assessment includes carbon storage credits, waste-to-energy electricity production credits, and avoided legacy waste treatment credits.

PepsiCo says the lightweight advantage of

IMAGE: PEPSICO NETHERLANDS

Right: PepsiCo Europe is this year trialling crisp packaging made with recycled content

flexible plastic packaging means it has a low carbon footprint. But it says it recognises that "change is needed to reduce the amount of virgin fossil-based plastic that is used and to drive circularity in flexible packaging. PepsiCo Europe will focus its work on three strategic pillars: the right design; the right infrastructure and the right new life for flexible packaging."

The "right design" involves designing simpler bag structures to make them easier to recycle. The company says the new bag designs include polypropylene mono-material structures. These meet the design for recycling guidelines developed by the Ceflex consortium of companies active in the flexible packaging value chain.

Gerald Rebitzer, Sustainability Director at **Amcor**, PepsiCo's flexible packaging partner in Europe, says: "We are building a future where flexible packaging is part of the circular economy. Together with PepsiCo, we enhanced the material technologies on PepsiCo's new crisp packet to make it easier to recycle. And we are beginning to integrate renewable and recycled content into PepsiCo's packaging. To meet the demands of our clients like PepsiCo, we encourage more partners upstream to invest in the supply chains of these new materials."

Another pillar for Pepsico Europe's flexible packaging strategy is "the right new life" in which it aims to build demand for recycled content made from flexible packaging to support its use more widely. So, in addition to its planned trials of recycled plastics in new crisp packets, the company is also exploring other possibilities for waste snack bags. This will involve recycling packets into pellet form for use in non-packaging items, and it cites floor posts and automotive parts as possible applications.

"The right infrastructure" element of the company's strategy will see it investing in infrastructure and technology and advocating for policy changes. Its work includes collaborating on and financing the development of effective waste collection systems in Europe and investing in schemes such as the Flexible Plastics Fund in the UK and REFLEX in Poland. As part of this approach PepsiCo Europe says it is advocating ambitious EU-wide recycling targets for flexible packaging including accelerating the ban on landfill and to swiftly adopt Extended Producer Responsibility fees that drive collection, sorting and recycling of flexible film.

This year PepsiCo is collaborating to further scale and improve sorting and recycling, trialling smart packaging on several brands in 2022 in Germany and France as part of the Holy Grail 2.0 Digital Watermarks initiative. It says it is working with partners Borealis and Tomra to progress advanced recycling technologies for flexible packaging.

"Through collaboration and innovation, we can progress to a viable circular economy for our food packaging in Europe," says Archana Jagannathan, Senior Director, Sustainable Packaging, PepsiCo Europe. "Today, the supply of recycled and renewable materials for flexibles is limited. The regulatory environment is very dynamic and we need more clarity on policy and recognised technologies. If a policy and waste infrastructure, similar to beverage bottle packaging, accelerates for flexibles, we will speed up our plans and go even faster to meet our commitments."

Recycling technology group **Starlinger** says that because countries have been banning single-use

IMAGE: STARLINGER

Above: Starlinger highlights many countries are legislating in the area of single-use packaging, including mandated recycled content

plastic products and demanding recycled content in plastic packaging, recycling is becoming an increasingly important topic for the plastics film industry.

Starlinger says: "Legislative measures by governments as well as directives by various industry associations reflect the trend towards more sustainability in the plastics sector – be it the UK Plastic Packaging Tax which proposes a £200 fee per tonne for packaging containing less than 30% recycled plastic (coming into effect on 1 April 2022), or targets set by the Australian Packaging Covenant Organisation calling for a minimum of 20% recycled content in plastic packaging by 2025, among others. Governments, corporations, businesses, as well as educational and scientific entities have joined the Plastics Pact Network, a globally aligned network of local stakeholders initiated by the Ellen MacArthur Foundation to implement solutions towards a circular economy for plastic. The transformation towards more sustainable plastics is on its way, and many film and sheet producers have already started to adapt production to future standards."

The technology used by recyclers and flexible packaging producers needs to be flexible to be able to process different and varying input streams, but also due to unpredictable future developments, says Starlinger, which offers technology covering a range of needs.

It says: "With existing and upcoming legislative measures and industry directives, film recycling is no longer only a matter of saving costs or raw materials. It is a significant contribution to more sustainability in the plastics industry and an important step towards a circular economy in the packaging sector."

Film extrusion and recycling technology company **Polystar**, based in Taiwan, says there is strong demand coming from film extruders and converters incorporating more post-industrial and post-consumer recyclate in their products.

It says: "New regulations in many countries now require producers to use a higher percentage of recycled content in flexible and rigid packaging products. Instability of raw material prices and supplies also forces plastic producers to better recycle their own production waste."

The growing demand is reflected in the machine sales for Polystar. By the end of April 2022, a total of over 110 recycling machines will have been shipped by the company over a 12 month period, which is twice as many as in the previous year.

Polystar says plastic recycling machines are getting bigger. "Recyclers are now buying larger-capacity machines and more machines. The 800-1,000 kg/hour pelletising extruders have become a standard for post-consumer and even some post-industrial recyclers," it says.

IMAGE: POLYSTAR

Above: Post-consumer film recycling line from Polystar

In December 2021, a recycling company in Kanagawa, Japan, placed an order with Polystar for four 800-1,000 kg/hour machines. The company says that in the same month, several recyclers in Australia, Colombia, Mexico, Russia and the US placed repeat orders for higher-capacity machines to be able to comply with the increasing recycling demand of washed PE film and bottle waste.

In India, the requirement for more advanced recycling machines is rising, especially for PP raffia, woven bags and FIBC producers which need to process their internal waste, says the company. So far, Polystar says 75 Repro-One recycling machines have been installed in this sector in India.

In the film and flexible packaging sector, recent installations of Polystar's Repro-Flex recycling machine (which is a cutter-compactor integrated model designed for recycling film waste) have been in Denmark, Italy and Switzerland. These lines are equipped with smart features to minimise energy consumption and the need for operator intervention.

Polystar says that, despite challenges such as high shipping costs and shortages in the supply chain, "Our manufacturing facility in Taiwan, Sinji industrial park, continues to operate at 100% during this time, making sure our customers receive the recycling machines within a very short time. The delivery time for standard recycling machines such as Repro-Flex 85, Repro-One and Repro-Air is only 30-45 days.

The major **Ceflex** collaboration among European producers, users and recyclers of flexible packaging has been making good progress. Talking about 2021 in a newsletter to Ceflex's 180+ consortium members in December, Graham Houlder, Project Coordinator, said: "This year marked a definitive shift from designing a circular

IMAGE: CEFLEX

Above: Ceflex has been sampling, sorting and analysing the light packaging fraction recyclables stream at PreZero's Porta Westfalica waste sorting facility in Germany

economy for flexible packaging, to developing and delivering it. While that transition had already begun, 2021 crystalised key proof points, initiatives and industry wide alignment."

Ceflex has many work programmes, the detail of which was illustrated by a study last year which made an in-depth analysis of the amount of flexible and rigid packaging in mixed plastics waste streams (*Plastics Recycling World* March-April 2021 issue). The study highlighted the significant amount of recyclable flexible packaging that remains in residual household waste.

In June 2021, Ceflex published a position statement recommending that all flexible plastics packaging should be collected for recycling in Europe, as a separate stream or with other light packaging. Additional sorting of flexible packaging from mixed waste is likely necessary (*Plastics Recycling World* July-August 2021 issue). Ceflex says teams operating on a country-by country basis will work with national authorities and Extended Producer Responsibility (EPR) schemes to bring about the necessary changes in collection and sorting.

A major work programme is the development of a Quality Recycling Process which will demonstrate state-of-the art sorting and recycling of flexible packaging. "The Quality Recycling Process (QRP) enables a much greater percentage of flexible packaging to be returned to the economy – and in the quantities and the qualities needed to meet the requirements of new end markets," says Dana Mosora, Technology Workstream Lead at Ceflex.

An update on the QRP project in December explained it uses a combination of four steps based on existing technology, including advanced sorting techniques, hot washing, extrusion with extra filtration and deodorisation. While these technologies are already being used in different facilities in Europe, they have not been used together at the same commercial site.

Trials have found that if a single so-called 310 bale of flexible packaging waste went through QRP's four steps, a minimum of 20-25% of recyclate would be produced to one of the highest grades (PE Film Natural) and about 60-55% of the remaining material would be left over for other rigid commercial activities, such as making laundry baskets or bottle caps.

Ceflex is planning to build an industrial scale QRP demonstration plant which is expected to be running commercially by the end of 2023. "This will help us demonstrate the economic viability of the solution at a large industrial scale," says Dana. "We need to incorporate more partners in order to build the demo at an industrial scale and achieve better quality, quantity, and, most importantly, to

FDA food-contact green light for Revolution

US integrated recycler and flexible packaging producer Revolution, based in Little Rock, Arkansas, says the US Food and Drug Administration (FDA) has issued a Letter of No Objection for its proprietary recycling method to produce post-consumer recycled LLDPE for food contact applications. PCR produced under Revolution's process can be used at content levels up to 100% in the manufacture of food contact articles for all food types under nearly all Conditions of Use as defined by the FDA.

Revolution's food contact recycling process is the result of a long-term development project. The company says it "leveraged its more than 25 years of flexible film recycling experience to develop new proprietary processes, testing methods and quality control measures to meet the stringent requirements specified by the FDA".

The company is currently expanding capacity and ramping up processes to meet market demand. It is also expecting more approvals paving the way for further innovations.

IMAGE: REVOLUTION

PCR LLDPE produced with Revolution's process can be used at content levels up to 100% in the manufacture of food-contact articles

validate the business model."

Prof Steven De Meester from **Ghent University** in Belgium worked with Ceflex on the affordability of developing QRP and his team considered the investments needed for new equipment, like hot washing, as well as the general operating costs. The researchers used a range of market data to create a model that analysed the composition of a typical 310 bale of flexible packaging and how much it would cost for it to go through a QRP plant and the revenues this could then generate.

The model allowed the Ghent team to extract value ranges of the reclaimed materials and calculate prices and revenues for how much the subsequent recyclate could be sold for. The analysis found that it could cost around €520 for each tonne of a 310 materials to pass through a QRP plant, which incorporates the capital investment in QRP technologies like hot and cold washing, as well as additional sorting processes. "However, if the output experiences high enough demand it could see a revenue generated upwards of €600 per tonne, leaving a net profit of €80 per tonne and enough income to guarantee long-term profitability," says Ceflex.

"This is a very important conclusion because it shows that it's actually worth the effort," says Prof De Meester. The team's research also found similar results for other bales of flexible packaging waste consisting of polyolefins and polypropylene.

In a related QRP study, Ceflex worked with researchers at **Maastricht University** in the Netherlands to explore how QRP could supply new and existing markets with a source of materials that can compete with virgin plastic. Prof Kim Ragaert, Chair of Circular Plastics at Maastricht University, led a range of trials on using the recycled output from 310 bales and found that the reclaimed materials can be used for new packaging film applications as well as robust film and injection moulding applications.

"A PE collation shrink film has been made with 30% recycled content blended from the QRP materials," says Ragaert, adding that this "performed very well" when used to wrap a bundle of Pepsi bottles.

The trials were also able to demonstrate a 30% threshold of recycled content in resealable PP pouches. This packaging was good enough to meet the needed functionality and production process. "That is very promising because the recycled content threshold of 30% is quite important for many companies," says Ragaert.

IMAGE: CEFLEX

Above: Trials were undertaken of PE collation shrink film made with 30% recycled content from the Ceflex QRP process

The Maastricht team has also examined applications for PO and PP, as well as how such recycled polymers can be used for higher-value rigid applications, where they found a range of other valuable markets that can reinforce the business model for QRP. "We are now looking at irrigation pipes, we are looking at pallets, we are looking at home and gardening applications," says Ragaert.

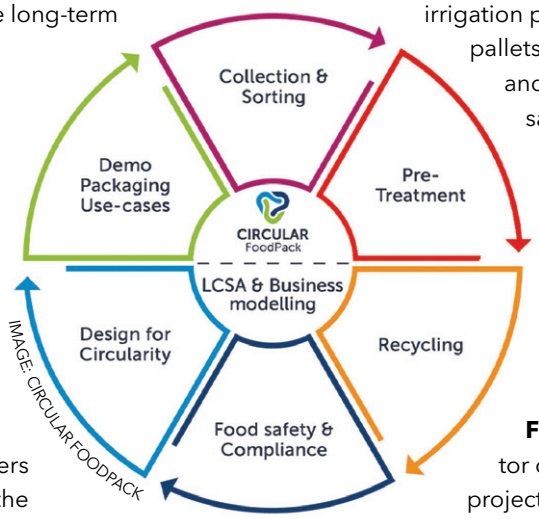


IMAGE: CIRCULAR FOODPACK

Left: The Circular FoodPack project is looking at the elements of food-contact packaging recycling

Fraunhofer Institute for Process Engineering and Packaging IVV in Germany has been a leading R&D organisation in plastics recycling, notably because of the CreaSolv process it developed a few years ago. **Fraunhofer IVV** is co-ordinator of a new collaborative project called **Circular FoodPack** focusing on the challenge of recycling flexible food packaging in a closed loop and making it suitable for certified food-contact applications. The project started in June 2021 and will run until November 2024 with about €5.4m of EU funding from the Horizon 2020 programme.

The Circular FoodPack project involves the development of mono-material packaging that performs as well as multilayer composites regarding its protective function, but can be sorted and recycled more easily. A safe food packaging partially made of recyclates is being developed as part of the project. A protective barrier layer prevents the migration of individual components.

A key focus is on improved sorting and the project is investigating the use of tracer-based sorting systems to allow plastics waste streams to

IMAGE: BOREALIS

Above: In a supply deal with Reclay, packaging waste will be processed at Borealis recycling plants, such as the plant operated by its Ecoplast business in Wildon, Austria

be separated into food packaging and non-food packaging. "Fluorescent tracers containing a material-specific code that can be read by lasers allow for an efficient sorting process," says Fraunhofer IVV.

Objectives include: development and validation of food-contact compliant fluorescent tracers, which can be printed as additives of typical printing inks; successful minimal adoption of conventional NIR sorters so that these can reliably detect small and commercially viable amounts of sorting tracers on all types of multi-layer food packaging; successful sorting trials with tracer-based sorting of marked food packaging items, mixed in representative streams of packaging waste to prove technical feasibility with detection rates of 99% and above.

The recycling process includes several cleaning stages to minimise odour, colour and other impurities. A deinking technology will remove printing inks and perform deodorisation. The solvent-based CreaSolv process will separate the cleaned material into different components, such as fillers, additives and polyethylene.

"These new approaches of sorting, deodorisation and deinking in combination with novel recycling process cascades will boost the current quality level of recycled polymers to a high-purity grade that is necessary for highly demanding and sensitive packaging applications," says project coordinator Esra Kücükpinar-Niarchos of Fraunhofer IVV.

In a further phase, Circular FoodPack intends to develop high performance functional barriers, to effectively prevent migration of any residual contaminants from the PCRs below the migration limits set out by legislation and EFSA.

There will also be demonstrations in three use cases: dry food, home care and personal care packaging. These will be achieved by designing packaging films that can be completely recycled and are suitable for reuse in food packaging.

Nestlé, Amcor Flexibles, Kreyenborg and Polysecure are some of the companies taking part in Circular FoodPack along with research institutes.

The escalating activity in film and flexibles recycling is evidenced by new supply chain collaborations. In January, polyolefins producer **Borealis** and **Reclay** waste management group announced a strategic partnership giving Borealis access to supply of plastics packaging waste in Europe, starting with waste collected by Reclay's EPR scheme in Germany. The waste stream will be processed at Borealis recycling plants, such as the plant operated by its Ecoplast business in Wildon, Austria.

Borealis says this "enables value chain partners, customers, and brand owners to meet recycling quotas and increase the volume of plastic recyclate used in products and applications".

"The reliable supply of high-quality recyclate is a prerequisite for a functioning circular economy," says Lucrèce Foufopoulos, Borealis Executive Vice President Polyolefins, Innovation & Technology and Circular Economy Solutions.

Ineos, another major supplier of polyolefins to film and flexible packaging companies, has announced a collaboration with flexibles group **Coveris** in the UK. In response to the UK government's pending mandate for recycled content in packaging, Coveris has developed pallet stretch-hood that contains Recycl-IN polymer from Ineos.

Ineos has worked closely with the technical team at Coveris in Winsford, England on development of the new stretch-hood packaging film, containing a minimum of 30% recycled material, which has undergone a series of testing and trials at the Ineos facility in Grangemouth, Scotland. Ineos says these trials have demonstrated that the new recycled stretch-hood covering for pallets performs to the same standards as a previous solution made from 100% virgin material.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.pepsico.com**
- **www.amcor.com**
- **www.starlinger.com**
- **www.polystarco.com**
- **https://ceflex.eu**
- **www.ugent.be**
- **www.maastrichtuniversity.nl**
- **www.ivv.fraunhofer.de**
- **www.circular-foodpack.eu**
- **www.borealisgroup.com**
- **https://reclay-group.com**
- **www.ineos.com**
- **www.coveris.com**
- **www.revolutioncompany.com**

AMI | Databases

Plastics Recyclers
Europe and Turkey

Target your market with confidence by accessing data on over 1,300 mechanical recycling sites

We provide a unique level of detail

- Source and origin of waste recycled
- Polymers recycled
- Recycling technology used
- Recycling machinery information
- Reprocessed products offered
- Company specialisations
- Managerial contact details

Get your free sample database

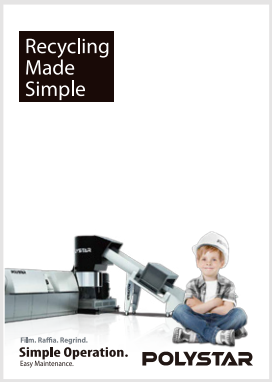
Download these new product brochures

COPERION: PLASTICS RECYCLING

This white paper by Coperion looks at the current state of plastics recycling technology, including technical challenges in production. Coperion explains why it thinks better results can be achieved in many recycling applications by using twin screw extruders.

❯ CLICK HERE TO DOWNLOAD

POLYSTAR: PLASTICS RECYCLING



Recycling Made Simple is the brochure from Polystar where you can find information about all of the company's plastics recycling systems. Its Repro Flex lines can recycle post-industrial and post-consumer PE/PP packaging and PP raffia/ woven materials.

❯ CLICK HERE TO DOWNLOAD

GLOBAL COLORS GROUP

Find out about Global Colors Group in this brochure showcasing the group companies, their vision and focus on quality, R&D, technology and sustainability. Its portfolio includes colour, white and black masterbatches.

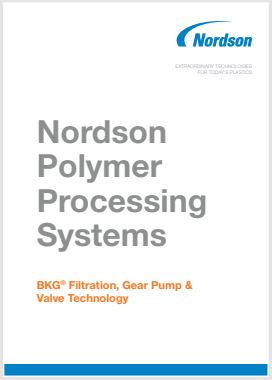
❯ CLICK HERE TO DOWNLOAD

STRUKTOL: CREATIVE RECYCLING

Struktol Company of America offers a range of polymer additives designed to simplify the process of recycling plastics. Learn about its latest options for viscosity modification, odour control and compatibilisation.

❯ CLICK HERE TO DOWNLOAD

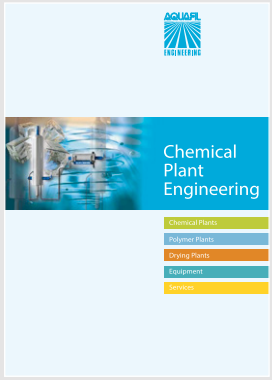
NORDSON: FILTRATION SYSTEMS



The BKG range of filtration systems and screen changers from Nordson Polymer Processing Systems are detailed in this six-page brochure which also features products from BKG's ranges in gear pump and valve technologies.

❯ CLICK HERE TO DOWNLOAD

AQUAFIL: PLANT ENGINEERING



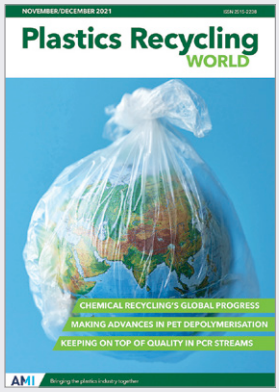
This 12-page brochure from Aquafil Engineering details its comprehensive range of chemical plant engineering capabilities, which include polyamide polymerisation, polyester condensation and polymer drying installations.

❯ CLICK HERE TO DOWNLOAD

If you would like your brochure to be included on this page, please contact Claire Bishop claire.bishop@ami.international. Tel: +44 (0)1732 682948

Keep informed: read our latest editions

AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app

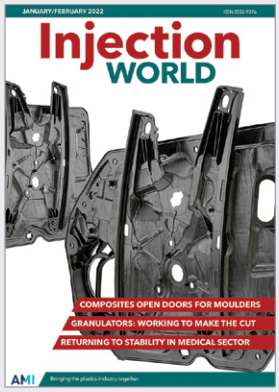


Plastics Recycling World November/December 2021
The November-December edition of Plastics Recycling World has a lead feature on progress in chemical recycling projects around the world. Other features cover PET depolymerisation and quality measurement in mechanical plastics recycling.

› CLICK HERE TO VIEW

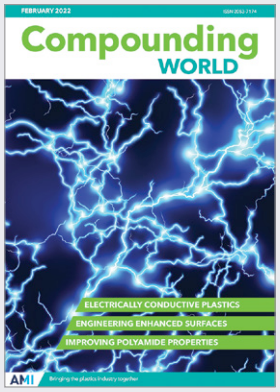
Plastics Recycling World October 2021
The October issue of Plastics Recycling World has technology features on the growing choice of recycling extruders and recompounders, the challenge of odours in recyclate, and R&D in additives. Plus a preview of Plastics Recycling World Expo North America.

› CLICK HERE TO VIEW



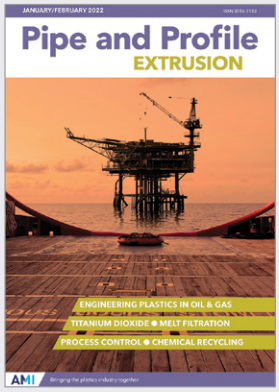
Injection World January/February 2022
The January/February edition of Injection World magazine takes a look at some of the latest developments in thermoplastic composite part production. This first edition of 2022 also reviews recent innovations in the area of medical moulding.

› CLICK HERE TO VIEW



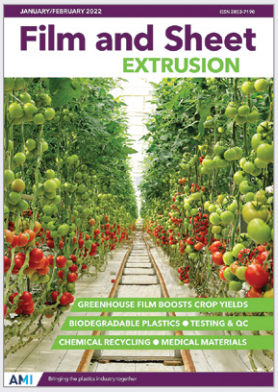
Compounding World February 2022
The February issue of Compounding World reports that for polymer compounders, the route to a low carbon future is likely to mean a greater use of electrically conductive carbon additives, while other features focus on polyamide additives and surface modification.

› CLICK HERE TO VIEW



Pipe and Profile January/February 2022
The Pipe and Profile Extrusion January-February edition looks at the success of engineering plastics and composites being used in oil and gas applications. Other features cover regulatory issues around titanium dioxide, controls and melt filtration.

› CLICK HERE TO VIEW



Film and Sheet January/February 2022
The first edition of Film and Sheet Extrusion magazine in 2022 explores innovations in the agricultural film industry. It also looks at how enzymes may be used as plastics additives, and reviews developments in bioplastics, quality testing, and medical applications.

› CLICK HERE TO VIEW

Take out your own FREE subscriptions to any of the magazines. Click on the logos below to simply register on-line.

Compounding WORLD
Film and Sheet EXTRUSION
Pipe and Profile EXTRUSION
Injection WORLD
Plastics Recycling WORLD

GLOBAL EXHIBITION GUIDE

2022	**8-11 March**	Plastimagen, Mexico City	www.plastimagen.com.mx
	5-8 April	FIP, Lyon, France	www.f-i-p.com
	25-28 April	Chinaplas, Shanghai, China	www.chinaplasonline.com
	3-5 May	JEC 2022, Paris France **NEW DATE**	www.jec-world.events
	3-6 May	GreenPlast, Milan, Italy	www.greenplast.org
	18-19 May	PlastExpo Nordic, Helsinki, Finland **NEW DATE**	https://pfsptec.messukeskus.com/
	25-26 May	Injection Moulding & Design, Detroit, MI, USA	https://injectionmoldingexpo.com/
	26-30 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.org
	27-29 September	Fachpack 2022, Nuremburg, Germany	www.fachpack.de
	3-7 October	Plastex, Brno, Czech Republic	www.bvv.cz/en/plastex/
	19-26 October	K2022, Dusseldorf, Germany	www.k-online.com
	9-10 November	Recycling World Expo USA, Cleveland, USA	https://na.plasticsrecyclingworldexpo.com
	1-3 December	Plast Print Pack West Africa, Accra, Ghana	www.ppp-westafrica.com
2023	**1-5 February**	PlastIndia, New Delhi, India	www.plastindia.org
	14-15 June	Recycling World Expo Europe, Essen, Germany	https://eu.plasticsrecyclingworldexpo.com
	5-8 September	Plast 2023, Milan, Italy	www.plastonline.org/en
	26-28 September	Interplas, Birmingham, UK	www.interplasuk.com
	17-21 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de

AMI CONFERENCES

28-30 March 2022	Agricultural Film Europe, Barcelona, Spain
29-30 March 2022	Chemical Recycling, Houston, TX, USA
14-15 June 2022	Chemical Recycling Europe, Cologne, Germany
28-30 June 2022	Polymer Sourcing & Distribution, Hamburg, Germany
16-17 August 2022	Agricultural Film, San Diego, CA, USA
13-15 September 2022	Plastics Recycling Technology, Vienna, Austria

For information on all these events and other conferences on film, sheet, pipe and packaging applications, see

www.ami.international

DON'T MISS A SINGLE ISSUE

Register now for your free subscription at:

www.plasticsrecyclingworld.com

And don't forget to tell your colleagues, customers and suppliers about the magazine. You can use the share button above (the ⍐ symbol in the browser) to help spread the word.

Chemical Recycling

GLOBAL INSIGHT 2022

Download your own standalone PDF version of Chemical Recycling Global Insight 2022

SPECIAL PUBLICATION FROM AMI MAGAZINES

INDUSTRY OUTLOOK ● COMPANY PROFILES

TECHNOLOGIES EXPLAINED ● GLOBAL PROJECTS

AMI | Market Intelligence

Inform your strategic thinking

Discover how the plastics recycling and sustainability market is growing and who the key players are

Dr. Hanne Jones

Market report: Chemical Recycling Global Status

Understand current and future market infrastructure and uncover where most value is created.

Author: Dr. Hanne Jones, AMI Consulting

Other products include:

Market report
Mechanical Plastics Recycling Europe 2022

Market report
The Recycling of Flexible Polyolefin Films Europe 2021

Database
Plastics Recyclers in Europe 2021

www.ami.international/plastics-recycling

Chemical Recycling
GLOBAL INSIGHT 2022

Letter from the Editor

Welcome to Chemical Recycling Global Insight 2022, a special publication written and produced by AMI Magazines, with support from AMI Consulting. The development of chemical recycling is a response to the global problem of waste plastics in the environment. Its advocates see chemical recycling as complementary to mechanical recycling which is itself growing in importance.

In this publication, we look at the market prospects for chemical recycling and how the industry is taking shape.

The articles cover not just the scope of the waste plastics problem, but also influencing factors such as legislation and targets for use of recycled content. There is an article on the various technologies that come under the chemical recycling umbrella term, offering a guide to their differences and relative advantages.

You will find our article on what's new in chemical recycling projects very helpful in staying up-to-date with the many facilities being built around the world. Some of the players in this fast-moving industry are featured in a series of company profiles.

We hope you find this publication informative and useful.

David Eldridge – Editor
AMI Magazines

CONTACT US

AMI

Third Floor, One Brunswick Square,
Bristol, BS2 8PE, United Kingdom
Tel:+44 (0)117 924 9442
Fax:+44 (0)117 311 1534
www.amiplastics.com
www.twitter.com/plasticsworld
Registered in England No: 2140318

DOWNLOAD MEDIA DATA

EDITORIAL

Editor-in-Chief: Chris Smith
cs@amiplastics.com

Editor: David Eldridge
de@amiplastics.com

Technology Editor: Peter Mapleston
editorial@plasticsrecyclingworld.com

Events and Magazines Director: Andy Beevers
abe@amiplastics.com

ADVERTISING

Head of Business Development: Paul Beckley
pb@amiplastics.com T/ +44 (0) 117 311 1529

Advertisement Manager: Claire Bishop
cb@amiplastics.com T/ +44 (0)7905 848744

Advertising Sales (China/Hong Kong): Maggie Liu
maggieliu@ringiertrade.com T/ +86 13602785446

Advertising Sales (Taiwan): Ms Sydney Lai
sydneylai@ringier.com.hk T/ +886-913625628

Chemical Recycling

March 29-30, 2022
Hilton Houston Post Oak by the Galleria
Houston, TX, USA

Headline sponsor:

American Chemistry Council

Explore the advances in chemical recycling technologies and their integration into the North American recycling supply chain

- **Discover** the potential of chemical recycling
- **Learn** about processing and application challenges
- **Discuss** the various technologies and outputs available
- **Gain** real business insight
- **Network** with industry experts

Book your place today

Industry-leading speakers include:

Hanne Jones
Business Unit Manager
AMI Consulting

Craig Cookson
Senior Director,
Plastics Sustainability,
American Chemistry Council

Dr Mario Reyes
CTO
GSF

Marcus Trygstad
Chief Technology Officer
Aduro Clean Technologies

Dr Christoph Koffler
Technical Director Americas,
Sustainability Consulting
Sphera Solutions

Maurizio Longhi
Principal Engineer, Materials Technology - Global Materials Regulatory SME
Whirlpool

Also sponsored by:

GSF AVEVA MURA TECHNOLOGY erema group

Media supporter:

Plastics Recycling WORLD

AMI

www.ami.ltd/attend-chem-recycling-usa

The need for more plastics recycling

The problem of plastics waste has come to dominate the outlook for the plastics industry. Many polymer producers and technology companies are now turning to chemical recycling as a possible solution

IMAGE: SHUTTERSTOCK

Main image: Mixed plastics waste is the source of feedstock for many plastics recycling companies

The circularity of plastics has risen rapidly up the agenda for the global plastics industry. It is now the top talking point at any conference, forum and exhibition at which industry companies gather. Campaign groups have tried to highlight the problem of plastic waste in the environment for many years, but it only cut through to the public as a mainstream issue in 2018. The blanket media coverage of plastic pollution in oceans and on beaches has receded since then, but the problem of what to do about waste plastics remains just as strong.

The European Union responded quickly with actions to tackle plastic packaging waste, including its Plastics Strategy, setting medium-term targets for reducing plastics waste, and more immediate action to ban plastics in certain single-use items. But it's not just in Europe that the issue has achieved such prominence. The challenge has been recognised in all regions of the world and many countries have implemented or are planning to implement regulations, notably China's ban on most plastic waste imports, which was followed by other Asian countries imposing similar import bans.

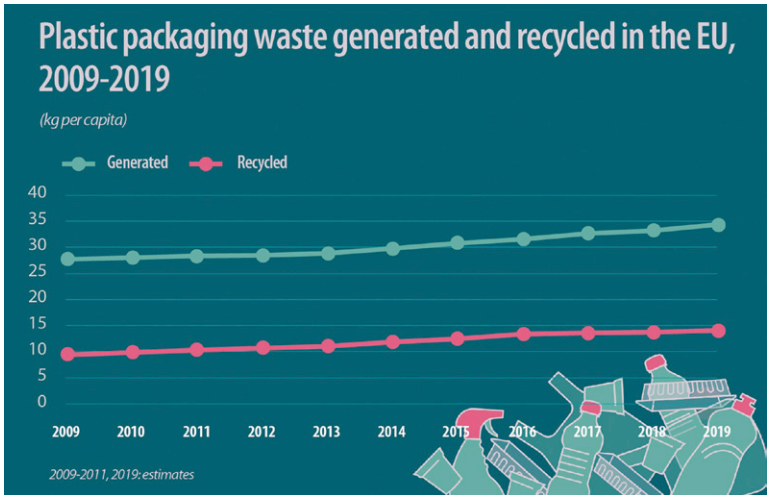
A key approach to the problem is circularity, which encompasses reduction in material usage and the recycling of materials so that loops are created in material production and use, thereby cutting the amount of waste. Multinational brand-owners have become active in reducing virgin plastics and increasing recycled plastics in packaging of their products.

Ellen MacArthur Foundation has been at the forefront of the drive towards a circular economy in plastics packaging, along with other areas such as fashion and food. In November 2021, it published the third annual progress report on its New Plastics Economy Global Commitment. It said signatory businesses, accounting for 20% of all plastic packaging produced globally, have progressed towards their 2025 targets to create a circular economy for plastics.

The report was nonetheless critical of companies in terms of reducing packaging: "There is very little evidence of ambitious efforts to reduce the need for single-use packaging in the first place."

Chemical and mechanical recycling can be used for plastics waste that arises in all sorts of industries, including automotive, electronics and others. But it is plastics packaging that is the major focus for many companies in the plastics industry, because of the huge volumes of packaging waste and because this is where social concern is the greatest.

Plastics packaging recycling has actually been increasing in the EU for more than a decade. A study published by Eurostat in October 2021 indicated a 41% EU recycling rate for plastics



SOURCE: EUROSTAT

packaging waste in 2019. Between 2009 and 2019, the recycling volume of this waste increased by 50%. However, a burgeoning plastics packaging market in the decade meant that the volume of waste generated per inhabitant over the decade increased by 24%.

Recycling of plastics packaging waste has not kept pace with the growth in the EU packaging market. So the pressure is on the plastics industry to deal with the problem and plastics producers have turned to chemical recycling as a solution.

Mechanical recycling is a more established transformation route for waste plastics, and it has the advantages of being a cheaper and less energy-intensive process than chemical recycling. But current small capacities for mechanical recycling are not enough to deliver the huge tonnage of recycled plastics that are necessary to meet regulatory and corporate targets. This is where large-scale polymer producers believe they can step in and help.

In May 2021, PlasticsEurope, the representative body for polymer producers in Europe, announced a significant increase in planned chemical recycling investment, from €2.6bn in 2025 to €7.2bn in 2030. Its member companies are aiming to increase their investment in chemical recycling to produce 1.2m tonnes of recycled plastics in 2025 and 3.4m tonnes in 2030. Advocates of chemical recycling state that this growth will not impact on the further development of mechanical recycling, as the focus would be on mixed plastics waste and other types of hard-to-recycle waste streams.

PlasticsEurope said: "Chemical recycling allows us to recycle plastic waste which is otherwise incinerated or sent to landfill. It delivers significant quantities of recycled material with virgin plastic properties. It is complementary to mechanical recycling and has a huge potential for creating quality jobs and contributing to a climate neutral and competitive Circular Economy in Europe."

The American Chemistry Council is supporting US-based polymer producers involved in projects to increase capacity for chemical recycling, or advanced recycling as it is more commonly called in the USA. A chemical recycling report from ACC in 2019 estimated the US could support investment in 260 new facilities converting plastics waste to products such as feedstocks for new plastics and chemicals.

ACC's polymer producing members have set a goal for 100% of US plastic packaging to be reused, recycled or recovered by 2040. To help reach that goal, ACC has drawn up its Roadmap to Reuse which highlights six key areas for plastics makers and the value chain to focus on to help solve plastic waste challenges.

Increased plastics recycling capacity will certainly be needed as plastics usage is set to grow over the next decade in all regions of the world. According to a forecast by AMI Consulting, China accounted for almost one-third of commodity polymer demand in the world in 2019. By 2030, China is forecast to account for 38%. This contrasts with slower virgin polymer demand growth in Europe (0.2% annually to 2030) and in North America (1.1% annually) and South America (also 1.1% annually). South East Asia and the Middle East/Africa are both forecast to grow by 3% per year. The Indian Subcontinent will be a hotspot with its polymer demand forecast to grow by 5.3% per year up to 2030.

In its *Chemical Recycling Global Status 2020* report, AMI Consulting presents its expectations for the global chemical recycling market in 2025 and 2030. It is forecasting a compound annual growth rate (CAGR) for global chemical recycling of 28.0% up to 2030. Europe is expected to grow fastest and have a lead over North America by 2030 due to the more advanced legislative agenda of the European Union. But North America will not be far behind, and Asia is likely to also experience good growth.

Of the four types of chemical recycling technologies – pyrolysis, gasification, depolymerisation and dissolution – pyrolysis will be the dominant one in terms of total waste recycled (also see separate technology article). This is due to a few factors: the greater number of pyrolysis projects currently being developed; less complexity than other processes; fewer concerns about the scale required to achieve commercial viability.

Mixed polyolefins can readily be recycled in large amounts using pyrolysis. Depolymerisation technologies will mainly be used for PET waste types, such as coloured material, that mechanical recycling is not targeting. Polystyrene waste will be recycled by different technologies, especially dissolution and depolymerisation. ■

IMAGE: SHUTTERSTOCK

Explaining chemical recycling processes

Chemical recycling is an umbrella term that includes a variety of technologies, each with their own process characteristics, input requirements and outputs. We explain the technologies

Few in the plastics industry will not have heard of chemical recycling but that simple term covers a huge range of quite different technologies. Today's chemical recycling technologies can be classified into three broad concepts: dissolution, depolymerisation, and thermal cracking. These three approaches differ, at a conceptual level at least, in the type of materials they can handle, the amount of "chemistry" involved, and the product that results.

Dissolution technologies use carefully selected solvents to dissolve the polymer from the mixed waste, allowing insoluble contaminants such as fillers and pigments to be filtered out. The dissolved polymer can then be precipitated and recovered from the solvent, which is reused. This is a physical process – the chemical composition and structure of the polymer is unchanged. As a result, many of its proponents consider it to be closer to mechanical than chemical recycling and promote it accordingly, using terms such as solvent-based purification or physical or material recycling.

The key to success in dissolution is the selection of a solvent that recovers only the target polymer. This means it is best suited for use with relatively homogenous waste streams. A number of pilot projects are already well advanced – Purecycle Technologies in the US, for instance, is targeting polypropylene with a technology licensed from P&G while Canada's Polystyvert is focusing its efforts on polystyrene.

The need for a relatively homogenous waste stream does not necessarily mean that dissolution technologies are suitable only for mono-material plastic waste. Germany's APK, for example, is developing its technology to recover LDPE and PA from multi-layer films. ›

Main image: Some chemical recycling involves changes in chemistry, but not in the case of dissolution

In theory, at least, dissolution exposes the polymer to less thermal and physical stress during the recovery process than conventional mechanical recycling. However, the recovered polymer is likely to require compounding or pelletising to make it suitable for further use, which may mitigate that benefit to some extent. In addition, the cost of the numerous processing steps – pre-treatment, dissolution, filtration, precipitation, solvent removal and reformulation – is likely to make dissolution most attractive for processing of mono-material waste streams with a relatively high level of contaminants that would be difficult to remove mechanically otherwise.

Depolymerisation is certainly a chemical recycling process, typically using heat (and often a catalyst) to convert a polymer back to its building block monomers – for this reason it is sometimes referred to as monomer recovery. It is most suitable for use with step-growth polymers such as PET, which are polymerised by polycondensation.

A number of companies are developing various processes to depolymerise PET, with pilot projects underway at Carbios in France, CuRe Technology and Ioniqa in the Netherlands, Rittec in Germany, and BP Infinia, Eastman and Loop Industries in North America.

Depolymerisation of polycondensation polymers typically involves reintroducing the molecular component that was eliminated during the original polymerisation process. Several solvolytic processes are being investigated to do this, including hydrolysis, glycolysis, methanolysis and transesterification. These are all multi-step processes that include pre-treatment of the waste, followed by depolymerisation, monomer recovery, repolymerisation, and finally extrusion and pelletising.

Solvolytic depolymerisation techniques are not suitable for use with polymers produced by chain-growth or polyaddition reactions, such as PE, PP and PS. However, some companies – including Pyrowave in Canada and Agilyx in the US – are working with alternative thermal depolymerisation technologies that are capable of converting PS polymer back to styrene monomer.

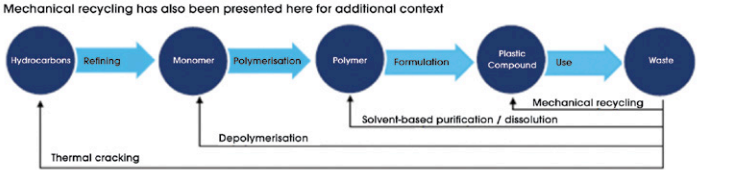
By converting polymers back to the original monomers, depolymerisation can lead to new polymers of virgin quality. However, it uses highly specific chemical processes so the incoming waste stream has to be consistent in terms of polymer composition, meaning considerable cost may be incurred in pre-sorting. Energy requirements can also be quite high.

Thermal cracking converts waste plastic – and many of the contaminants the waste may carry – back to basic feedstock components such as hydrocarbons and syngas (a gaseous mixture of CO, CO_2, H_2 and CH_4). Two processes are used to thermally crack – or feedstock recycle – polymers: pyrolysis cracks the polymer chains at high temperature in the absence of oxygen; gasification heats the polymer with a controlled but limited amount of oxygen. Both yield a different mix of end products with targeted applications ranging from fuels to chemical feedstocks.

Conventional pyrolysis thermal cracking is a relatively simple technology. Waste goes through a pre-sorting and shredding process and is then pyrolysed at high temperature – typically 400-600° – to create vapour and gas, which is then purified to create a range of hydrocarbons. These hydrocarbons can include gas, wax, oils and char. Yields of each can be controlled to some extent by adjusting temperature, pressure, and residence times, as well as through the use of particular catalysts and thermal profiles.

As pyrolysis occurs in the absence of oxygen, the process is only really suitable for polymers with a limited oxygen content, such as PE, PP and PS. Polymers containing high levels of oxygen or halogens – particularly PVC and compounds containing brominated flame retardants – must be sorted and removed from the waste input stream.

Oxygen and halogen concerns aside, pyrolysis can handle waste streams with a mixed polymer composition that would be highly challenging for either mechanical or dissolution and depolymerisation chemical recycling methods. That said, it is an energy intensive process and the quality and mix of the output materials is still dependent to some extent on the input materials. In addition, much of the gas and oil output from pyrolysis plant is likely to be burnt as fuel, either to provide energy for the process itself or because of the need for additional purification steps to upgrade it to be used as a cracker or chemical plant feedstock. Under most regulatory and accreditation regimes, the use of



	Mechanical recycling	Solvent-based purification / dissolution	Depolymerisation	Thermal cracking
Feedstock	PET, POs, PS, PVC, mixed plastics	POs, PS, PVC, PET	PET, PS	Mixed plastics, POs, PS
Output	Plastic compound	Polymer	Monomer, oligomer	Hydrocarbon mix
Status	Industrial scale	Pilot stage	Pilot stage	Pilot, industrial

Four types of plastics recycling
Source: AMI Consulting

outputs as a fuel is not recognised as recycling.

Major players in the development of pyrolysis-based technologies include Luxembourg-headquartered Clariter, Enval, Recycling Technologies, Renew ELP and Plastic Energy in the UK, Fuenix Ecogy in the Netherlands, OMV in Austria, Quantafuel in Norway, Brightmark, Encina, Nexus Fuels and Alterra Energy in the US, GreenMantra Technolgies in Canada, and Licella in Australia.

Gasification thermal cracking differs from pyrolysis in that the process takes place in the presence of a controlled but limited amount of oxygen. It can handle almost any organic material – including plastic waste and biomass – and can take on polymers containing oxygen and halogens. The end result is syngas that, depending on its composition and purity, can be used as a production feedstock.

The gasification process involves fewer steps than pyrolysis: pre-treatment of the waste (including water removal); gasification; and cleaning of the gas to remove tars and other contaminants. That final purification step is required to remove impurities such as ammonia, H_2S, alkali metals, NO_x and tars.

Gasification is not a new technology. Texaco developed and licensed its TCP (Texaco Gasification Process) technology back in the 1980s to handle hazardous waste organics. It is a non-catalytic, partial oxidation process capable of converting organics to syngas and chars. However, the TCP process does not produce feedstocks suitable for reintroduction into plastic-to-plastic or other value-added chemical synthesis chains.

A number of companies are investigating gasification processes to crack plastic waste to heavy oil and non-condensable gases and condensable gases. The non-condensable gases are used as process fuel while condensable gases and heavy oils can be gasified with oxygen and steam. These processes typically involve use of high temperature gasification at more than 900°C, which is energy intensive, followed by additional purification steps.

Gasification thermal cracking technologies are under development by a number of companies, including Enerkem in the Netherlands, Eastman in the US, and Showa Denko and Sekisui/Sumitomo in Japan.

Chemical recycling is still a very young technology. However, it seems clear from the work carried out to date that hopes that it will solve the challenge of handling mixed waste streams may be misplaced. The reality is that most of the technologies currently under development will need some level of homogeneity in waste feedstock. That means that, initially at least, chemical recycling is likely to draw on the waste sources and supply infrastructure developed for mechanical recycling.


IMAGE: BASF

Above: BASF's Andreas Kicherer holding a jar containing pyrolysis oil

Drawing on the same collection and sorting infrastructure does not necessarily mean that chemical recycled material will compete directly with mechanical recycled material. Compared to mechanical recycling, all chemical recycling processes are more complex and are likely to be more costly. So, where high quality waste streams are available, mechanical recycled polymer is likely to win out simply on economics.

Chemical recycling, on the other hand, begins to look a lot more attractive where waste streams are less homogenous than is preferred for mechanical recycling, or where volumes of recycled material exceed the capacity for reuse in new applications (either for reasons of regulation or for deterioration in material properties).

There may be some competition for feedstocks, but even that is likely to be limited. In its most recent *Chemical Recycling Global Status* report, AMI Consulting says that while the potential exists for competition to develop between the two recycling technologies in some areas – it cites the example of PET bottles and trays – it is also quite conceivable that separate markets may emerge. PET waste with the lowest levels of contamination, for example, could be sought out by mechanical recyclers while PET waste streams with higher contamination levels may be processed by depolymerisation, the report authors say.

Looking at feedstocks for the thermal cracking processes – either pyrolysis or gasification – that are expected to account for the majority of chemical recycling in volume terms, the AMI consultants say the fact that mechanical recycling can only offer a "downcycling" solution for mixed plastics waste makes it a prime stream for the chemical route. The study authors conclude that the likelihood of feedstock competition "is minimal for the vast majority of chemical recycling." ■

PLASTICS RECYCLING WORLD EXPO

November 9-10, 2022

CLEVELAND, OHIO, USA

The must-attend show for 2022

Raise your company profile and generate new sales leads at this targeted expo

Secure your perfect booth location. Contact us today:

exhibition_sales@ami.international
+1 610 478 0800

Brought to you by: AMI

Colocated with: COMPOUNDING WORLD EXPO · PLASTICS RECYCLING WORLD EXPO · POLYMER TESTING WORLD EXPO

Proudly supported by: Film and Sheet EXTRUSION · Pipe and Profile EXTRUSION


IMAGE: GR3N

What's new in chemical recycling projects

The number of companies getting involved in chemical recycling of plastics waste has been growing rapidly. This article provides an update of recent developments in projects around the world involving chemical recycling of mixed waste, plus ones focussed on PS and PET

Announcements of new plastics chemical recycling projects have been coming out regularly in recent months, along with progress reports on previously announced projects. Most operations are set for the 2022/23 time frame. What follows is a non-exhaustive review of projects in various states of construction and operation around the world, mostly related to mixed plastics waste but also for individual polymer streams (PET and polystyrene).

Plastic Energy, probably the most prominent independent technology company operating in chemical recycling, already has two commercial chemical recycling plants in operation, in Almeria and Seville, Spain. They have been running since 2015 and 2017 respectively. Each has a capacity of 5,000 tonnes/yr. The technology uses a thermal anaerobic conversion (TAC) process to produce what Plastic Energy brands as Tacoil. The Spanish facilities take waste, mostly film, collected by a waste management company that would normally send the material to landfill.

Main image: Swiss company Gr3n has constructed a demonstration plant for its PET recycling technology

Plastic Energy says it is continuing to increase its portfolio of European projects, with a 20,000 tonnes/yr plant currently under construction in the Netherlands with partner **SABIC** in a joint venture called SPEAR (SABIC Plastic Energy Advanced Recycling), and a 25,000 tonnes/yr plant that has recently started construction in France, along with a collaboration offtake agreement with ExxonMobil.

The company also has a joint venture with **TotalEnergies** (previously Total) for a 15,000 tonnes/yr recycling plant at the latter's Grandpuits "zero-crude platform" site in France, with construction expected to start soon. This will be France's first chemical recycling plant using pyrolysis to produce Tacoil.

The plant in the Netherlands is expected to become operational in 2022, with SABIC building a treatment facility to purify the pyrolysis oil coming from this joint venture, before feeding the oil into its own processes. Both plants in France should be operational in 2023.

This October, Plastic Energy also announced a partnership with Freepoint Eco-systems and its first recycling project in the US, with plans to build a 33,000 tonnes/yr plant in Texas, and a collaboration offtake agreement with TotalEnergies; it should be operational by mid-2024. In addition to this, Plastic Energy has an MoU with Petronas for a recycling project in Malaysia, and says it is working towards expanding in other parts of Asia.

SABIC is also exploring opportunities in other regions. It is for example working with Saudi Investment Recycling Company (SIRC). The two companies are cooperating in Saudi Arabia to build the first chemical recycling facility in the country, producing feedstock for SABIC's local polymer units. SABIC is also doing something similar in Asia and in the Americas, but no announcements have yet been made.

In March, **BP** and SABIC signed a new agreement to work together to drive a circular economy in the petrochemical activities at the Gelsenkirchen chemical complex. The two companies have a long history of cooperation on the site, dating back to when the SABIC operations were owned by DSM.

Below: BP and SABIC are working to drive a circular economy in petrochemical activities at the Gelsenkirchen chemical complex

IMAGE: SABIC

Pyrolysis oil will be processed at BP's Gelsenkirchen refining site and then used by SABIC in its Gelsenkirchen polymer plants to produce certified circular products, which SABIC brands as Trucircle. After successful trials in December 2020, polymer production using the alternative feedstock started at the site early this year.

BP and **Brightmark**, a global waste solutions company that has proprietary chemical recycling technology, have signed a Memorandum of Understanding (MoU) to jointly evaluate opportunities for development of the next generation of plastic waste renewal plants in Germany, the Netherlands, and Belgium. BP is already the offtaker for Brightmark's 100,000 tonnes/yr pyrolysis plant in Ashley, Indiana, USA, which is currently undergoing final commissioning. The Ashley facility produces plastics-to-fuel and waxes. "Moving forward, all facilities will be designed for circular end products," says a representative.

In January, Brightmark and **SK Global Chemical**, headquartered in South Korea, signed an MoU to create a partnership to build a commercial scale pyrolysis plant in South Korea with a 100,000 tonnes/yr capacity. Both parties are currently carrying out a feasibility study. By the end of this year, they should have completed evaluation of the most optimal methods to operate, scale and develop the technology within South Korea.

In September, Shell Ventures and BlueAlp Holding announced a strategic partnership to develop, scale and deploy BlueAlp's pyrolysis technology. Shell has taken a 21.25% equity stake in BlueAlp as part of the agreement.

Shell and **BlueAlp** will form a joint-venture company to build two new conversion units in The Netherlands, which are forecast to convert more than 30,000 tonnes/yr of plastic waste. The units are planned to be operational in 2023 and will supply 100% of their pyrolysis oil as feedstock to Shell crackers in The Netherlands and Germany. Shell is exploring licensing a further two units for deployment within Asia to supply the Shell Energy and Chemicals Park Singapore.

In October Shell Chemicals Europe also announced a strategic cooperation and offtake agreement for pyrolysis oil made by Rotterdam-based company **Pryme** from recycled plastic waste. Pryme will supply Shell from its first plant located in Rotterdam. Currently under construction, the plant

is scheduled to become operational in 2022 and is forecast to convert 60,000 tonnes/yr of plastic waste into pyrolysis oil by 2023.

The agreement also includes provision for future supply to be delivered from Pryme's proposed second plant in the region. This will have an estimated annual pyrolysis oil production capacity of 350,000 tonnes.

Eastman has two chemical recycling technologies that tackle different feedstock streams. Polyester Renewal Technology processes polyester feeds (see section on PET below), while its Carbon Renewal Technology can recycle most other thermoplastics, with the exception of PVC. In late 2020, Eastman said it expected to use up to 50m pounds (close to 27,000 tonnes) of waste plastic in Carbon Renewal Technology operations in 2020, with projects underway to significantly expand that amount. No update was available at the time of writing.

In early November, **Aduro Clean Technologies**, a Canadian developer of patented water-based technologies to chemically recycle plastics and transform heavy crude and renewable oils into new resources and higher-value fuels, announced a pending partnership with Brightlands Chemelot Campus in Limburg, The Netherlands.

Aduro says the objective of this partnership is to complete an installation that applies Aduro Hydrochemolytic technology (HCT) to demonstrate, on a tonnes per day scale, the conversion of polyethylene waste to useful feedstock for chemical processes, including production of new PE.

Ofer Vicus, CEO of Aduro, says: "This year we plan on doing our proof of concept. This is nearly done and we are working on the data to submit it to a third party," says Vicus. "Our next step in the road map is to work on the pilots – this is happening now with Brightlands and possibly others."

He says: "Traditional methods rely on high temperatures from 400°C to as high as 1,100°C, and on hydrogen produced by conversion of fossil fuels at between 700°C and 1,000°C. Aduro Hydrochemolytic processes operate at only 240-390°C."

Marc van Doorn at the Brightlands Chemelot Campus says: "We are at the early stages and it still needs quite a lot of development, but lab results were quite interesting. Aduro is planning to scale the process up to pilot plant level at our campus, where we have a number of other things going on in chemical recycling."

Another chemical recycling process that relies on water – super-critical steam in this case – has been developed by **Mura** in the UK. In April, it announced a partnership with Dow Chemicals to support the rapid scaling of its HydroPRS (Hydrothermal Plastic Recycling Solution) process. Dow will also take recycled materials from the first plant, in Teesside, UK. The first of four 20,000 tonnes/yr lines is expected to be operational in 2022. Dow and Mura are looking to co-operate on offtake at a number of additional European projects, currently in Mura's development pipeline.


IMAGE: EASTMAN

Above: Eastman has two chemical recycling technologies that tackle different feedstock streams

Alongside its first plant in the UK, Mura also has four 100,000-tonnes/yr sites under development in Germany and four of the same capacity in the US – Washington State has just been announced as the first location. It also recently announced the sale of the first HydroPRS licence to Mitsubishi (MCC), which has plans to develop the process to commercial operation by 2023 at its Ibaraki site, Japan. It will have the capacity to handle 20,000 tonnes of plastic waste per year – with MCC studying the possibility of increasing capacity in the future. Initially, the project will aim to use post-industrial plastics.

"Our ambition is to have 1m tonnes of plastic recycling capacity in operation or development by 2025," says a representative.

Dow says it is actively pursuing a number of commercial partnerships with customers and brand owners to scale chemical recycling technology. Two years ago, for example, it announced its partnership with Fuenix Ecogy Group for the supply of pyrolysis oil feedstock made from recycled plastic waste, to be used in the production of new polymers at Dow's production facilities in Terneuzen, The Netherlands. It has since announced additional investments in Fuenix to help scale this advanced recycling technology further. Most recently, in October 2021, Dow and Fuenix announced the construction of a second plant in Weert, which will process 20,000 tonnes of waste plastic.

As well as its partnership with Mura Technology, Dow has also established a multi-year agreement with New Hope Energy, based in Tyler, Texas, USA to supply it with pyrolysis oil feedstocks derived from plastics recycled in North America, which Dow


IMAGE: RENASCI

Above: Renasci's ISCC PLUS-certified recycling centre in Oostende, Belgium

will use to produce circular plastics.

BASF is working with several partners to further develop pyrolysis technology. In 2019, it invested €20m in **Quantafuel**, a Norwegian company specialised in the pyrolysis of mixed post-consumer plastic waste and the purification of the resulting oil. In September 2020, Quantafuel started up its first pyrolysis plant with a capacity of approximately 20,000 tonnes/yr in Skive, Denmark. "Together, we are also working on further developing and improving the process," says BASF. "Developing suitable catalysts for the new process technology is an important aspect of this. These catalysts aim to ensure that high-purity pyrolysis oil is always produced, even when the composition of the plastic waste varies."

In late August, Quantafuel said the Skive plant would undergo upgrades before the end of the year, allowing for stable, long-term commercial production. "We are working on removing the last known obstacle," said Quantafuel's interim CEO Terje Eiken. In September, it announced plans to expand into the UK, with a plant in Sunderland that could be up and running "in a few years." Additional sites are also being considered by Quantafuel UK. The Sunderland plant will be designed to process more than 100,000 tonnes/yr of waste plastics, to be sourced from across the north of England.

In June, **Borealis** announced an exclusive agreement with **Renasci** which has enabled Borealis to offer commercial volumes of chemically recycled base chemicals and polyolefins since May. (Borealis has a10% share of Renasci.) Borealis obtains chemically recycled material from Renasci Oostende Recycling in Belgium. Projected output is 20,000 tonnes/yr. Feedstock will be subsequently processed in the Borealis steam crackers, initially at its production location in Porvoo, Finland.

Earlier, in April, Borealis announced a feasibility study for a chemical recycling unit to be established at the Borealis production location in Stenungsund, Sweden is being carried out with project partner Stena Recycling, and could lead to operations beginning in 2024. Borealis will also co-operate independently with Fortum Recycling and Waste on a project involving the sourcing of plastic waste to the chemical recycling unit.

In October, **ExxonMobil** announced plans to build its first, large-scale plastic waste advanced recycling facility in Baytown, Texas, USA, which is expected to start operations before 2023 with a planned capacity of 30,000 tonnes/yr. A smaller, temporary facility, is already operational and producing commercial volumes of certified circular polymers that will be marketed by the end of this year.

ExxonMobil's initial trial of its proprietary process recycled more than 1,000 tonnes of plastic waste and has demonstrated the capability of processing 50 tonnes per day.

The company says it is developing plans to build approximately 500,000 tonnes/yr of chemical recycling capacity globally over the next five years. As mentioned earlier, it is collaborating with Plastic Energy on a plant in Notre Dame de Gravenchon, France, which is expected to process 25,000 tonnes/yr of plastic waste when it starts up in 2023, with the potential for further expansion to 33,000 tonnes/yr. ExxonMobil is also assessing sites in The Netherlands, the US, Canada, and Singapore.

At the beginning of November, **Honeywell** announced the commercialisation of its UpCycle Process Technology, which incorporates pyrolysis. Sacyr, a Spain-based global engineering and services company with operations in more than 20 countries worldwide, will be the first to deploy the Honeywell technology. The two companies will form a joint venture to operate a facility in Andalucía, Spain, with a capacity of 30,000 tonnes/yr of mixed plastics waste. Production is expected to begin in 2023.

Arcus Greencycling uses a pyrolysis process that can handle a wide range of polymers found in mixed waste, from PP, PE, and PS to more difficult polymers like PVC and ABS. The company has a co-operation agreement regarding pyrolysis technology with Karlsruhe Institute of Technology.

Arcus is currently building a 4,000 tonnes/yr industrial-scale pilot plant in Frankfurt am Main, Germany. The company expects this to start operations in the second quarter of 2022. "This plant will offer customers a highly robust process at an industrial scale to either test the suitability of a wide variety of waste streams for chemical recycling and/or utilise the facility to produce commercially usable pyrolysis oil," it says.

Clariter says its chemical recycling technology

enables it to make end products, not a feedstock like pyrolysis oil. The company has developed a three-stage process for recycling mixed plastics waste. First it uses thermal cracking which generates a wide range of hydrocarbons. Stage two is a hydro-refining process developed to remove impurities and form naphthenic and paraffinic hydrocarbons. The third distillation stage results in three product families, waxes, solvents and oils for industrial and consumer use which are sold to its customers.

Clariter's technology has been proven through an operational pilot plant in Gliwice, Poland, and a demonstration plant in East London, South Africa. In 2021, it has announced collaborations with DSM and Mitsubishi. In addition, South African chemicals group AECI has made a €2.5m investment in Clariter and is exploring construction of full-scale plants in South Africa, Germany and USA.

Recycling Technologies, in Swindon, England, has developed thermal cracking technology that it says can be installed at existing waste sites anywhere. Its RT7000 machine produces pyrolysis oil branded Plaxx. A demonstration plant and testing facility has been operating at Swindon Borough Council's recycling facility since 2017. The first commercial-scale unit will be installed at Binn Eco Park in Perth, Scotland, in collaboration with Binn Group and Zero Waste Scotland.

Polystyrene

Chemical recycling of polystyrene is well-advanced. This April, Recycling Technologies was selected by **Ineos Styrolution** as the technology provider for commercial scale recycling of PS back to styrene monomer. Prior to building the commercial scale recycling plant, a PS recycling pilot plant will be built in Swindon, UK. It uses the same basic technology as the RT7000 but the machine to recycle polystyrene will have a different name.

Ineos Styrolution plans to build its full commercial scale recycling facility in Wingles, France, but has not given a date; capacity should be 15,000 tonnes/yr. **Trinseo** has said it plans to build a dedicated 15,000 tonnes/yr plant at its Tessenderlo, Belgium location, to come into operation in 2023.

In May, Trinseo announced that it could supply recycled polystyrene (rPS) for food contact applications with the launch of the first yogurt pot integrating rPS (again from Yoplait), now on shelves in France. Styron CO2RE CR55 contains 55% recycled content resulting from depolymerisation.

In September, Trinseo and Indaver, a leader in sustainable waste management in Europe, signed an offtake agreement for recycled styrene monomer. Trinseo said it would buy a minimum of 50% of the monomer produced at Indaver for a 10-year period, following start-up of the plant planned in 2023.

Indaver will collect post-consumer polystyrene, such as yogurt pots and single-use packaging, and produce new styrene monomer through a proprietary depolymerisation technology at its Antwerp, Belgium site, for repolymerisation at Trinseo's Tessenderlo, Belgium site.

At the end of last year, Total (now TotalEnergies), sheet extrusion company Intraplás, and yoghurt producer Yoplait said they had successfully run a pilot test aimed at using certified chemically recycled polystyrene in yogurt pots. Total said that by converting mixed plastics waste in its steam cracker in Antwerp, it can produce certified chemically recycled polystyrene.

Canadian technology company **Pyrowave** is involved in a major polystyrene chemical recycling project in a partnership with Michelin in Europe. Pyrowave manufactures modular equipment that uses microwave technology to depolymerise polystyrene and it licenses its use. Michelin will operate the equipment at a location yet to be decided. It will acquire several units from Pyrowave. Michelin will use the styrene monomer as a feedstock to make rubber for tyres.

At the end of last year, the two companies said they would work together to fast-track the industrialisation of Pyrowave technology with a view to a certification and commercial roll-out in international markets. The joint development agreement will ultimately account for an investment of more than €20m. Michelin and Pyrowave are working together to develop an industrial demonstrator, funded and operated by Michelin, by 2023.

PET

Eastman is building the world's largest polyester chemical recycling facility at its site in Kingsport, Tennessee, USA, employing its Polyester Renewal Technology (PRT) which uses methanolysis. Eastman expects the facility to be mechanically complete in late 2022. "Our goal is to recycle 250m pounds (around 113,000 tonnes) annually by 2025 and 500m pounds annually by 2050," says a representative.

"We pioneered the technology decades ago when we were formerly part of Eastman Kodak and used methanolysis to recycle polyester including Kodak films. We've retained that R&D knowledge and actually improved on it in the decades since."

Aquafil Engineering designs polyamide and polyester polymer plants based on its own patented technology and production know-how. It also offers several recycling solutions under the brand

IMAGE: CARBIOS

Abve: The Carbios demonstration plant

name EverPET for internal, industrial or post-consumer waste. It has recently been building a recycling unit to produce 100% PCR PET on a small scale for customer and test samples for different PET customer applications (bottle, film, yarn, multi-layer packaging).

In the chemical EverPET process, the raw materials (oligomers, monomers and BHET) are recovered from previously cleaned polyester wastes, which can be re-processed into a high-quality polyester by downstream polycondensation.

Carbios, which has developed an enzymatic recycling technology (C-Zyme) for depolymerising PET using hydrolysis, brought its first demonstration plant onstream in September. The plant includes a 20 m^3 depolymerisation reactor capable of processing 2 t of PET per cycle, which is the equivalent of 100,000 bottles. It is co-located with a Michelin tyre production plant in Clermont-Ferrand, France; Michelin is a major shareholder in Carbios, and is interested in using various recycled or renewable materials in its tyres.

Martin Stephan, the company's Deputy CEO, says Carbios will also build and operate a 40,000 tonnes/yr reference unit, the first industrial plant. Its intention is to start up the plant in 2025 and that the plant will be adjacent to an existing PET production line. Carbios has Expressions of Intent with at least one PET supplier.

Swiss company **Gr3n** has another technology that uses alkaline hydrolysis. A demonstration plant should be fully operational early next year. Fabio Silvestri, Head of Marketing and Business Development, says the first industrial plant, with a capacity of 30,000 tonnes/yr, could start up before the end of 2024. He says the company has had confirmation that its technology can depolymerise textiles. Gr3n has an MoU with Kolon Industries to accelerate the commercialisation and the implementation of its technology throughout Asia.

Ioniqa, a clean-tech spinoff from the Eindhoven University of Technology in The Netherlands, has a 10,000 tonnes/yr plant producing BHT monomer from bottles using glycolysis, which it currently supplies exclusively to Indorama. Maarten Stolk, the company's Business Developer, says that it plans also to use fibre as a feedstock. The company is currently in discussions with a plant engineering firm so that it can sell licensed packages.

In June, **Loop Industries** in Terrebonne, Quebec, Canada, announced a strategic partnership and equity investment from SK Global Chemical (now called SK Geo Centric); Loop and SKGC intend to form a joint venture with exclusivity to build recycled PET resin and polyester fibre manufacturing facilities using Loop's depolymerisation technology throughout Asia. SKGC currently has a 10% shareholding in Loop. In August, plans were announced for the first Infinite Loop Asian facility in Ulsan, South Korea, to begin preparation in 2022.

Loop recently completed the conversion of its Terrebonne, Québec pilot plant to a small production facility. In September of this year, together with French mineral water company Evian, Loop unveiled the Evian Loop bottle, made from Loop's 100% recycled PET coming from waste plastic and fibre. The bottles will be rolled out at commercial scale in South Korea in 2022, with the goal of launching in other markets later. ■

CLICK ON THE LINKS FOR MORE INFORMATION:

- **https://plasticenergy.com**
- **www.sabic.com**
- **https://totalenergies.com**
- **www.bp.com**
- **www.brightmark.com**
- **http://eng.skglobalchemical.com**
- **www.shell.com**
- **www.bluealp.nl**
- **https://pryme-cleantech.com**
- **www.eastman.com**
- **https://adurocleantech.com**
- **https://muratechnology.com**
- **www.dow.com**
- **www.basf.com**
- **www.quantafuel.com**
- **www.borealisgroup.com**
- **www.renasci.be**
- **https://corporate.exxonmobil.com**
- **www.honeywell.com**
- **www.arcus-greencycling.com**
- **https://clariter.com**
- **https://recyclingtechnologies.co.uk**
- **www.ineos-styrolution.com**
- **www.trinseo.com**
- **www.pyrowave.com**
- **www.aquafileng.com**
- **www.carbios.com**
- **https://gr3n-recycling.com**
- **https://ioniqa.com**
- **www.loopindustries.com**

Aquafil

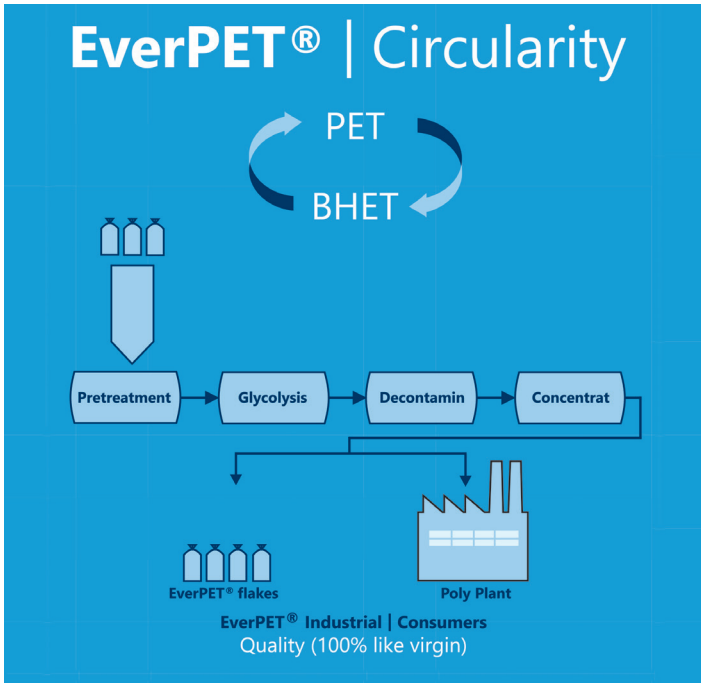
Aquafil Engineering: Experts in polyester and polyamide recycling plants

Aquafil Engineering, an independent company of Aquafil Group, is located in Germany, and is one of the worldwide leading companies in technology and equipment design for polyamide, polyester and recycling plants. The plant design is based on patented technology and production know-how which provides customers with state-of-the-art technology combined with high quality, flexibility, efficiency and sustainability.

Aquafil Engineering understands itself as provider for customised solutions for fibre, film, technical and bottle applications.

The EverPET™ technologies are the newest developments in polyester recycling. EverPET™ is the brand name for a collection of different recycling systems and includes solutions for mechanical (extrusion) as well as for chemical (glycolysis) recycling.

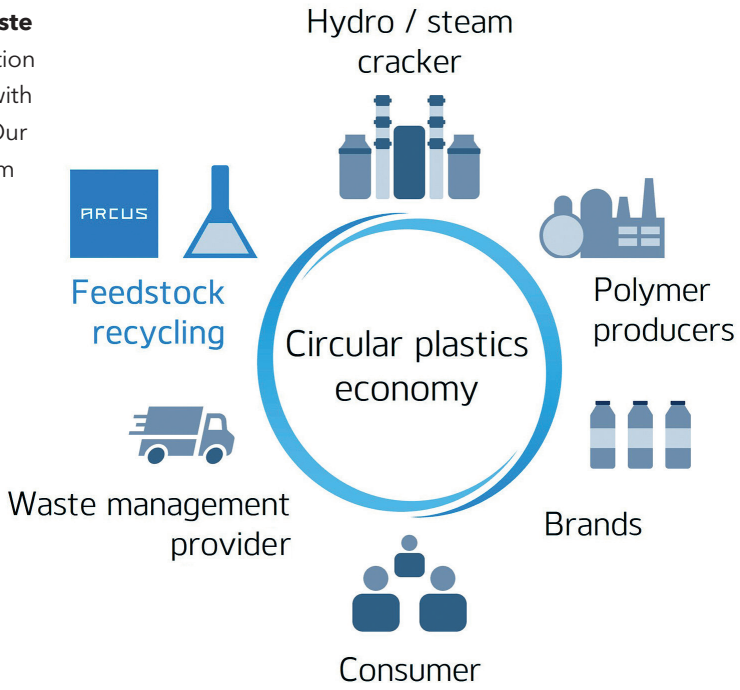
› **www.aquafileng.com**



Arcus

Leading the way to recycle mixed and dirty plastic waste
Arcus leads the way in providing a chemical recycling solution for currently non-recyclable mixed plastics waste streams with as little as possible prior sorting or cleaning of the waste. Our process successfully handles a wide range of polymers from PP, PE, and PS to difficult to process PVC, ABS, or PET.

First industrial scale plant of its kind in Germany
Arcus is currently building a fully authorised (BImSch approved, REACH registered, end-of-waste status acknowledged as well as ISCC, RedCert2, and EfbV certified) 4,000 tonnes per year industrial-scale pilot plant in Frankfurt am Main, Germany, which will go live in the second quarter of 2022. This plant will offer customers a highly robust process at an industrial scale to either test the suitability of a wide variety of waste streams for chemical recycling and/or utilise the facility to produce commercially usable pyrolysis oil.
› **www.arcus-greencycling.com**



The ARCUS Greencycling solution: Closed loops are the model for a world without plastic waste and lack of resources

- Variable and truly mixed inputs (incl. PP, PE, PS, PVC, PET, etc.)
- High-value feedstock for the petrochemical industry (incl. REACH registration)
- Longstanding operations and research track record
- Fully approved and certified testing plant in Germany

Greencycling ...

Recovers raw materials | Closes the material loop | Is eco-nomical | Preserves natural resources

www.arcus-greencycling.com

Click here for more

Clariter

clariter
A Clean Slate

Clariter takes plastic waste no one wants and transforms it into products everybody needs. While the recycling industry is turning plastic waste into new plastics, fuels, or intermediates that require further processing and blending, Clariter's innovative technology transforms most plastic waste streams, even those with the lowest value, into pure, ready-to-use industrial products: aliphatic solvents, mineral oils, and snow-white waxes.

According to the latest Life-Cycle Analysis, Clariter's process is preferable to landfill, incineration, and other pyrolysis-based solutions. This is a real paradigm shift and a resource efficient approach to meet circularity standards in the EU and beyond.

The company unlocks the value of the circular economy without compromising on profitability or sustainability. Clariter's short-term plan is to build and operate full-scale plants in Israel, Poland, and the Netherlands.

Each plant will recycle 60,000 tons of plastic waste and produce 50,000 tons of clean products annually.

Clariter's solution bridges the world of recycling and the petrochemical industry by replacing crude oil with upcycled plastic waste, thus saving significant amounts of CO_2, cleaning the earth of plastic waste, and making sustainable products for the market with 1000+ end applications, e.g. paints, shoe polishes, degreasers, detergents, inks and even ski waxes.

› **https://clariter.com**

Watch the video Clariter in Brief

Above: Clariter's Industrial-scale plant has been in operation in East London, South Africa since 2018

Left: Clariter's technology transform plastic waste into aliphatic solvents, mineral oils and paraffinic waxes

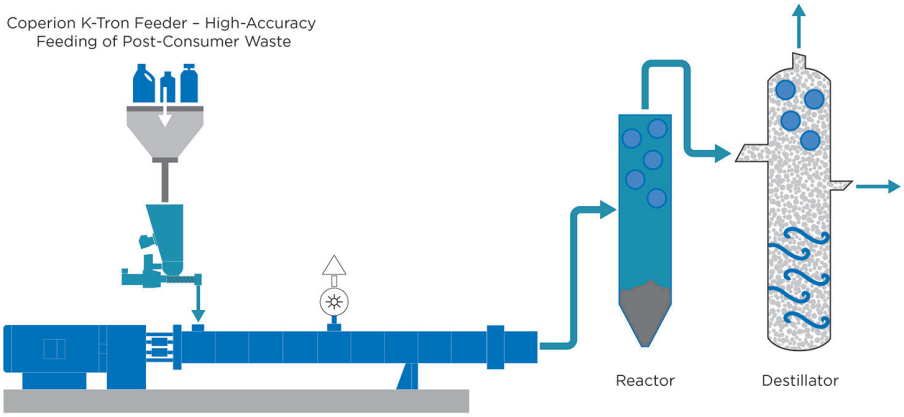
coperion
confidence through partnership

First class technology for chemical recycling

Chemical recycling is a promising process for recycling mixed plastic waste into chemicals, waxes or liquid energy carriers. Coperion provides process know-how and superior technologies for chemical recycling.

Coperion K-Tron feeders ensure high-accuracy feeding of raw materials into the extruder. Coperion's ZSK twin screw extruders enable a very efficient energy addition to the material in shortest time. Within 30 seconds, ZSK extruders produce a homogeneous, highly devolatilised melt with high temperatures. Throughputs of up to 20 tonnes per hour can be realised.

COPERION PROCESS FOR CHEMICAL RECYCLING



Next the melt is further processed to the reactor and destillator to transform it into marketable products such as oil, heavy fuel, or waxes.

Contact: Jochen Schofer
Business Segment Manager
jochen.schofer@coperion.com
› **www.coperion.com**

›extruders ›feeders ›components ›pneumatic conveying ›complete systems

COPERION PLASTICS RECYCLING TECHNOLOGY.
EFFICIENT. SUSTAINABLE. RESPONSIBLE.

Discover our first-class technology solutions:
+ for compounding, extrusion, feeding, conveying and bulk material handling
+ fulfilling highest quality standards and maximum reliability

coperion K-TRON

Join us on the responsible path to a successful future. Benefit from our comprehensive know-how and first-class technology solutions for various plastics recycling processes. www.coperion.com/recycling

coperion
confidence through partnership

MAAG Group

MAAG Group
a DOVER company

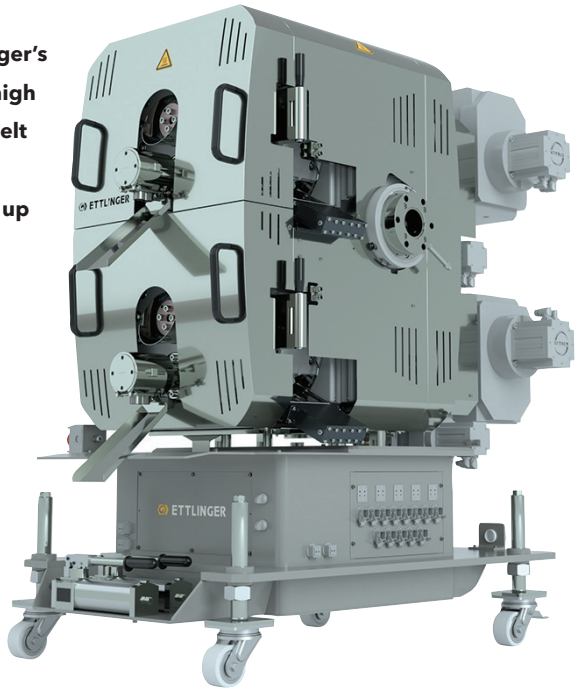
Next level solutions for recycling applications
MAAG Group systems play a key role in enabling a more circular economy for plastics. Our equipment and solutions cover the entire plastics value chain and help to introduce used plastics back into high quality products.

As a specialist for polymer filtration and recycling systems, we have developed custom melt filtration and pelletising systems that meet the strict requirements of our customers. Our systems provide solutions to process the most demanding material streams and turn them into valueable resources.

Our goal is to preserve material properties and produce pellets that are equal in quality to virgin materials when processing post-consumer and post-industrial plastic materials.

› **https://maag.com**

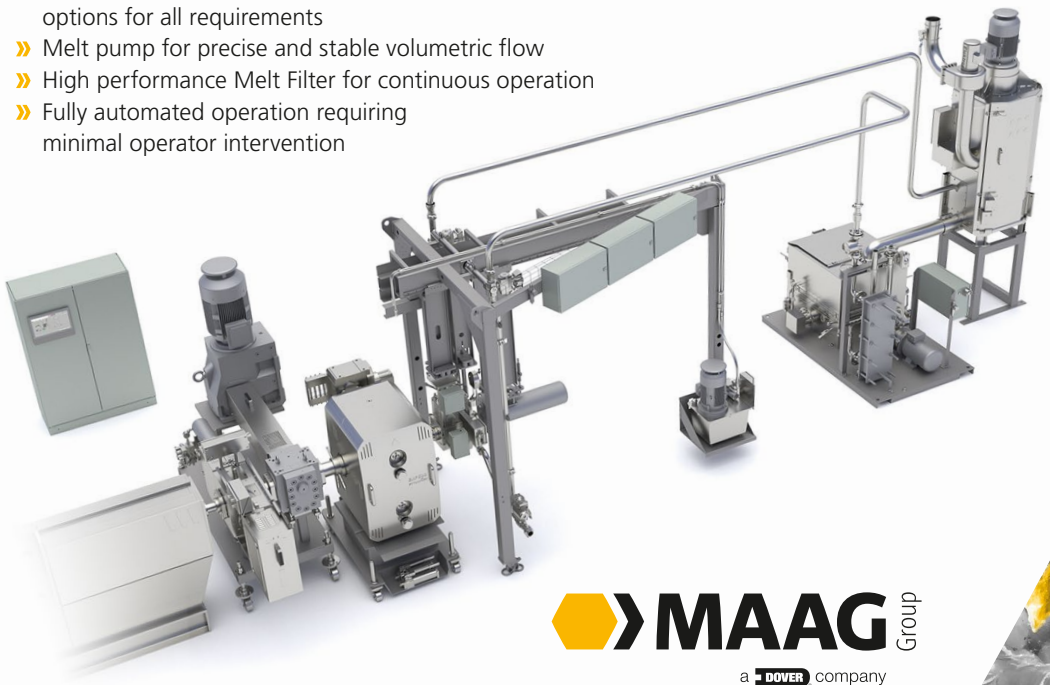
MAAG Group company Ettlinger's new ECO 500 high performance melt filter achieves throughputs of up to 4,000 kg/h



PUMP & FILTRATION SYSTEMS ›
PELLETIZING & PULVERIZING SYSTEMS ›
RECYCLING SYSTEMS ›
DIGITALIZATION ›

An Optimized System for challenging Recycling Applications

- High quality pellets with low residual moisture level
- Purpose-built for recycling applications and flexible options for all requirements
- Melt pump for precise and stable volumetric flow
- High performance Melt Filter for continuous operation
- Fully automated operation requiring minimal operator intervention



MAAG Group
a DOVER company

maag.com

Pryme

Pryme contributes to a meaningful solution to the global plastic waste problem by enabling the circularity of plastic. We convert plastic waste into valuable petrochemical products using a proven pyrolysis process that is enhanced with proprietary characteristics and has a low carbon footprint.

Our R&D team has worked long to take the pyrolysis process to a higher level, so we teamed up with a reactor manufacturer that boasts over 80 years of experience in this area. As a result, our reactor ensures a very precise and controlled application of heat at lower temperatures, which makes the recycling process more energy-efficient.

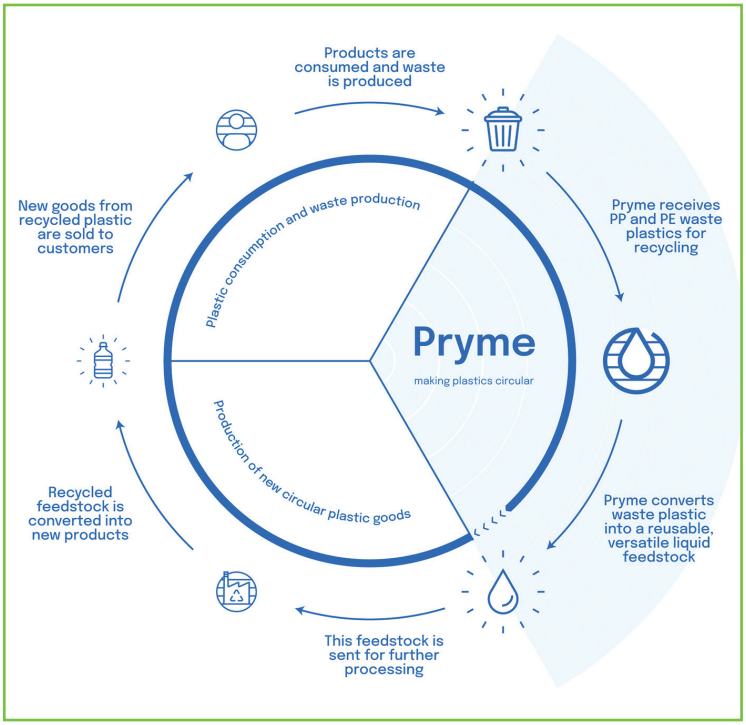
In addition, we have enhanced the process in order to remove contaminants such as chlorine, which we know oil majors don't want in recycled oil because it is highly corrosive. Moreover, we can process more waste than our competitors do, giving us an extremely high conversion rate: 100% of the plastic waste that we treat is converted to value-added streams.

Thanks to our tweaks to the process and installation, we can ensure a high input and output capacity and can rapidly scale the technology, which is key for market feasibility. Pryme's first plant will start production in 2022 in Rotterdam. This plant will have an initial intake capacity of 40,000 tons of plastic waste per year and produce 30,000 tons of feedstock in its first year. That tonnage will grow by 50% by 2023.

Pryme is an ambitious and innovative company, so if you're interested in our business, technology or job opportunities, be sure to contact us via our website.

› **https://pryme-cleantech.com/**

Above: Sander Schiereck, Michiel Kool and Joeri Dieltjens at the site of the new Pryme plant



Above: Pryme provides a sustainable, circular solution to converting waste plastics into valuable feedstock

IMAGE: SHUTTERSTOCK

Realising the opportunity

How will the chemical recycling industry develop? We look at factors that have a major influence on the industry's progress, including legislation and the mass balance concept

The chemical recycling industry has started on a growth path as the drive for greater plastics recycling volumes stimulates demand. As well as supply-demand dynamics, there are other important factors that are helping to shape the chemical recycling industry, such as legislation.

In Europe, regulatory impetus in plastics recycling comes from the European Union's Strategy for Plastics in a Circular Economy which the European Commission announced in 2018. This set out a series of targets focussed on packaging recycling: a target for recycling 65% of packaging waste by 2025 and 70% by 2030, and a specific target for plastic packaging recycling of 50% by 2025 and 55% by 2030.

Another aim is for all packaging to be recyclable by 2030, which would not only help grow mechanically recycled volumes but would also benefit chemical recycling by reducing contamination in waste feedstock.

Going hand-in-hand with legislation is funding support from the EU. Among collaborative R&D projects is Demeto, in which 13 partners are developing a PET depolymerisation process using microwave-based process intensification, and which receives funding from the EU's Horizon 2020 research and innovation programme. Other EU projects are not looking at packaging but focus on other areas, such as the Plast2BCleaned project in WEEE plastics recycling, and the Circular Flooring project which is investigating the CreaSolv process as a means for recycling PVC flooring.

Associations have been set up to provide collaborative platforms as the chemical recycling industry grows. The European Coalition for Chemical Recycling was founded in early 2019 by Cefic and PlasticsEurope, which supports the work of the EU Circular Plastics Alliance and its aim to ensure that 10 million tonnes of recycled plastics find their way into new European products by 2025. Chemical Recycling Europe's members are companies fully focused on chemical recycling technology rather than production of plastics, although it does hope to involve petrochemical companies as well.

Voluntary commitments are also acting as a focal point for mechanical and chemical recycling companies. Many polymer producers are among the corporate signatories of the Global Alliance set up by Ellen MacArthur Foundation, which has also led the way for individual countries to formulate specific recycled plastics content targets within its Plastic Pacts initiative. Sector-specific recycling is supported by Extended Producer Responsibility (EPR) schemes in different countries. But the extent to which EPR schemes proliferate remains to be seen after some poor results and scheme failures.

The chemical recycling industry in the USA is also being influenced by legislation. In the past couple of years, federal bills formulated by often cross-party sponsors have targeted aspects of plastics waste, recycling and environmental improvement. The Break Free from Plastic Pollution Act envisages a producer responsibility scheme involving a 10-cent beverage container deposit

Main image: Mass balance aims to measure the waste plastics contribution from chemical recycling in a much larger manufacturing process and allocate that to the end product

IMAGE: RECYCLING TECHNOLOGIES

Above: Recycling Technologies makes its Plaxx pyrolysis oil from waste plastics at its plant in Swindon, UK

program to operate nationally, minimum recycled content targets, phasing out some single-use plastics items, and a temporary halt to new polymer production plants being built. The RECOVER Act focuses on allocating federal grants to states and municipalities to invest in improving their recycling programs and infrastructure.

In addition to federal and state legislation, the Environmental Protection Agency has developed a National Recycling Strategy with a goal of achieving a 50% recycling rate for all materials by 2030. The American Chemistry Council, representing petrochemical and polymer producers, has been proactive and developed its own Roadmap to Reuse to support its members' aim for all US plastics packaging to be reused, recycled or recovered by 2040.

In the ACC's opinion, crucial to the US achieving its plastics sustainability ambitions is the need for official recognition of chemical recycling and its contribution to the country's efforts. Placing chemical recycling on a par with mechanical recycling is also desirable for plastics producers working in Europe. The risk for the chemical recycling industry is that its processes are not defined as recycling if the European Commission holds the position that the waste plastics input can be converted to fuel either for processing purposes or in the creation of new fuel products. After much lobbying of the European Commission, it has still not officially announced if its definition of plastics recycling includes chemical recycling processes.

Mass balance

A counter approach is being followed by chemical recycling companies with regard to the input-output of their plants and its use in the production of new plastics: it's called the mass balance approach. Tracking use of recycled material is relatively straightforward in the mechanical recycling supply chain but not so easy in chemical recycling, where outputs typically take the form of basic hydrocarbons that subsequently make their way through multiple and complex cracking and polymerisation processes. The solution for the chemical recycling industry is to follow the principles of mass balance.

Already applied in sectors as varied as electricity marketing and Fair Trade agriculture, the mass balance concept aims to determine and measure the contribution of a particular component in a much larger manufacturing process and allocate that accordingly to each unit of end product. In the case of chemical recycling, it aims to ensure that the amount of recycled feedstock entering a production plant equates to any claims made about the recycled content of a product leaving it.

While this may sound a simple task, the reality is much more complex as different approaches can be taken with regard to what and where to allocate. For instance, the entire output of a chemical recycling process could be allocated as a contributor to any polymer or chemical production process – so called free-attribution. Alternatively, it may be decided to allocate only the non-fuel components. Or, at its strictest, only those components used as a non-fuel contributor to production of a polymer.

Chemical Recycling Europe leans toward the free-attribution approach. In a recent white paper it said: "Our position is that all mass-balance interpretations should ensure that the full recycled output from chemical recycling finds a credible value and recognition though the system."

Others, however, favour more restriction. Zero Waste Europe, together with several other environmental NGOs, this year published 10 recommendations to ensure that mass balance does not undermine circularity goals. These include only allowing post-consumer waste streams, not allowing trading of recycled content credits, and ensuring allocations are restricted only to processes where there is a direct link between feedstock and final product (an approach being followed by Sweden's Perstorp with its traceable mass balance scheme).

Mass balance will be essential in the development of chemical recycling as an industrial process and to that end must be seen to be transparent and trusted – consumers, for example, must understand the claims made and, more importantly, have confidence in them. A number of organisations are already running certification programmes, of which the best known are International Sustainability and Carbon Certification (ISCC)and RedCert (both headquartered in Germany). In addition, last year the International Organisation for Standardisation (ISO) announced it had started work on a global mass balance standard. ■

AMI | Events

Plastics Recycling Technology

13-15 September 2022 | Vienna, Austria

Exploring the future of plastics recycling - new ways to boost productivity, quality and profitability

DEVELOP YOUR KNOWLEDGE

Themes for 2022:

- **Innovation** in machinery and processing for increased recyclet quality and throughput
- **Traceability** as a key to high value and quality supply chains
- **Compounding and additives** for recycling
- The impacts of changing **legislation and regulation**
- **Feedstock security** as a growing industry challenge

Save €300* - Book your place today!

Sponsored by: erema group, Starlinger RECYCLING TECHNOLOGY

Media supporter: Plastics Recycling WORLD

*Discounts cannot be used in conjunction with other offers. Offer valid until 11 March 2022. Price may be subject to VAT.

AMI | Events

Chemical Recycling

14-15 June 2022 | Cologne, Germany

Explore the potential of chemical or advanced recycling to turn waste plastics into new materials

www.ami.ltd/attend-chem-recycling

Discover how chemical recycling is assisting the transition to a circular economy, and the impact on your business

Save €200*
if you book your delegate place before 18 March 2022

Book your place today

*VAT may apply. Discount cannot be retrospectively applied or used in conjunction with any other offer.

Sponsored by:

Pryme making plastics circular

GSF

MURA TECHNOLOGY

erema group

To sponsor or exhibit, please get in contact:

Joe Huckings
Sales Executive
E/ joe.huckings@ami.international
T/+44 (0) 117 314 8111

AMI Bringing the plastic industry together.

Media supporter: Plastics Recycling WORLD