European Commission

LIFE & the EU PLASTICS STRATEGY

Environment

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LIFE (*"The Financial Instrument for the Environment and Climate Action"*) is a programme launched by the European Commission and coordinated by the Environment and Climate Action Directorates-General. The Commission has delegated the implementation of many components of the LIFE programme to the Executive Agency for Small and Medium-sized Enterprises (EASME).

The contents of the publication "LIFE and the EU Plastics Strategy" do not necessarily reflect the opinions of the institutions of the European Union.

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Foreword


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Plastics are everywhere. That is why the **EU Plastics Strategy** is set to make a key contribution to the transition towards a circular economy and to the modernisation of our industry.

The aim is to foster a new plastics economy, where reuse and recycling activities are truly integrated into production chains, delivering greater added-value and prosperity in Europe.

New materials, new business models, new jobs.

Fully in line with the thinking and approach already put forward in the **Circular Economy Action Plan.** It addresses the whole value-chain, creates synergies between economic and environmental goals and aims to bring everyone on board. The private sector, public authorities and Europe's citizens all need to play their part to achieve the desired results – I know I can count on all of you.

The Plastics Strategy's vision for the future is clear.

It sets out key commitments for action at EU level and identifies key actions for other stakeholders. The goal is to ensure that, by 2030, all plastics packing is reusable or recyclable, that more than half of EU plastic waste is recycled and that demand for recycled plastics in Europe grows at least four-fold by 2025.

It also features actions to reduce pollution from microplastics, proposals for new port reception facilities to tackle sea-based marine litter, and plans for new labelling rules to make it easier for consumers to dispose of biodegradable and compostable plastics.

Additionally, with the amount of harmful plastic litter in oceans and seas growing ever greater, the Commission has also **proposed a directive** to address the impact of single-use plastics and fishing gear – covering around 70% of all marine litter found on Europe's beaches.

Curbing plastic pollution will have positive effects both on our lives and on the environment.

LIFE looks ahead

The LIFE programme for the environment and climate change is an essential building block. It is also an important tool for the transition to a new plastics economy, by funding innovations and strengthening capacity to achieve the goals of the Plastics Strategy.

This is already visible through the tangible LIFE projects, which have brought technologies that improve the quality – and cost-effectiveness – of recycled plastic closer to market, upcycling plastic waste into high-quality products and creating new jobs.

Across Europe we have seen a number of projects, such as AGANFOILS in the Netherlands, which has developed an industrial-scale process that takes hard-to-recycle plastic foils from food and drink packaging and recycles them into plastic granules that can be used to make foils as good as the originals.

Projects are also improving methods of collection and sorting, developing innovative ways to separate plastics with different properties in order to increase recycling rates, such as REC-POLYOLEFIN.

Plastics production and the incineration of plastic waste generate an estimated 400 million tonnes of carbon dioxide each year. BREAD4PLA is recycling food waste into new bioplastics for food packaging. Doing away with petroleum-based materials while achieving the same properties and extending the shelf life of food.

A strong lead on practical tools in the fight against plastic waste in our seas and on our beaches has also been demonstrated through LIFE DEBAG with its dramatic impact on the number of plastic bags discarded on the Greek island of Syros, which is now being replicated throughout the Aegean Sea.

These excellent LIFE projects and more, fully justify the Commission proposal to increase LIFE's funding by almost 60% in the next long-term EU budget 2021-2027. Together with the new Strategic Research Innovation Agenda for Plastics, more of our money can be spent on delivering the real change we need.

Enjoy the examples of inspiring and innovative projects in this brochure on how to deliver our goals in the Plastics Strategy.

Karmenu Vella
European Commissioner for Environment, Maritime Affairs and Fisheries

A new vision for plastic

"Plastic is very useful but it has many downsides," says Hugo-Maria Schally, Head of DG Environment's Sustainable Production, Products and Consumption Unit. The EU's vision is to transform it into a material for the future.


Photo: © Stephan Huger

"Plastic has been central to the development of our economy and in providing functionality to consumers," explains Mr Schally, whose unit led development of the EU Plastics Strategy. "But it has a lot of negative aspects, in the way it's produced, designed and disposed of, and how much finds its way into the natural environment. The strategy addresses all of these issues so that plastic can be part of the circular economy of the future."

The design, production, use, disposal and recycling of plastic take priority, as well as the fight against marine litter. "We looked at how plastic products – and the materials in them – can be better designed, better used and made more durable. Then, when they come to the end of their useful lives, how they can be disposed of so as much content as possible is used as secondary raw materials and re-injected into the economy. This is the way to make plastic circular."

Circular value chains

The main barrier lies at the design stage. "Plastic and plastic products are designed for their functionality. Recyclability, durability and reusability – the things that are important in a circular economy – are not kept in mind," Mr Schally points out. The problem persists along the value chain, from designers and producers to retailers, recyclers and end-users. "Plastic producers and material designers work to specifications set by brand owners, who are the ones in touch with retailers and the consumer market to gauge what's sellable." The answer is to establish a deeply integrated approach, according to Mr Schally. "If a product isn't designed with recycling or reuse in mind, at the end of the value chain it will be very difficult and costly to recycle. But if the recycling and secondary raw material aspect is borne in mind from the very beginning, it will become easier to do."

Photo: LIFE10 ENV/DK/000098

"Full implementation of EU waste rules will go a long way to reducing plastic waste."

The chemical substances found in plastic products (e.g. additives and colourants) present a challenge, though, affecting their handling further down the line. Mr Schally explains: "There's limited information along the value chain about the chemical content, which makes it difficult to guarantee certain characteristics in the recyclates. We can't say exactly what chemicals are included in the material a producer wants to reuse and put back on the market."

Ensuring that information travels along the value chain is key to solving this problem and also part of the Plastics Strategy. "Anybody trying to reuse or recycle a plastic material should have access to the information that will tell them what they're dealing with," he emphasises.

Room for innovation

Plastic is a greatly underexploited material; less than 30% of the EU's plastic waste is collected for recycling. Mr Schally pinpoints several advances that could help turn this around. "There's potential to improve plastic's recyclability by moving from polymers to monomers. Plus, with better recycling technology, a shift from mechanical to chemical recycling would solve the issue of toxic substances' traceability; with chemical recycling you get the clean polymer back at the end of the process." At the retail level, he sees potential for cutting waste by moving from packaged items to more loose, bulk goods where possible, to keep packaging to the essentials. "And at the end of the pipe, full implementation of EU waste rules will go a long way to reducing plastic waste."

Businesses can take advantage of the possibilities offered by the Plastics Strategy through innovating in these and other areas, he believes. "There are opportunities for companies to make new plastic products, that are more durable, consume fewer resources and can be recycled more easily while keeping the same functionality for consumers. Also for those who want to offer alternatives to plastic," says Mr Schally. "While retailers and the restaurant sector could, for example, change or cut back on their packaging, or offer a different kind of service."

Cooperation is vital to achieve the EU's goals. "Plastic is part of a series of global value chains," he notes. "We need to work with international partners, otherwise our efforts will not make a decisive contribution to solving the global problem." At a regional level, EU programmes such as LIFE have an important role to play in the shift to a new plastic economy. "LIFE can bring people together to pioneer or implement solutions, to look at alternative business practices and new approaches," says Mr Schally. "For example, there are a lot of good waste management practices that can be piloted, shared and perhaps adapted to other needs." In particular, he sees LIFE as a useful tool for bringing scientific knowledge and breakthroughs closer to market: "Taking knowledge and turning it into innovation."

Mr Schally concludes: "The work on plastic has only just begun. With the strategy, we've defined a range of actions to transform it into a material of the future. Continued support and integration of plastic-related issues into EU funds and programmes is crucial to ensure we can empower those who want to make the change and move forward, to be a driver of innovation. The European Commission also understands the importance of reaching out with our messages and initiatives to citizens and stakeholders – in parallel to the adoption of the Plastics Strategy and single-use plastics initiative, we launched a pan-European awareness-raising campaign: 'Ready To Change' (www.BeReadyToChange.eu). We hope that projects presented in this publication will serve as success stories and will help illustrate further how the Plastics Strategy principles are being implemented in practice.''

A pioneering plastic economy for Europe

The EU's Plastics Strategy shows impressive leadership, says Clarissa Morawski, managing director of the non-profit organisation Reloop, which is dedicated to advancing Europe's shift to a circular economy.

Tackling plastic packaging and waste is a vital step towards meeting the strategy's ambitious goals.

reloop
resources remain resources

"One of the biggest end-uses for plastic in Europe is packaging," says Ms Morawski. "Unlike construction and building materials, which also use a lot of plastic but will be around for 20 to 25 years, packaging is consumed and discarded very quickly. Recycling rates are also low, so this area requires serious attention." The strategy calls for all plastic packaging to be reusable or capable of being recycled cost effectively by 2030. The EU also wants to see plastic recycling reach similar levels to other packaging materials such as paper, glass and metals.

Collection and recycling rates must be ramped up urgently to achieve this, Ms Morawski believes. "We need better and more different types of collection systems. It's also important to collect all of the clean material available, gathering it as far upstream and as well sorted as possible." The technology already exists to separate dry waste into clean fractions for recycling. "Near-infrafred technology can identify different types of plastic shapes and colours. We need to invest in more of these machines." Educating both businesses and consumers should help improve the quantity and quality of collections, she thinks. "But it's important to design and extend collection networks for the vast majority of people, who are ultimately lazy, and make it as easy as possible."

Although not included in the strategy, new laws on the recycled content of plastic and plastic products would help increase the market share and use of recycled plastic, with a knock-on effect on collection and recycling, Ms Morawski reckons. "The price of oil, and therefore plastic procurement costs, fluctuates which provides an insecure marketplace for investment in collection, sorting and processing systems. If legislators introduce mandated minimums for recycled content, producers can do the right thing without worrying that their competition will not. It creates a level playing field."

Photo: © Jason Wilcox

Changes in store

The EU's strategy lays the groundwork for a new plastic economy, where products are designed and made with reuse, repair and recycling in mind, and more sustainable materials are developed and promoted. But the shift to a more circular system will mean big changes for players throughout the chain, according to Ms Morawski. "Retailers will have to take more ownership of what they sell. They'll need to think about the content of their packaging and who is supplying their products. In some cases, they may have to take back old items, such as via collection bins."

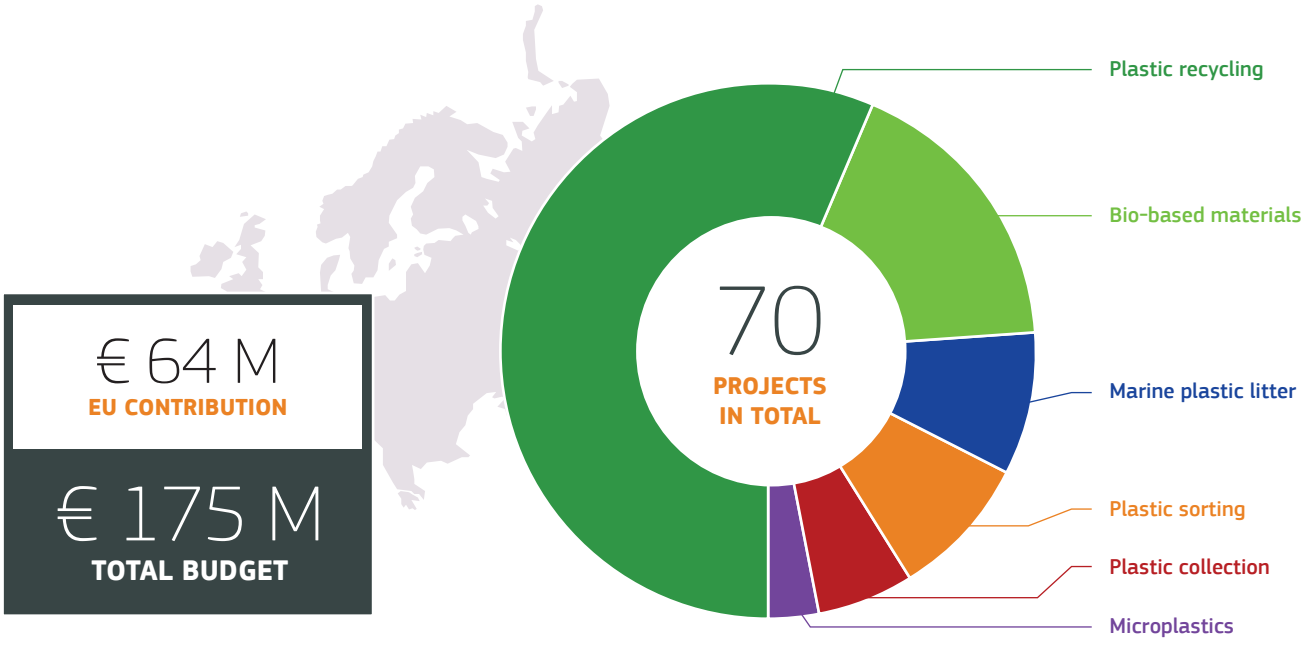
"Brand owners will also have to completely change their way of thinking," she adds. "Their designers will need to engage fully with recyclers. They'll also need to rethink relationships with existing EPR [extended producer responsibility] providers, to consider if they're providing what's needed – access to material and a high collection rate of what they're putting on the market. If not, they'll have to find alternatives, either alone or with like-minded companies."

Changes are in store for the waste management sector, too. "If you're in the business of sorting, landfilling and incinerating, you'll have to start thinking of the future where these methods of disposal are a very small and diminishing part of your trade," says Ms Morawski. "Every tonne of material kept out of landfill and in circulation is way more valuable. Any company that makes money from putting waste in the ground or burning it needs to expand their service to provide value to that material. If you're a progressive company, that's the way forward."

The LIFE programme has an important role to play in sharing best practices and in bringing different parts of the value chain together, she believes. "The plastic chain includes many different industries and sectors, from brand owners and retailers to waste management and logistics companies. They don't naturally come together to talk," Ms Morawski points out. "But LIFE could help facilitate discussions between product designers and recyclers, for instance. If recyclers highlighted which materials are problematic – perhaps their colour makes them difficult to recycle in automated systems, or they contain a particular glue – then designers would know to avoid them when developing their products." This could help make plastic items more circular and cut down on waste. She concludes, "With its legislation and programmes such as LIFE, the EU can bring people together to exchange information and flesh out good circular models that add value to plastic."

LIFE and plastics – an overview

LIFE projects are addressing the challenges posed by plastics throughout their lifecycle and across the value chain. They are showing how a circular economy for plastics could deliver considerable benefits for the environment, in particular in terms of tackling marine pollution and climate change. Circular thinking is also unlocking business potential and creating new jobs.



To date, LIFE has contributed €64 million to around 70 projects that deal with the plastic value chain. These projects have a combined total budget of some €175 million.

LIFE projects have covered all the areas addressed by the EU Plastics Strategy, from improving the economics and quality of plastics recycling, to curbing plastic waste and littering and driving investment towards circular solutions.

Many have had an integrated approach that has enabled them to contribute to the implementation of other EU policies at the same time, for instance food waste or marine policy. Furthermore, they are creating marketable solutions: 4 of the projects featured in this publication have already helped create viable businesses (and jobs), while another 10 are close to market.

Improving plastics recycling: collection and sorting

Expanding separate collection of plastics and improving sorting capacity are identified in the strategy as key to efforts to recycle more plastic waste. LIFE projects have tackled the issue of improving collection and sorting facilities and technologies in a holistic way in order to create value chains for plastic waste within the EU.

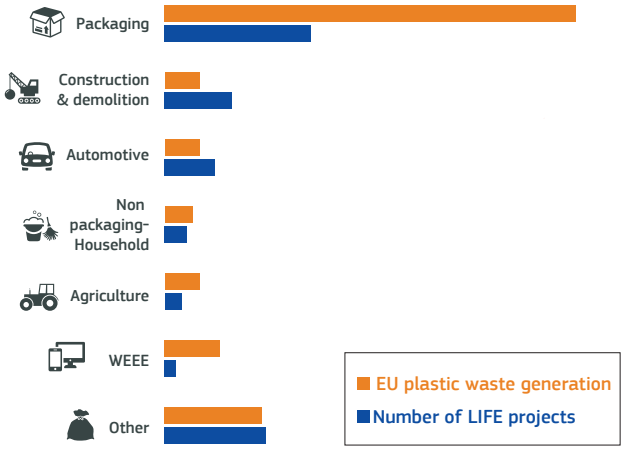
Projects led by municipalities are devising better collection systems and are involving stakeholders in the plastic recycling value chain. They are also raising awareness and advising citizens how to recycle plastic waste (one of the strengths of the LIFE programme is stakeholder engagement and awareness raising). As an example of what can be achieved, the city of Copenhagen now collects over 2 000 tonnes of plastic waste each year, inter-

cepting 15% of all plastic packaging used by households thanks to LIFE-funded Plastic ZERO.

LIFE is also addressing the technological challenge posed by difficult-to-sort plastics, such as plastic films used in packaging or black plastic in computer monitors and other electronic equipment. Given that there are large quantities of both types of waste, these new technologies are ready to be scaled up.

An important lesson to heed from many LIFE projects is that creating viable markets for recycled and renewable plastics is not possible without a guaranteed stream of waste of the right quality. Thus, they call for better collection and sorting and for uniform legislation.

Plastic waste volumes and number of LIFE projects per sector



Improving plastics recycling: upcycling and overcoming barriers to reuse

Around 40 of the LIFE projects on plastics (combined budget: €110 million) have addressed technological improvements to recycling processes to produce recycled material that is effectively as good as virgin plastic and capable of being used for similar high-end applications. Upcycling rather than downcycling. Better quality recyclates can also often be kept in the loop for longer, in some cases almost indefinitely.

A total of 16 of these recycling technology projects have focused on plastic packaging. Since packaging accounts for 59% of waste in the EU, this is in line with expectations. There is a comparatively high representation for projects on waste from the construction and automotive sectors (10 and 8 respectively). Fewer projects have addressed plastic waste in electrical and electronic equipment, agriculture or textiles. Non-recyclable plastic waste is another area where there is clearly scope for LIFE to do more in future.

LIFE projects are also overcoming barriers to recycling more plastic. They are developing innovative methods of recycling material that contains hazardous substances (LIFE EXTRUCLEAN, AUTOPLAST), or finding new end uses for plastic waste that is currently non-recyclable (ECOMETHYLAL). Other projects are upcycling polystyrene packaging into new food containers that meet food safety standards in partnership with major retailers (LIFE EPS SURE).

Curbing plastic waste and littering

In recent years, LIFE has been at the forefront of efforts to stop single-use plastics littering the environment, especially beaches and seas. Intensive awareness-raising and clean-up campaigns have empowered citizens to become part of the solution, tackling everything from plastic bags to cigarette butts, bottles and straws.

LIFE DEBAG's recommendations fed into Greek legislation regarding lightweight plastic carrier bags. Since the law came into force there has been a 50% reduction in single-use plastic bags across Greece. With a budget of only €2 million Clean Sea LIFE has organised more than 600 clean-ups, recovering 10 tonnes of marine litter to date. Marine plastic is also being collected through effective management systems in ports, in line with the requirements of the Port Reception Facility Directive.

Fishing boats in places like Galicia and Sardinia are bringing used nets and other plastic gear back to port rather than dumping them at sea. They are happy to be 'fishing for litter' as a direct result of the stakeholder engagement efforts of projects like Clean Sea LIFE and 3-R Fish. Putting the fishing industry, coastguards, port authorities, local authorities and waste management companies together is creating a value chain for this type of litter too.

Two projects have addressed the hot topic of microplastics. One contributed to efforts to ban microbeads in cosmetics in Italy, which became law in 2017. The other is reducing the impact of washing textiles on the release of microfibres by modifying the surface of fabrics using finishing agents.

Investing in circular solutions

Bio-based materials can tackle some of the environmental challenges associated with plastics by substituting for them in a range of applications. LIFE projects have designed and manufactured biodegradable and compostable plastics and brought them to market or close to market. End uses include coffee capsules, food packaging, netting, adhesives and mulching films for agriculture. LIFE has helped one project (BREAD4PLA) turn bakery waste into bags to pack bakery products. This not only addresses EU policy on food waste as well as plastics, the new bioplastic has been found to extend shelf life.

Viable business opportunities are also being created through projects that are upcycling plastic waste and putting it back in the loop to produce new products. LIFE has funded such efforts in the construction, automotive, logistics (pallets) and footwear industries, among others. The long-term impact of the RECIPLAS project in creating a sustainable new business and new jobs is an example of LIFE at its best.

Opportunities for future projects

- More targeted awareness raising on single-use plastics, preventing the release of microplastics and effective waste sorting at home
- More projects working on ways to improve systems of collection and sorting
- Supporting the design of plastics and plastic products that allow for greater durability, reuse and high-quality recycling

Photo: LIFE10 ENV/DK/000098

Improving plastics recycling

What has LIFE done?

Improved recycling processes to produce upcycled material that is effectively as good as virgin plastic

Addressed barriers preventing recyling of certain types of plastic waste

Brought new technologies close to market in sectors such as packaging, construction, the car industry and electronic waste

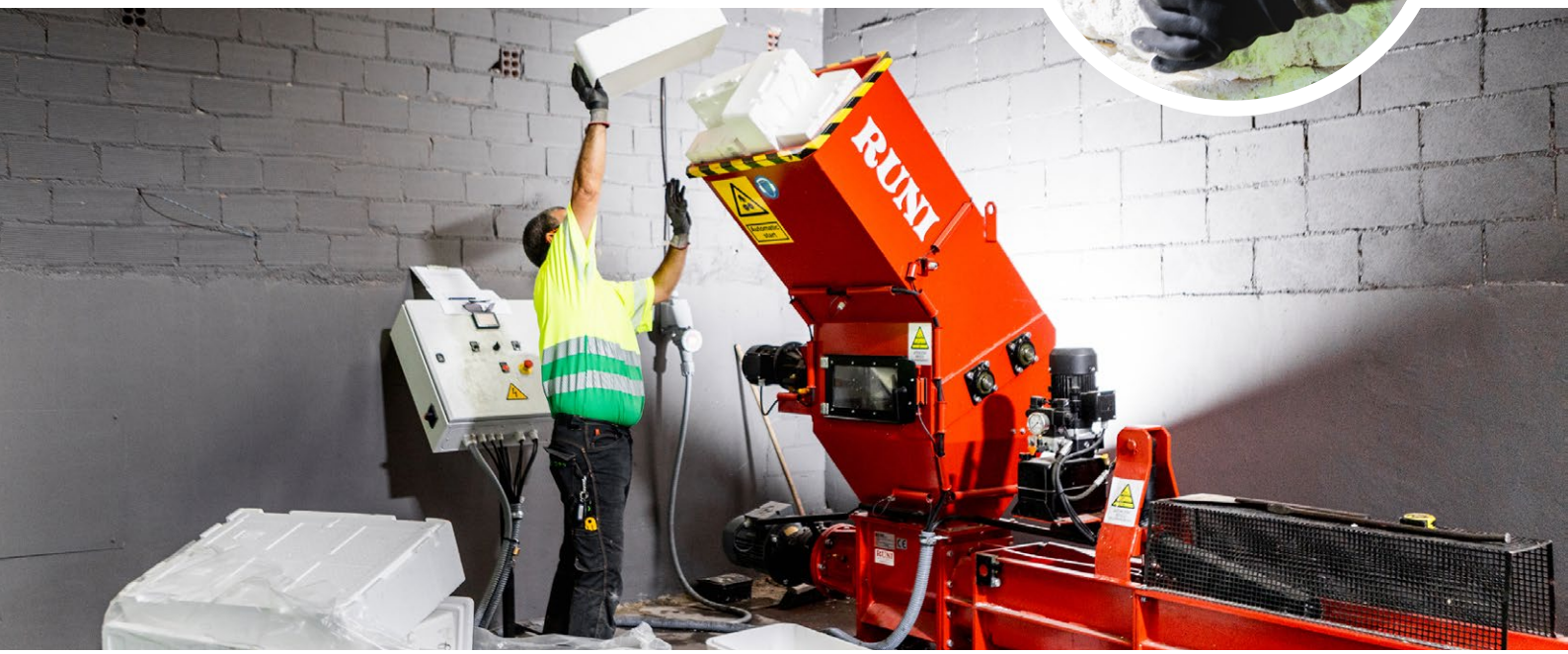
Low demand for recycled plastics is a major obstacle to transforming the plastics value chain. In the EU, uptake of recycled plastics in new products is low and often remains limited to low-value or niche applications. Uncertainties concerning market outlets and profitability are holding back the investment necessary to scale up and modernise plastics recycling capacity in Europe and boost innovation. Recent developments in international trade, restricting key export routes for plastic waste collected for recycling, make it more urgent to develop a European market for this material.

One of the main reasons for the low use of recycled plastics is the misgivings of manufacturers and brand owners. They are concerned that recycled plastics will not always be available in the volumes they need and at the quality specifications they require. Plastics are often recycled by small and predominately regional facilities, and more scale and standardisation would support smoother market operation.

Greater integration of recycling activities into the plastics value chain is essential and could be facilitated by plastics manufacturers. Their experience and technological expertise could help reach higher quality standards (e.g. for food grade applications) and boost demand for recycled feedstock.

The chemical composition of recycled plastics and their suitability for intended uses can also act as a barrier in some instances. Incidental contamination or lack of information about the possible presence of chemicals of concern is a problem for various streams of plastics waste. These uncertainties can also discourage demand for recycled plastics in a number of new products with specific safety requirements. The Commission's work on the interface between chemicals, waste and product policy is set to address some of these issues and will therefore contribute directly to increased uptake of recycled plastics.

Upcycling used food packaging



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The plastics sector faces additional challenges when producing food packaging in terms of health and safety standards. The European Food Safety Authority (EFSA) has only authorised PET recycled plastic to be used in direct contact with food products. The European Commission is now working with the EFSA to assess whether other recycled plastic materials could be allowed through better characterisation of contaminants.

One candidate material could be proposed to EFSA as part of the LIFE EPS SURE project. Petrochemical producer Total is field-testing a new recycling process to transform expanded polystyrene (EPS) from fish boxes into plastic clean enough for food contact packaging. If successful, the project will bring a new recycled plastic to the food market, broadening options for plastic converters and supporting EU efforts to protect public health through its food safety policy. “We are upcycling polystyrene packaging into new food containers,” says project manager Isabel Goyena. “This is unprecedented.”

The fish boxes have been collected from supermarkets across Catalonia. They have been washed, treated and shipped to a chemical reactor in which their molecular building blocks will be torn apart. Mixing this recycled feedstock with fresh material LIFE EPS SURE plans to produce polystyrene sheets fit for new yoghurt pots and meal trays. “All the EPS waste going into the reactor is transformed into usable plastic,” says Ms Goyena. “We are still demonstrating the technology, but after mixing recycled expanded polystyrene with 70% virgin polystyrene, we envisage that the final compound will present the same quality as virgin polystyrene.”

Once production has been optimised, project partners will run health and safety tests on the plastic and apply to the EFSA to launch it on the food market. Ms Goyena says that demand for environmentally-friendly packaging is growing as shoppers pay increasing attention to the waste streams of their supermarkets. At present, alternatives are expensive. Expanded polystyrene is a notably bulky material that shops can only recycle in treatment plants nearby. The limited choice of recycled materials authorised for food packaging also restricts the applications of its second life. “Today it is a problem for supermarkets to dispose of expanded polystyrene fish boxes,” said Ms Goyena. “In Spain, most end up in landfills.”

Retail partner

LIFE EPS SURE is working with the major Spanish department store chain, El Corte Inglés, to broaden the options. “They are satisfied with our solution to close the cycle and are considering displaying their own brand on yoghurt pots and meal trays made with recycled polystyrene,” says Ms Goyena. If approved, this new plastic for food applications could boost recycling rates in a packaging sector dominated by single-use plastics. The demonstration project aims to collect 10 tonnes of EPS fish boxes from El Corte Inglés shops across Spain and use it to produce over four tonnes of recycled EPS. Ms Goyena expects that the recycling process could collect over 70% of fish boxes in circulation, reducing landfilling and damage to marine ecosystems.

Read more:
www.life-eps-sure.com

Car scrappers smell the coffee

Photo: VALSIR

The risk of dangerous chemicals in end-of-life plastics raises barriers for recyclers entering some of the largest potential waste markets in Europe. Old vehicles contain a lot of recyclable plastic, but the presence of chemical contaminants in the material has dampened efforts to make full use of it.

Fuel tanks made of high-density polyethylene absorb hydrocarbons, which are difficult to eliminate during the recycling phase. This results in poor quality plastic granules that retain the smell of fuel and cause surface defects in finished products. As for old bumpers, body shops rarely separate them from other types of waste and, although they are made of quality plastics (polypropylene), they often end up landfilled or incinerated, and sometimes illegally dumped.

The AUTOPLAST-LIFE project set up an innovative network in northern Italy to collect, sort and recover plastic from end-of-life vehicles. More than 200 garages took part in a micro-collection scheme coordinated by the social cooperative, CAUTO, which provides employment for the socially disadvantaged.

CAUTO's teams sorted used bumpers and fuel tanks into dedicated recycling streams. This meant that the polypropylene in the bumpers was not contaminated, enabling it to be recycled into higher quality materials. Meanwhile the old fuel tanks were taken to a treatment plant built by the project beneficiary, VALSIR.

"The material that we collect is ground, washed, dried and sent to the extrusion line to be turned into plastic granules," explains AUTOPLAST-LIFE project manager, Andrea Sbicego. "During some phases of this process coffee grounds and a small percentage of bicarbonate of soda are added. These remove the smell of hydrocarbons from the recycled plastic and improve its final quality," he says.

The process is better at removing hydrocarbons than traditional washing and allows 20% more plastic from fuel tanks to be recycled. It has also significantly reduced recycling costs. In another virtuous circle, AUTOPLAST-LIFE made use of over 5.5 tonnes of coffee dregs recovered from the break rooms of local companies. "In total, we managed to recycle over 150 tonnes of car bumpers and 300 tonnes of fuel tanks," says Mr Sbicego. VALSIR's treatment plant is capable of processing over 10 000 tonnes of plastic fuel tanks per year at full capacity.

"By the end of the project, 12 agreements had been signed to use the recycled granules coming from the AUTOPLAST line for products in the automotive, construction, textile and furniture sectors," notes Mr Sbicego. CAUTO's micro-collection scheme is financially sustainable and ready to be replicated on a larger scale.

Read more:
www.progettoautoplast.eu

Getting hazardous plastic back in the loop

At present, one in every 30 kilograms of plastic waste generated in the EU is hazardous. Concerns about contaminants spreading through recycling streams can discourage demand for recycled plastic in a number of new products with specific safety requirements.

"The accepted treatment method for hazardous plastic waste involves a series of washes that consume a lot of water, cleaning agents and energy," says Rosa Gonzalez from LIFE EXTRUCLEAN. This method also degrades the properties of the plastic which means the pellets produced are typically used in applications with lower added value.

The project showed how blasting plastic surfaces with carbon dioxide at extreme pressures and temperatures can eliminate hazardous substances found in waste polyethylene packaging for solvents or phytosanitary products.

"The technique has boosted the removal of hazardous contaminants by close to 70% compared to traditional processes," says Ms Gonzalez. It has more than halved water and energy consumption and reduced use of cleaning substances by 23%. "It also improved the mechanical properties and quality of the plastic recycled. We can now substitute over 70% of the virgin material in new packaging for dangerous goods," she explains.

The renewed plastic is attracting interest from companies looking to use it to make pipes and package domestic bleach. Importantly, it meets the exacting ADR regulations for packaging materials for dangerous goods.

Read more:
www.life-extruclean.eu

Making a resource of non-recyclable plastic

"Treatment of plastic waste to produce methylal aligns with the Plastics Strategy."

Some types of plastic waste can't be recycled using conventional methods. This includes waste containing mixed plastics, contaminated or severely-degraded plastics. Most of this non-recyclable plastic waste is currently landfilled. To achieve EU targets of zero plastic to landfills, new treatment processes and end uses are needed.

At a site in Spain, LIFE ECOMETHYLAL is bombarding such plastic waste with highly energised particles that turn into gas, a process called catalytic hydro-gasification with plasma (CHGP). According to Feliu Sempere from AIMPLAS, the technology institute coordinating the project, "CHGP is more efficient, versatile, cleaner and has lower investment costs than other technologies that are normally complementary to traditional mechanical recycling."

The project is turning plastic waste into high-quality syngas. "In the coming months, methylal will be produced from this syngas," says Mr Sempere.

Methylal is a colourless liquid that is used as a chemical solvent and fuel additive. It's a lucrative business, with a market worth an estimated €5.2 billion per year. Yet only 6% of the 800 000 tonnes or so used annually in Europe is made in the EU.

"Treatment of plastic waste to produce methylal aligns with the Plastics Strategy in that it reduces landfilling and adds value to plastic waste," says Mr Sempere. "It also decreases imports of materials derived from fossil fuels from non-EU countries."

The pilot plant in Spain is using non-recyclable plastic waste from the automotive, electronics and packaging sectors. Later the pilot unit will be moved to Croatia to test its replicability. Mr Sempere is confident in the commercial potential: "Its small space, modularity and low investment makes it appropriate to be installed inside/close to plastic recycling companies."

Read more:
ecomethylal.aimplas.es

Closing the loop for plastic foils

An innovative waste-to-resource recycling plant in the Netherlands is making plastic foils as good as new.

Low-density polyethylene (LDPE) is a soft and pliable plastic that is widely used in packaging. The material's flexibility is a great advantage. It allows LDPE foils to be created with special blocking layers, for instance for blocking ultraviolet light, keeping food and drinks fresh longer. However, such multi-layer packaging is also difficult to recycle.

"Existing recycling processes for LDPE from municipal waste are not able to sufficiently reduce the contamination level, negatively affecting the quality of the recycled regranulate. As a result, the regranulate does not reach the quality of virgin material and can only be used for lesser applications," explains Willy Peeks from Attero, a waste processing company in the Netherlands. These uses include irrigation pipes, bin bags, black film and sheeting for agriculture and the building industry.

Attero has applied funding from LIFE to demonstrate a new process that sets the stage for recycled foils that are 'as good as new'. The LIFE AGANFOILS project has built a waste management plant in Wijster in the northern Dutch province of Drenthe. This is the first integrated full-industrial scale, waste-to-resource recycling facility for foils from municipal solid waste.

"Our new plant – which uses heat from our company's waste-to-energy plant – has the technical capabilities to clean this very polluted post-consumer film to a quality regranulate that enables producers to make new film products out of it," says Attero's CEO, Paul Ganzeboom. So, for example, a sweet wrapper can be treated and the material reused to wrap more sweets. Closing the loop in this way makes LIFE AGANFOILS a great example of how the EU's vision for a European circular economy can be made a reality.

The AGANFOILS process

The waste foils arrive in bales. The LDPE is first shredded and other materials (wood, paper, textiles, other plastics) are removed. It is then washed. "The washing process contains multiple steps: a cold prewash, and after a second shredding step, a hot wash process in which we reduce most of the odours, organic and mineral contaminations," says Mr Peeks. It is the first time in Europe that hot washing has been used to treat LDPE plastic waste on a full-industrial scale. The material is then dried and extruded into high-quality regranulate, which is bagged or stored in silos.

Demonstration phase

Attero has created 25-30 new jobs at the new LDPE recycling plant, which started up in April 2018. "We are now in a phase of continuous improvement of the process," says Mr Peeks. Once the process has been optimised, Attero will focus on increasing throughput and on commercialisation.

The plant in Wijster is expected to recycle around 24 000 tonnes per year of plastic foil waste, leading to about 15 000 tonnes per year of high-quality plastic regranulate. Since the waste LDPE would no longer need to be transported from the Netherlands to Germany, this would reduce carbon dioxide emissions by up to 1 100 tonnes per year.

"We can see that the progress of the AGANFOILS project is being monitored by manufacturers of process equipment and producers of LDPE foils throughout Europe," says Mr Peeks.

"We are also considering pursuing opportunities within Europe ourselves, especially when a combination of recycling and energy-from-waste development is required," says Mr Ganzeboom. To this end, LIFE has linked the company with its local Enterprise Europe Network (EEN) branch to help facilitate commercial development and potential cross-border expansion.

"There is a lack of recycling capacity in Europe, especially for plastics packaging such as post-consumer film. To implement the new EU Plastics Strategy, Member States will need to address this shortage," says Mr Ganzeboom.

He adds that "to further drive demand and make initiatives like AGANFOILS viable in other European countries it is essential that more recycled content is applied in packaging and other plastic products. Governments should step up for green procurement to include such recycling as well as lower the extended producer responsibility (EPR) fees for producers who apply recycled content and design-for-recycling."

Read more:
www.attero.nl

Photo: Shutterstock/Rhonda Roth

Collection and sorting

What has LIFE done?

Helped municipalities implement better collection systems that boost recycling rates and lower transport costs

Raised awareness and involved stakeholders along the whole value chain

Supported new technologies that tackle difficult-to-sort plastics

There are opportunities for future LIFE projects to develop upon these experiences and to improve collection services within EU municipalities and and develop better ways of sorting sorting plastic waste for reuse

Systems of collection and sorting of plastic waste have a major impact on the quantity and quality of material available for recycling. More and better separate collection and sorting services are essential to achieving the goals of the Plastics Strategy. Separate sorting is also essential to avoid introducing contaminants into recycling streams and to maintain high safety standards for recycled materials. National, regional and local authorities, in cooperation with waste management operators, have a key role to play in raising public awareness and ensuring high-quality separate collection. Money collected through extended producer responsibility (EPR) schemes can do much to boost such efforts. Similarly, deposit systems can contribute to achieving very high levels of recycling.

Reducing fragmentation and disparities in collection and sorting systems could significantly improve the economics of plastics recycling, saving around a hundred euros per tonne collected.

To encourage more standardised and effective practices across the EU, the Commission will issue new guidance on separate collection and sorting of waste. Public authorities need to invest in extended and improved separate collection. Innovative solutions for advanced sorting, chemical recycling and improved polymer design can have a powerful effect.

Cities sort out plastics value chain

Today, the value chain for recycling plastic sprawls across continents and economic sectors. To tackle its complexity, the City of Copenhagen in Denmark has unified private citizens, public entities and corporations behind the same cooperative strategy.

Senior Adviser for the City of Copenhagen Mette Skovgaard says that the secret has been clearer communication and transparency. As part of the LIFE-funded Plastic ZERO project, the city introduced a door-to-door collection scheme for plastic waste in 2012. It started with blocks of flats and has gradually extended to all residential buildings in the city.

Copenhagen initially had no plastic recycling facility nearby. "We found out that we didn't even have a sorting facility in Denmark," recalls Ms Skovgaard. "So, the plastics had to be exported for sorting. It is much more expensive and complicated to transport waste across national borders."

Ms Skovgaard points out that recycling plastic costs more to the community than incinerating it. Effective collection schemes have to be simple for citizens, with many collection points. That implies more waste transport, which increases costs. "Once collected, there is a business case for companies to process and sell the waste," she says. "But for municipalities, it is a cost."

One observation that emerged from experience in the field was the importance of packaging design. Plastics with many layers, bright colours or labels built into them are harder to sort and recycle, making it necessary to inform product manufacturers of what plastics could be recycled and how.

"It proved vital to sit the entire value chain around the same table and discuss the barriers and solutions to recycling plastics together," explains Ms Skovgaard. By considering the needs of sectors involved in plastic waste, Plastic ZERO "initiated a debate that had not been there before. It raised awareness among companies, boosted enthusiasm among citizens and fed into design guidelines now available to product manufacturers."

She believes that municipalities are well placed to answer a call in the EU Plastics Strategy for greater cooperation. They have the scale to interact with a broad range of stakeholders involved in the plastic recycling value chain and a financial incentive to do so.

Since launching the LIFE-funded Plastic ZERO campaign in 2011, the city now collects over 2 000 tonnes of plastic waste each year, intercepting 15% of all plastic packaging used by households in Copenhagen. "We have lost count of how many jobs this has created," says Ms Skovgaard.

Data gathered during the project has been instrumental in streamlining waste collection in the city, striking deals with recyclers abroad and building a local plastic sorting test-facility to pilot technologies and communicate with partners and the public. "We are now working with 38 municipalities to pool our plastic waste and tender it to other recyclers for added value," notes Ms Skovgaard.

Read more:
www.plastic-zero.com

Shedding light on invisible plastic waste

Comparatively little of the black plastic used in electrical and electronic equipment such as plasma screen televisions is recycled. It's a question of technology. The dark polymers are invisible to the infrared light used in conventional waste-sorting machinery. What's more, the black plastic often contains bromine compounds, which are used as flame retardants. "They can spontaneously degas in the environment, which proves toxic in closed environments. The technologies used to detect the bromine (mainly X-ray fluorescence) require clunky equipment that is not always compatible with vast production lines," explains Sébastien Michel of Bertin Technologies.

Mr Michel is in charge of INSPIRE4LIFE, a project that has found an innovative solution in the form of a machine that sorts different kinds of plastic, bringing together components including a laser, a detector and a six-axis robot.

"If you just mix all plastic waste together, you can't recycle it into a good plastic material. The quality would be so bad, you wouldn't even be able to make granulates out of it," says Mr Michel. Instead he says that it is better to break down the waste into high-purity batches of different materials and recycle them separately for a higher-quality end result.

"We use laser-induced breakdown spectroscopy, which means that we focus a laser on each piece of plastic waste we blast a 0.1 mm hole on its surface, and analyse the light emitted by the resulting spark. Its colour immediately identifies the composition of the plastic," explains Mr Michel. "The technique can sort any plastic waste material, including black bags, so long as its composition is homogenous and it presents a flat, clean surface," he adds.

As set out in the EU Plastics Strategy, recyclers must avoid introducing contaminants such as bromine into recycling streams to retain high safety standards when giving materials a new life. "Our sorting technology can spot the contaminants and remove them from waste streams ergonomically. The other materials have a second life, regenerating recycled secondary plastic from bromine-free material sorted by resin type," says Mr Michel.

INSPIRE4LIFE's machinery has been undergoing trials at a large recycling plant in Belgium since January 2018. "It is achieving purities and efficiencies of 98.8-99.5%. Once you're above 97% you can derive much higher value from the material treated," he explains. The project is already demonstrating this upcycling dividend. "At present, you would sell the sorted plastic to a recycler who can turn it into other products (like electrical meter boxes). We have shown that you can recycle it into films for 3D printers. In principle, in the future, better sorting could help recycle materials in a fully-closed loop."

The aim is to commercialise the new technology in 2020. "It is financially viable. Right now, we are reducing the investment risk. We suggest installing the machine at the end of dismantling chains. Given that there are 250 000 tonnes of plastic released each year from electrical waste, there is a vast market for us to scale up in," believes Mr Michel.

Read more:
www.libs-quantom.com/life-project

"Better sorting could help recycle materials in a fully-closed loop."

Using heat to sort plastic films

Plastic films are widely used in packaging. However, they are not all made of the same material, which presents challenges for recycling.

"Today most plastic waste is still separated using techniques based on physical properties like density," says Claudio Fernández from the REC-POLYOLEFIN project.

The approach has proven notoriously ineffective for separating plastic bags and films used in packaging, which can be variously made of low- or high-density polyethylene or polypropylene. "These three plastics have very similar densities, leading recyclers to simply mix them together into a low-quality, low-value material," explains Mr Fernández.

In line with the Plastics Strategy's push for improved and harmonised separate collection and sorting, the team from REC-POLYOLEFIN built a pilot plant in Spain that sorts and treats plastic films based on their different properties when heated to around 100 degrees Celsius. "Each plastic responds differently to the temperature. Polypropylene stays a film, high-density polyethylene contracts a little and low-density polyethylene (LDPE) scrolls up into a small ball," says Mr Fernández. "We then sieve the heated remains like gold miners to sort the LDPE out of the mixture and recycle it separately."

The pilot machine can separate one tonne of plastic waste every hour. "We managed to obtain a decent fraction of pretty clean LDPE, the most valuable of the three films, with a purity in the range of 95%, and recovering 85% of the total initial content," he explains. "When mixed with virgin material, this plastic is pure enough to blow into films for new products. Recycled films are ideal for thicker or layered LDPE films like those used in new plastic bags or plastic films for greenhouses. The rest of the plastic is melted together and pushed through a mould, to make hard plastics used for manufacturing of garden furniture for example. That also reduces the demand for virgin plastics."

In trials with local supermarkets, the project was able to separate more than half of the LDPE in their plastic waste and turn it into marketable films. "The price of suitable recycled plastics could be easily in the range of 70% of the price of virgin material, and we could match their quality in many markets," notes Mr Fernández. "But the financial sustainability of the technology also depends on the cost of input materials. To scale up the technology, we would need full circuits for recycling that collect plastic waste at low cost."

To this end, the project team is planning to establish a larger plant with a capacity of 5 tonnes per hour, and a plastic waste collection plant at the site of project partner SMSA in Carcar, Navarre. If this initiative succeeds, two more plants will be created elsewhere in Navarre.

Read more:
www.rec-polyolefin.eu

Curbing plastic waste and littering

What has LIFE done?

Organised huge awareness campaigns empowering citizens to become part of the solution

Carried out nearly one thousand clean-up campaigns across the Mediterranean

Influenced new Greek legislation on single-use plastic bags, leading to a 50% reduction in their use

Developed management systems to bring marine plastic back to harbour, in line with the Port Reception Facilities Directive

Worked with stakeholders to tackle the problem of abandoned fishing gear

Found solutions for littering on land (e.g. cigarette butts)

Funded new ways of keeping microplastics in textiles and cosmetics out of our seas

Growing use of plastics for a wide range of short-lived applications generates large quantities of plastic waste. Single-use plastic items are a major source of plastic leakage into the environment, as they can be difficult to recycle, are often used away from home and often littered. They are among the items most commonly found on beaches, and represent an estimated 50 % of marine litter.

Where waste management is sub-optimal, even plastic waste that has been collected can find its way into the environment. Marine litter from sea-based sources is also significant. Fishing gear abandoned at sea can maim or kill marine animals that become entangled in it.

Curbing plastic waste and pollution is a complex problem, given its diffuse nature and the link with social trends and individual behaviour.

The EU has already taken steps to tackle the problem by setting requirements for Member States to adopt measures to cut the consumption of plastic bags and to monitor and reduce marine litter. EU funding is also being deployed to understand and combat the rise of marine litter, supporting global, national and regional action. Awareness campaigns, measures to prevent littering and projects to clean up beaches can be set up by public authorities and receive support from EU funds. To reduce discharges of waste by ships, the European Commission is presenting together with the Plastics Strategy, a Port Reception Facility Directive. Finally, it will continue its work to improve understanding and measurement of marine litter, an essential but often neglected way to support effective prevention and recovery measures.

As a complement to these preventive measures, EU funds, including LIFE, support action to retrieve plastics floating in the oceans using innovative technologies

Stopping plastic bags reaching the Aegean Sea

"Greece is the kingdom of the plastic bag. It is one of the EU Member States with the highest per capita consumption of single-use plastic carrier bags," says George Papatheodorou, leader of LIFE DEBAG, a project that is helping to stop those bags ending up as marine litter in the Aegean Sea.

Legislative change

One of LIFE DEBAG's greatest achievements is its contribution to new Greek legislation on plastic bags. "We arranged a series of national consultation forums with all relevant stakeholders to define policy agreements for single-use plastic bags. We then took those recommendations for legislation to the Greek Parliament. Many of them were incorporated into the law that came into effect at the beginning of 2018. This set an environmental fee of four euro cents per plastic bag," says Professor Papatheodorou. "Since the law came in there has been a 50% reduction in single-use plastic bags across Greece."

Intensive campaign

As well as reaching out to legislators, "we are carrying out a campaign to prevent and reduce plastic bag pollution in the marine environment of Greece," explains Professor Papatheodorou. This includes raising awareness nationally through the mass media and an intensive, local 'demonstration' campaign.

The island of Syros was chosen for this intensive campaign, which went door-to-door to homes, shops, hotels and tourist lets. The project distributed over 10 000 reusable cotton shopping bags and persuaded more than 200 shop owners to sign a voluntary agreement to reduce the use of single-use plastic bags. Three 'plastic bag-free weeks' on Syros "have been very successful and very well supported by the local community", says Professor Papatheodorou.

"It is the first time that an intensive marine litter awareness and information campaign has been systematically monitored for its impact on the natural environment. This has involved surveys of supermarket customers and monitoring the amount of plastic bags through beach clean-up campaigns, and airborne drone and underwater camera surveys," he explains.

The scale of the problem is evident from the fact that nearly 60 000 items of litter have been collected during 16 beach clean-ups on Syros to date. Around three-quarters (over 43 000) of these items are plastic waste.

According to Professor Papatheodorou, "there has been a 70% reduction in plastic bags on the beaches of Syros in the first two years of the project, as well as a 30% reduction in plastic bags on the seafloor in Ermoupolis Bay. We believe this is a direct result of our awareness campaign on the island."

He highlights three best practices that other campaigns can replicate to reduce litter from plastic bags and other single-use plastics: "Provide free reusable alternatives; involve all relevant stakeholders in decision-making processes; and exhaustively monitor the marine environment, ideally with the participation of citizens, communicating the results to the public as a positive feedback of changing consumer habits."

Other islands in the Aegean Sea are now carrying out similar campaigns. "We strongly believe that our project was the triggering mechanism," says Professor Papatheodorou. "The next step will be to coordinate all these initiatives with the aim of making the Aegean Sea a pilot area to tackle marine pollution by plastics."

Read more:
www.lifedebag.eu

"There has been a 70% reduction in plastic bags on the beaches of Syros in the first two years of the project."

Stubbing out the scourge of cigarette butts on beaches

Cigarette filters are made from cellulose acetate fibres, a type of plastic. The cigarette butts that smokers leave behind do biodegrade, but the rate of decomposition is extremely slow. Butts left on beaches are a particular problem since they end up at sea where they are ingested by birds, fish, turtles and marine mammals. “Cigarette butts are commonly found in the stomachs of dead aquatic species,” says Ioannis Spanos from the environmental engineering consultancy, Terra Nova, one of the partners in a LIFE project called AMMOS.

As well as causing death by suffocation, “cigarette butts contain some hazardous chemical substances, such as nicotine, cadmium, lead and arsenic which are gradually leached into the marine environment and thus pose an increased threat to wildlife due to chemical poisoning,” explains Mr Spanos. To give an idea of the scale of the problem, he says that approximately 5.6 trillion filtered cigarettes are smoked every year worldwide, of which an estimated 4.5 trillion end up as litter. Some 10% of those (or 450 billion cigarette butts) end up directly or indirectly in the marine environment.

AMMOS actions

With high visitor numbers and a visible problem with cigarette butts, the tourist beaches of Greece are an ideal place to begin to address this form of plastic litter. LIFE AMMOS ran an information campaign to reduce smoking-related litter in the country, focusing on 15 pilot beaches in particular.

The project monitored the scale and distribution of cigarette butts and carried out surveys of public opinion. These were used to develop a series of preventive measures, including TV and social media campaigns, a smartphone app to rank beaches according to how few cigarette butts are present, information kiosks on the pilot beaches during the summer and engagement with restaurants, hotels, beach bars and other local stakeholders. The project also ran education campaigns in schools.

One novel awareness-raising tool was an information leaflet designed by Terra Nova that folded up into a special beach ashtray for smokers. Around 145 000 of these were distributed during the course of the project.

The project beneficiary MED SOS organised beach clean-ups, collecting more than 7 000 cigarette butts for correct disposal in municipal waste facilities.

Impact and lessons

Monitoring of the pilot beaches revealed a 66.9% decrease in the number of cigarette butts between the first (2013) and second (2014) year of the information campaign. “This probably reflects a behavioural change of the beach visitors that can be attributed to the extensive campaign that was implemented,” says MED SOS.

In order to help implement the Plastics Strategy and stop more cigarette butts ending up as marine litter, Mr Spanos says more needs to be done upstream. “One out of 10 cigarette butts littered in cities, towns and villages ends up in the sea through storm water wash out.” To prevent this the LIFE AMMOS team proposes a combination of measures, including intensive campaigns to inform the general public of the environmental impact of cigarette butts, ashtrays permanently fixed to rubbish bins on pavements and fines by municipal police for people who throw butts on the ground.

Read more:
www.life-ammos.gr

Lessening the impact of fishing industry waste

Photo: NEEMO EEIG/Audrey Thénard

Fishing gear lost or abandoned at sea can have harmful impacts on marine species. That is why the Plastics Strategy includes a proposal to develop targeted measures to prevent this happening, and why the Commission is also proposing legislation on port reception facilities for plastic and other waste.

Such measures will likely draw on the lessons of a successful LIFE project called 3-R Fish. Between 2009 and 2011 it piloted new systems for collecting, processing and reusing the fishing industry's main solid wastes at ports in Galicia (Spain) and north-west Portugal. These wastes included (plastic) fishing nets and expanded polystyrene packaging, which is used at fish auctions.

The project beneficiary CETMAR developed the systems in collaboration with port entities, the fishing industry, waste managers and recycling companies. This multi-stakeholder approach paid dividends, with nearly 750 tonnes of fishing nets and more than 130 tonnes of expanded polystyrene collected and managed. Fishing fleets were encouraged to bring waste trawling and entanglement nets back to port. "Fishermen felt involved and proud of preventing those materials entering the sea," says CETMAR.

By the end of the project, logistics for collecting, sorting, transporting and reusing nets and polystyrene fish boxes were well-established at the ports of Marín, Ribeira, Vigo and A Coruña and have since been extended to other ports.

However, margins for port managers and recyclers are low. Large quantities of well-sorted waste are necessary for the system to be profitable. One lesson for policy-makers is to encourage ports to set up a network to provide more waste to the recycling companies.

Read more:
http://leitat.org/english/maritimo/leimar3.htm

Keeping microplastics out of the ocean

Mariacristina Cocca works for CNR, the Italian National Research Council. She was one of the researchers involved in MERMAIDS, a LIFE project that set out to reduce the impact that washing textiles has on the release of microplastics into our marine environment.

When synthetic fabrics are washed, they release tiny plastic microfibres. Scientists have found these fibres in aquatic habitats and species across the world, where they have been shown to have harmful impacts on fish, plankton and other organisms. "We published a study in the journal *Environmental Pollution* showing that washing 5 kg of polyester fabrics releases between 6 million and 17.7 million microfibres, depending on the type of detergent used," says Ms Cocca.

The MERMAIDS team focused on prevention strategies. In particular, treating the surface of the fabric to create a protective layer able to prevent the release of microfibres. "The most promising results were obtained by modifying the fabric surface with natural substances such as pectin," reveals Ms Cocca. The researchers found that while using laundry softener could reduce microfibre release by 35%, "with the finishing treatment based on pectin it was more than 80%."

In the EU Plastics Strategy, the European Commission says it will consider measures such as better information and minimum requirements on the release of microfibres from textiles. However, it recognises that more research is needed to improve our understanding of the sources and impacts of microplastics and to develop innovative solutions to prevent their dissemination.

Ms Cocca agrees, and says that "the development of new finishing treatments and filtration systems for washing machines and for wastewater treatment plants could be useful to prevent the entrance of microplastics in freshwater systems."

Read more:
www.life-mermaids.eu

"We are specifically targeting fishermen and authorities to tackle sea-based marine litter."

Raising awareness to reduce plastic waste

Clean Sea LIFE has brought home the impact on the marine environment of discarded fishing gear, packaging, microplastics and cigarette butts.

"Clean Sea LIFE is an awareness project. We target marine-related publics (divers, boaters, anglers, professional fishermen, beach and tourism operators) as well as students and teachers, and the general public," explains project manager, Eleonora de Sabata.

Since 2016, the Italian project has tackled littering, promoted clean-up operations, discouraged the use of single-use plastics and encouraged recycling.

"Marine litter is a very complex issue and it derives from a variety of sources," says Ms de Sabata. Poor waste treatment is one factor, "but in the Mediterranean Sea about a third is linked to tourism and another significant fraction is related to fishing activities."

"Our strategy is to involve clubs, associations and schools and motivate them to address how their own activities may inadvertently contribute to marine littering, make cleaning up a regular part of their activities and raise the awareness of their own members through instructors and courses," she explains.

Those taking part in the project make a 'promise to the sea' to prevent littering, organise regular clean-ups, reduce single-use items, reuse and recycle more.

Over 5 000 people have taken this pledge in the first two years of the project. More than 600 clean-ups have been held, recovering in excess of 10 tonnes of marine litter. This includes 1.6 tonnes collected during 'fishing for litter' activities in four ports.

'Fishing for litter'

Stopping littering at sea is one of the ways in which the Clean Sea LIFE is helping implement the EU Plastics Strategy, says Ms de Sabata. "We are specifically targeting fishermen and authorities to tackle sea-based marine litter. Work in close collaboration with the coastguard, port and local authorities and waste management companies is allowing us to streamline the process for fishing for litter activities, with measures to ensure that marine litter collected in nets is not left at sea but returned to land and adequately managed there."

Beyond raising awareness, the project has tested the use of an underwater drone to retrieve lost coral fishing nets in deep seas. "We are also investigating ways to address aquaculture for mussels, which is responsible for a lot of littering," she adds.

Engaging content wins converts

One of the strengths of Clean Sea LIFE is its ability to engage with the different target audiences. "Tactics vary, but mainly they are based on very visual messages, and content creation based on original reports targeting current events in the spotlight," says Ms de Sabata. For instance, an accident at a water treatment plant that released millions

of plastic discs into the sea became an opportunity to raise awareness about marine litter. “We investigated the stranding, providing news organisations, the coast-guard and prosecutors with information, photos and videos on the occurrence, scale and the dynamics of the spill. We also launched a big clean-up operation, called #cacciaaldischetto, which resulted in hundreds of small and large clean-ups by clubs and citizens.” Over 160 000 discs were recovered.

A major regatta, the Barcolana in Trieste, offered the chance to launch a campaign aimed at boaters. The project filmed some of the best-known sailors encouraging crews of the thousands of boats taking part to throw ‘nothing overboard’.

“We are very active on social media, which allows us both to reach a wide audience and to provide a platform to the clubs and people to show their achievements and clean-up efforts, fostering a sense of belonging,” says Ms de Sabata. Some of the project’s social media posts have reached over half a million people.

Microplastics ban

One of Clean Sea LIFE’s biggest achievements is its contribution to efforts to ban microbeads in cosmetics in Italy, which became law in 2017. “We conducted an investigation and produced a report on products currently on sale in Italy, revealing that there were more than 100 containing polyethylene,” she recalls. In partnership with the LIFE – MERMAIDS project, the Clean Sea LIFE team first calculated, and then gave a visual demonstration of the amount of microplastics contained in each product. “This report and images were widely shared and were presented at the Italian Senate. Two of our partners (Legambiente and MedSharks) were instrumental in the passing of the law banning microplastics in cosmetics,” says Ms de Sabata.

Clean Sea LIFE’s political influence is not limited to microplastics. Some municipalities (e.g. Maruggio in Apulia) have implemented the project’s suggestion of banning the large-scale release of balloons. And, says Ms de Sabata, “we are working with authorities at all levels to advance the management of accidentally-fished marine litter.” This includes passing on suggestions to regional and national legislators, expanding fishing for litter activities to other ports and organising an event on the topic at the European Parliament.

Read more:
www.cleansealife.it

#ciccachallenge

“We are distributing thousands of cigarette butt holders, and every summer we launch the #ciccachallenge, i.e. we encourage people to collect cigarette butts in transparent bottles to show how many there are on Italian beaches,” says Ms de Sabata.

Bio-based plastics

What has LIFE done?

Designed and made biodegradable and compostable plastics for diverse applications (food packaging, coffee capsules, nets, adhesives, films for mulching)

Re-used food waste as a source material, addressing another EU policy priority

LIFE bio-based products used for packaging are complying to food safety standards and have proven to extend shelf life of food products

Brought new materials closer to market

Substituting bio-plastics for plastics could be one way to tackle the high level of plastic leakage into our environment and its harmful effects. In order to do this it necessary to establish a clear regulatory framework for plastics with biodegradable properties.

Targeted applications, such as using compostable plastic bags to collect organic waste separately, have shown positive results; and standards exist or are being developed for specific applications.

However, most currently available plastics labelled as biodegradable generally degrade under specific conditions which may not always be easy to find in the natural environment. Thus they can still cause harm to ecosystems. Biodegradation in the marine environment is particularly challenging. In addition, plastics that are labelled 'compostable' are not necessarily suitable for home composting. If compostable and conventional plastics are mixed in the recycling process, it may affect the quality of the resulting recyclates. For consumer applications, the existence of a well-functioning separate collection system for organic waste is essential.

It is important to ensure that consumers are provided with clear and correct information, and to make sure that biodegradable plastics are not put forward as a solution to littering. This can be achieved by clarifying which plastics can be labelled 'compostable' or 'biodegradable' and how they should be handled after use. Applications with clear environmental benefits should be identified and in those cases the Commission will consider measures to stimulate innovation and drive market developments in the area.

Transforming bakery scraps into food packaging

BREAD4PLA's biopolymer offers an environmentally-friendly alternative to traditional packaging that could help cut plastic waste at source and reuse food waste.

Photo: Charo Pascual

"We took part of the bakery waste that normally goes to landfill and turned it into a new bioplastic," explains project manager Raquel Giner Borrull. "This involved setting up a pilot plant to convert the waste into polylactic acid (PLA), which can then be extruded to make a packaging film for baked goods." PLA waste from the system can even be reused in small amounts without affecting the properties of the packaging. "Funnelling industrial scrap back into the production line like this is common practice for plastic converters," she points out.

A panel of experts tested the biomaterial's performance compared to standard products when used for packaging bread, biscuits and shortcakes. "They looked at items packaged for up to 12 months and considered factors such as flavour, texture, odour and rancidity," says Ms Giner. The results were impressive. "Our packages have the same barrier and mechanical properties as commercial PLA grades. The barrier properties are especially suitable for packaging shortcakes and shortbread, giving a 12-month shelf life. This is equal to the polypropylene packaging traditionally used for these kinds of products," she explains. "Products like shortcakes and shortbreads packed in our PLA packaging also proved less rancid than those in commercial polypropylene packaging. Plus, using our packaging could have a cost benefit for food producers, as it would allow them to use fewer antioxidants, which are commonly added to shortcakes."

The project consortium is keen to take the next step and scale up the process to industrial level, if suitable investors can be found. Uptake of BREAD4PLA's methods could help cut both plastic waste and its leakage into the environment – two major problems highlighted in the Plastics Strategy – since the biopolymer is also environmentally friendly at the end of its life. "Our thermoplastic film is fully biodegradable and compostable under industrial composting conditions," notes Ms Giner.

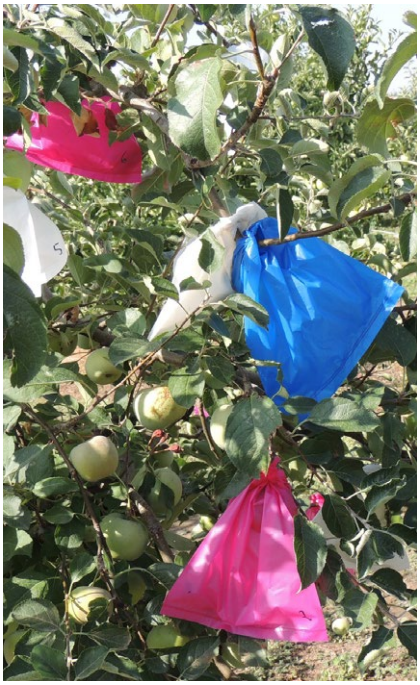
BREAD4PLA has identified several conditions needed for industrial scale-up and commercial replication of its results. "The bakery waste must be available in sufficient quantities, its supply must be constant rather than seasonal, and it should be sourced from as few locations as possible to simplify the logistics, minimise transport costs and ensure consistent quality," explains Ms Giner. "PLA yields of 48% were achieved at the pilot plant. We calculate this would increase to 77% at industrial scale. The cost of using bakery waste would also be significantly lower than the cost of using other feedstocks, such as corn or tapioca."

The project calculates that large bakeries could divert up to 25% of their food waste to manufacture packaging – the other 75% being used for animal feed. Germany and the UK are the EU countries with the most bakery waste, and so most likely to implement the technology on an industrial scale. With modifications, the BREAD4PLA process "could also be used to produce biodegradable packaging from fruit and vegetable waste," says Ms Giner.

Read more:
www.bread4pla-life.eu

Biodegradable mulch film improves soil fertility

LIFE MULTIBIOSOL's new agricultural mulch film could reduce plastic contamination in the environment and cut running costs for farms.



"Solid plastic waste left in the soil for a long time affects its fertility by lowering nitrogen fixation and nutrients," says project manager Dr Carolina Peñalva. "It limits biological activity and water drainage, blocks absorption of minerals and nutrients, and hinders plant growth since roots cannot pierce the plastic and penetrate the soil. It can also lead to soil erosion due to concentrated runoff."

Farmers use plastic mulch film to help prevent weeds and protect crops, regulate soil temperature and retain water and nutrients. The films are only used once and then generally incinerated or sent to landfill, or sometimes even abandoned. The Plastics Strategy calls for more recycling of these films, which would also help reduce leakage of plastic waste into the environment. LIFE MULTIBIOSOL's new bioplastic goes one better and biodegrades completely after harvest. It also incorporates trace elements such as zinc and iron that enrich the soil as the film decomposes, giving farmers higher quality produce in subsequent years.

"We mix bio-based polymers with these natural additives in a conventional compounding extrusion process and then produce the film with an extrusion machine," explains Dr Peñalva. The bioplastic is in the process of being certified with the label 'OK biodegradable SOIL'. This label guarantees a product will biodegrade completely in the soil without adversely affecting the environment. "Our bioplastic breaks down in natural conditions in the field within a short time after it's used."

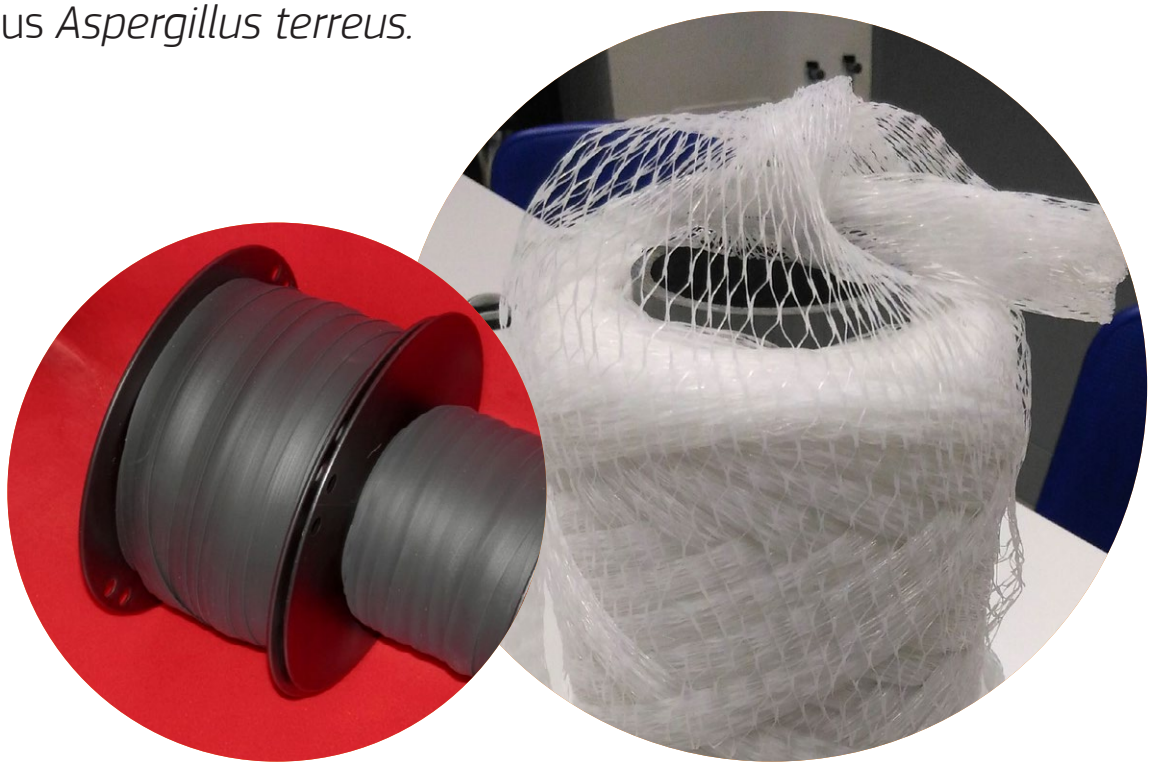
Field trials of vegetable crops found that the quality of agricultural produce grown under LIFE MULTIBIOSOL's biopolymer equals, and in some cases surpasses, that of conventional plastic films. "Our mulch film provides at least the same performance as conventional products, and it can be put in place using the same machinery," Dr Peñalva points out. "Also, two years of tests showed that tomatoes grown in Spain under our mulch film have less incidence of a problem called blossom end rot, and that peaches cultivated using our bio bags had more uniform colour than the controls. This is beneficial for farmers as it affects the price they can ask for their products."

The mulch film can be adapted to suit different soil types across the EU, giving it a huge potential market. "We're drawing up a preliminary business plan and already have clients interested in the product," says Dr Peñalva. "We might set up a company to commercialise it. Currently, our material is more expensive than conventional polymers such as polyethylene or polypropylene. But there are also labour and management costs associated with disposing of plastic correctly. The difference in overall costs of our material and plastic will diminish and then disappear as prices come down with increasing demand for sustainable solutions for agricultural plastic films."

Read more:
www.multibiosol.eu

Eco-friendly food netting from fungus

A more sustainable type of flexible packaging for food is now available on the market thanks to LIFE BiMoP. This project developed a biopolymer based on itaconic acid, produced by fermenting the fungus *Aspergillus terreus.*



The project coordinator Advanced Polymer Materials (APM) has since improved the bioplastic so it can be extruded to make food netting for fruit and vegetables, replacing conventional plastic nets.

"We've formed a partnership with Marina Plastic, a producer of extruded nets," says APM's Marco Scoponi. "We produce the polymer compound in pellets branded as BioRer. Marina uses the pellets to make biodegradable and compostable food netting, according to the method we developed for LIFE BiMoP. This netting is then marketed by the company Bio-Pro, under the name Bionet. It's mainly used for mussels and fruit."

The biopolymer is more expensive than polyethylene but less material is needed to make the nets, making the end cost about the same. "Our solution could replace about 20% of the current extruded netting made from polyethylene," he estimates. Bionet complies with EU standards on biodegradability and composting, as well rules on food contact.

The bioplastic is suitable for other products too, including food labels. "We're aiming to market biodegradable and compostable labels next as an alternative to paper," says Mr Scoponi. "Paper labels require adhesives which are very difficult to remove from surfaces such as glass, plastic and metals. Bioplastic labels don't need adhesives as they are attached to products, like bottles, by heat shrinking the material. They're biodegradable, easily removable and can help improve the recyclability of the other packaging materials."

Read more:
www.life-bimop.eu

Surplus whey finds new life as cheese packaging

"One of the main barriers to using biopolymers made from renewable sources, including our material, is the cost. It's between two and six times higher than traditional petroleum-based plastics," says Miguel Alborch, manager of the LIFE+ WHEYPACK project.

"But if produced at industrial scale, the cost would come down." EU policy could help boost uptake, he thinks. "It should encourage the use of bioplastics because of the associated environmental benefits. Perhaps through incentives or by mandating their use for certain applications, as is already being done with single-use bags."

Alongside this, he believes consumers need educating so they understand the issues around plastic and its effect on the environment, and can make greener choices. "It's also important to develop systems that make it simpler to identify and separate biodegradable materials during handling of packaging waste while encouraging the use of bioplastics."

LIFE+ WHEYPACK's biopolymer is made using surplus whey from the cheese industry, thus the project is also supportive of EU policy on food waste. Cheese-making generates on average nine tonnes of whey for every tonne of cheese produced. About 40% of the 75 million tonnes of whey generated each year in Europe is currently discarded.

"We ferment the whey using micro-organisms to produce polyhydroxybutyrate (PHB), a completely biodegradable and compostable material, which is then used to make packaging," says Mr Alborch.

"The PHB can be processed as a classic thermoplastic, showing properties very similar to those of polypropylene, and it can be processed in existing equipment," he explains. "We used it to make packaging for cheese. Tests showed the material met thermal, mechanical and barrier requirements for oxygen and water vapour. The PHB-based packaging's thermal and mechanical properties are similar to or even better than the conventional material, polypropylene."

Read more:
www.wheypack.eu

A new generation of coffee capsules

The LIFE-PLA4COFFEE project offers a more sustainable future for the coffee industry, thanks to its pioneering capsules made from bioplastic.

Europeans consume a huge number of single-serve coffee capsules each year – an estimated 21 billion in total. Almost half are made from conventional plastic (with aluminium lids), which is cheap and easy to process, and the rest from aluminium. The capsules are hard to recycle though, creating a significant waste problem. Separating the used coffee grounds, plastic and aluminium is difficult so the waste is generally sent to landfill.

"The coffee industry urgently needs more sustainable packaging options," says Cesare Rapparini, manager of LIFE-PLA-4COFFEE. "People have tried to use bio-based polymers for these capsules, such as polylactic acid [PLA, a plastic substitute made from fermented plant starch]. But PLA doesn't have the mechanical strength, thermal resistance and permeability needed. Capsules made out of pure PLA are too brittle and start degrading at about 70°C, yet temperatures in coffee machines can get up to 100°C."

Instead, the project team decided to test at pre-industrial scale a new PLA-based material. "We buy PLA, made from corn or sugarcane, and add fillers and other substances to elongate the molecular chain and obtain a resin," explains Mr Rapparini. "This gives our PLA blend a better strength and the other properties needed. The resin is processed into pellets which are fed into the packaging machines that make and fill the coffee capsules. The machinery then closes the capsules with filter paper lids."

All of these sustainable materials make for a much greener final product. "Our bio-based resin can be used in both injection mould and compression mould machines to make a product suitable for food contact that's also compostable and biodegradable. It contains no nano-materials, since it's not clear yet from research whether they're safe. The coffee capsules themselves are fully biodegradable and compostable in an industrial composting facility, complying with both European and US regulations."

An end to plastic capsules

LIFE-PLA4COFFEE's solution has great potential to reduce plastic consumption and waste. "Every kilo of our resin used would get rid of a kilo of plastic," says the project manager. Plus, the bio-based capsules' carbon footprint is 35-40% lower than conventional plastic ones. "The main benefit comes from being able to compost the product to obtain fertiliser. Also, the melting point of our resin is lower than that of plastic, so the production process uses less energy."

The high cost is a barrier to increasing uptake of the material, though. "Our bio-based capsules are 30-40% more expensive than those made of plastic," Mr Rapparini points out. He believes legislation will be important for boosting demand. Under new EU rules on single-use

"Every kilo of our resin used would get rid of a kilo of plastic."

plastics, Member States must reduce consumption of many plastic items by 2025. "If a country decided to get rid of plastic single-serve coffee capsules, we already have the solution. We can scale it up to industrial level. In fact, we're doing so right now." Aroma System, the project's coordinator, has acquired a large customer for the bio-based capsules. "We just need to decide where to produce them. We might invest in more packaging equipment ourselves or decide to work with a partner."

Green public procurement could also help drive up demand, Mr Rapparini thinks. "If a municipality were to ban the use of plastic or aluminium capsules, then hospitals, public offices and so on would have to use more sustainable solutions," he says. "Few coffee producers are thinking about changing to compostable capsules because they don't need to and they're more expensive. But if a big company or distributor moved into this area, that could also encourage a shift in the rest of the market."

More innovations on the way

Aroma System is also trying to develop coffee capsules that are home compostable, since industrial composting facilities are generally only found in larger towns and cities, as well as working on capsules that will break down in the marine environment. "We don't want to encourage 'seafilling' of these products, but a lot of plastic ends up in the oceans and takes a long time to decompose," Mr Rapparini points out. "We've got some promising resins. There isn't a taste-grade solution right now, where the coffee taste or odour is not affected, but at some point the capsules will be home compostable. Then marine biodegradable is the next step."

This is an important development. The EU Plastics Strategy highlights the needs to establish a clear regulatory framework for plastics with biodegradable properties, with harmonised rules for defining and labelling compostable and biodegradable plastics, so applications with clear environmental benefits can be known and supported.

The company has formed a start-up with another LIFE-PLA4COFFEE beneficiary, the University of Rome Tor Vergata. They plan to develop additional products based on the project's biopolymer. "The resin we produced for coffee capsules is really high end, because they need to withstand such high temperatures. But there are lots of other possible applications that are less demanding, so we're trying it out for different areas," says Mr Rapparini. "We've found it has very good barrier properties when it comes to oxygen transmission. Tests of milk and wine bottles made from the biopolymer have shown that the liquids have a longer shelf life than in the standard packaging on the market." The resin can easily be adapted for other products too, he says. "We'll go on developing the formula and keep trying to find new markets."

Read more:
www.pla4coffee.com

Boosting demand for recycled plastic

What has LIFE done?

Upcycled plastics such as polyester, expanded polysterene foams, plastic fibres from end-of-life vehicles, non-packaging plastic into new products across a range of sectors – construction, automotive, logistics (pallets) and footwear

Overcome barriers to the creation of a real value chain for plastics by supplying feedstock good enough for industrial production of recycled plastic products

Created marketable and close-to-market solutions and new jobs

The small market share held by recycled plastics today cannot be solely attributed to shortfalls in volume and quality. Resistance to change among product manufacturers and uncertainties about market outlets of closed-loop recycled plastics have also emerged as barriers to higher uptake of recycled content.

To further support the integration of recycled plastics in the market, the European Commission will explore more targeted sectoral interventions. For instance, certain applications in the construction and automotive sectors show good potential for uptake of recycled plastic (e.g. insulation materials, pipes, outdoor furniture or dashboards).

Chemistry for footwear

Shoemakers are pioneering a technique to reuse their own plastic waste as insoles for new shoes. Up to 11% of high-grade polyester is currently lost during footwear manufacturing.

The industry has historically landfilled or incinerated these trimmings as they are often mixed with glues and other materials that complicate recycling. Now a chemical process developed at GAIKER Technological Centre in Bilbao can transform the waste into polyester as good as the virgin materials it came from, thus creating a closed recycling loop. "We are testing the properties of our final materials and they fall within the parameters of the textile industry," says Asier Asueta, manager of the LIFE-funded ECOTEX project developing the technology.

The approach adopted by the ECOTEX team differs from conventional recycling techniques in that instead of melting and mixing plastic waste, it uses chemical reactions to break down and reassemble the chains of molecules inside it.

The shoemakers' waste is first sorted into pure streams of polyester, cotton and nylon. The polyester stream is then shredded, melted and broken down by solvents in a high-temperature chemical reactor. "Introducing the molecular chains into another reactor and mixing them with alcohol reassembles them into new solid fibres," explains Mr Asueta. The purified fibre-grade polyesters can be turned into staple fibres and nonwoven textiles that can either be used to make more footwear or in insulation materials.

High yield – if the feedstock is right

"The material yields are above 85%", says Mr Asueta. "One kilogram of polyester produces over 850 grams of high-quality and renewable, chemical compounds." In spite of the efficiency of this chemical reaction, the quality of the fibre that it yields is largely determined by the purity of its feedstock.

"We are still working on getting the same feedstock every time," says Mr Asueta. He explains that an industrial operation needs large quantities of polyester waste of homogenous composition to ensure the quality of the final product. Mr Asueta expects that more efficient waste-sorting techniques and better control over material inputs and outputs will gradually improve the quality of recycled materials and their commercial value.

Although polyester producers face multi-million-euro overheads in rolling out the chemical process developed by ECOTEX, Mr Asueta is confident that the investment will quickly pay off given how much cheaper sustainable recycling is compared to buying virgin materials. He also points to the emerging market for green products and mounting legislation on responsible waste disposal: "there is high potential for economic benefits given rising demand for fibres and polymers of renewable origin, in particular of chemically-recycled polyester." Diagrams for a plant capable of treating 20 000 tonnes per year of polyester waste have already been drawn up and the project beneficiary is networking with potential clients interested in taking up the technology.

Read more:
www.life-ecotex.eu

Near-endless recycling of construction foams

A new chemical process is filtering contaminants out of plastic waste from demolished buildings and returning it to good use.

Expanded polystyrene foams are used widely for insulation in the construction sector. At present, they cannot be recycled in Europe because of bromine-containing flame retardants inside them. These fire-safety compounds were used until 2015, before being listed as persistent organic pollutants that are no longer allowed in products or recycling streams.

To salvage natural resources and reduce plastic waste, the LIFE-PSLOOP project has set out to see if it is possible to recycle raw materials in polystyrene foams and bromine at market-competitive costs. Dutch companies and cooperatives are working together to take polystyrene foam discarded by the construction sector, dissolve it, remove the legacy compound in it, and transform the rest into clean polystyrene for new construction foams. Applications in the construction sector have notably been identified by the EU Plastics Strategy as showing potential for uptake of recycled materials.

How the process works

"We dip the polystyrene in a solvent and it dissolves like sugar in water," says project manager Jan Noordegraaf at BEWISynbra in the Netherlands. Via an antisolvent, the polystyrene precipitates into a gel that can be used to make new foams, and remove the legacy compounds from the remaining solvent. "We even found a way to isolate the flame retardant and recycle the bromine in it," explains Mr Noordegraaf.

The recycling process was invented by the Fraunhofer-IVV Institute. It is designed to deal with different qualities of input material to maximise the internal recycling of solvents and obtain better polymers. According to Mr Noordegraaf, the process produces recycled polystyrene with properties nearly as good as those of the virgin raw material.

"We get a 99% yield out of the polystyrene recycling process," he says. "About 1% of the material is the flame retardant and only 0.3% of the polystyrene is lost during the process, which means that you could recycle the material almost indefinitely."

In 2019, the project intends to build a recycling plant in the Dutch city of Terneuzen, capable of recycling some 3 000 tonnes per year of polystyrene foam. "Once we reach that target, we want to roll the process out to other EU companies," says Mr Noordegraaf. "We are confident that the technology will reach an economic breakeven point once production reaches this output, and we are now proving this."

Partners involved in LIFE-PSLOOP also aim to help recycling and collection companies establish a sustainable value chain for polystyrene waste by demonstrating a standard collection and pre-treatment system. The collection system will notably supply the demonstration plant with a constant stream of local waste

"By providing a local solution to recycle polystyrene foams, our new recycling process will also reduce greenhouse gas emissions and the need to transport this hazardous waste across borders," concludes Mr Noordegraaf. "We expect it to halve both volumes of polystyrene foam waste by 2030 and CO_2 emissions in the production of this material."

Read more:
polystyreneloop.org

High impact on market value

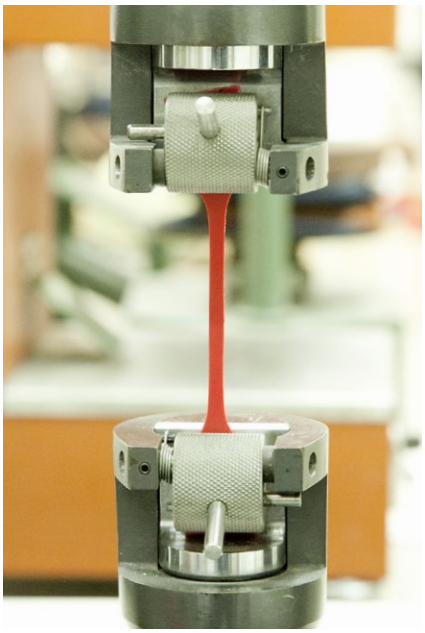
Recycled textile fibres sourced from end-of-life tyres are adding value to products that have so far been made from virgin plastic. Textile fibres make up about 10% of the weight of an old tyre, but are difficult to clean and extract from other materials. Every year around 320 000 tonnes of this waste is landfilled or incinerated.

REFIBRE-LIFE took on both barriers to reuse of the fibres: the lack of effective cleaning technologies to enable recycling and the absence of viable end uses for the recovered materials.

The project's pilot plant in Italy first cleans and processes the textile fibres. It then combines the recycled material with other plastic-based ingredients to improve the impact resistance and flexibility of plastic pallets used for transporting goods. According to project manager Roberto Cardinali, the inclusion of recycled fibre has made conventional plastic pallets cheaper, greener and better. "Two critical properties of these pallets is their flexibility and resistance to impacts. By recycling the fibre, we can give it a new life in a product that has new value." The new compounds can also be used in other applications where sturdiness is needed, such as car bumpers.

In addition to improving mechanical properties, Mr Cardinali says that the recycled plastic compound with the fibre presents financial and environmental benefits to manufacturers as it works out cheaper to produce than virgin plastic and offers a new life to raw materials used in manufacturing the tyres. The new plant is keeping 1 200 tonnes per year of waste tyre fibres from being burned or landfilled. Emissions of greenhouse gases and sulphur dioxide have been reduced.

Read more:
www.refibre.eu



A new use for bulky plastic waste

The Plastics Strategy calls for more recycled plastic to displace virgin materials as a feedstock for new products.

"It is essential to create a flow of recycled materials that can satisfy long-term industrial demand," says Alessia Zanuso from the LIFE REPLACEBELT project. "Otherwise recycled materials will never establish themselves in applications where virgin raw materials are used today."

Non-packaging plastic is recycled much less than packaging plastic although the recycling targets are the same. Led by the company Plastic Metal, LIFE REPLACEBELT has shown a way of upcycling this 'Cinderella' waste material. Ms Zanuso oversaw analysis of the process chain showing that intercepting domestic bulky plastic waste streams in the Italian region of Veneto alone could produce upwards of 30 000 tonnes a year of non-packaging plastic fit for manufacturing. "We also calculated in the project that better plastic waste collection could alleviate landfills of over 5 million tonnes of plastic each year," she says.

The project built an injection machine to show that bulk plastic can be moulded into components for a new type of conveyor belt, recovering 60 tonnes of waste in the process. "Rubber belts currently add 9-14 tonnes of PVC and rubber a year to landfills," explains Ms Zanuso.

During tests, recycled high-density polyethylene was found to be most suitable for the task. "It guarantees the same performance as virgin plastic and it can be recycled endless times without degrading its features," she says. The new conveyor belt complies with market standards and is more durable than PVC-made belts. Using recycled plastic also reduces the lifecycle carbon footprint.

Read more:
www.replacebelt.eu

Recycling shifts pallet production to sustainable plastic

Carlos Rivera explains how LIFE RECIPLAS piloted the recycling technology that transformed his family business into the largest manufacturer of plastic pallets in southern Europe.

"I was called mad across Europe... Today about 80% of our products are made of recycled plastic."

A new plastic recycling line has just come online at Ribawood's busy factory in Zaragoza, Spain. It will boost the site's production capacity by another third. "At first, we didn't recycle any plastic here," says Carlos Rivera who founded the company in 1975. "With this machine, we can now recycle up to 27 000 tonnes of plastic a year. Hopefully, my kids will someday be recycling 30 000 or 50 000 tonnes."

The shift towards recycling plastic has proven profitable. From under 50 employees initially producing sawdust-based compounds for the automotive sector, Ribawood has expanded operations in just over a decade to a 100-strong staff working almost entirely on recycling plastic for packing.

The turning point in the firm's history came in 2003, when a client set Ribawood on its new line of business by presenting the company with an industrial challenge. "A car manufacturer showed us a pile of plastic fibre discarded from its production lines and asked us to turn it into something useful," says Mr Rivera. The waste came from the carpet lining the interior of cars. Its mixture of shapes and compounds could not previously be recycled together."

Rising to challenges

Most recycling experts at the time told Mr Rivera that, once melted, plastic fibre from automotive textiles presented insufficient fluidity and rigidity to be shaped into useful products. "I was called mad across Europe," says Mr Rivera. A German supplier eventually suggested redesigning a machine to inject this plastic at exceptionally high pressures into moulds for transport pallets and collapsible containers. But using it still required an initial feedstock of homogenous plastic granules. That proved problematic as the automotive waste came in irregular shapes and sizes.

"We had to transform the plastic fibre into agglomerated particles before melting it," says Mr Rivera. Doing so meant building a machine that could densify the plastic waste into small granules on an industrial scale. "That's when we applied for funding from the LIFE programme," he recalls.

Tailor-made solution

Through the LIFE RECIPLAS project, Ribawood assembled the equipment necessary to compact plastic fibres from the automotive industry into granules, melt them and inject them into marketable products. The unprecedented industrial process required extensive optimisation.

"The quality of recycled plastic is inherently lower than that of virgin plastic," says Virginia Todo, who ran the RECIPLAS project at Ribawood. "To meet market specifications with recycled residues, we had to mix the right chemical additives and stabilisers into their formulation."

The resulting viscous melt was then injected into Ribawood's tailor-made machine at an unusually low temperature and high pressure.

This innovation resulted in collapsible containers and transport pallets made of 90% recycled plastic. Over the three years of the project, Ribawood optimised industrial processes to turn plastic that was heading for landfills into a reliable raw material, a marketable product and, eventually, its main source of income.

Southern leader

"Today about 80% of our products are made of recycled plastic," says Mr Rivera. "We pulled out of the automobile sector shortly after 2006 and focused on recycled pallets and containers." Ribawood continues to supply plastic containers to clients as far away as the United States, while its production of recycled plastic pallets has skyrocketed from zero to 3 million pallets a year.

"Since the RECIPLAS project, we have shifted our core business to injecting plastic for this kind of packaging," says Ms Todo. From one redesigned injection machine, the company has invested in 10 top-of-the-line units and diversified supply lines for homogeneous plastic waste.

In just 10 years, Ribawood has grown into the largest supplier of transport pallets in Spain, France, Portugal and Italy. Ana Rivera, daughter of the company's founder, is currently spreading these markets as far as Morocco and Latin America.

Booming market

Mr Rivera says that, today, manufacturing plastic containers and pallets from recycled plastic is a no-brainer. "Recycled plastic is the cheapest kind that you can make. Its raw material cost is 25% lower than that of virgin plastic," he says. But when his company first approached the sector, recycling wasn't even an option. Many of his peers considered it straight out impossible. But recovering industrial residues and adding value to them has been in his company's DNA since its foundation, he says.

"Industry now understands the recycling loop for glass and cardboard for instance," says Mr Rivera. "Today it is cheaper to recover these materials than to make them from scratch." But plastic is just entering this phase. He views mounting legislation and policy such as the EU Plastics Strategy as essential in guiding industry towards recycling plastic and reducing its burden on the environment. But he argues that innovative companies are still needed to produce the technologies that will solve the issue. "There is no standard machine on the market that delivers what our clients need," says Mr Rivera. "We had to pioneer our process, fine-tune our tools and find our own additives. Our market presented us with a challenge and the LIFE RECIPLAS project allowed us to materialise our ideas before rolling them out commercially."

Read more:
www.ribawood.com

Selected projects

Here is a complete list of LIFE projects that are featured in *LIFE and the EU Plastics Strategy.*
Arranged by theme, the list highlights more than 20 projects relevant to the Plastics Strategy.
For more information on individual projects, visit the online database at: http://ec.europa.eu/environment/life/project/Projects/index.cfm

A number of LIFE publications are available on the LIFE website: *http://ec.europa.eu/environment/life/publications/lifepublications/index.htm*
Printed copies of certain LIFE publications can be ordered free-of-charge at:
http://ec.europa.eu/environment/life/publications/order.htm

KH-AJ-18-002-EN-N

LIFE "L'Instrument Financier pour l'Environnement" / The financial instrument for the environment

The LIFE programme is the EU's funding instrument for the environment and climate action

Period covered 2014-2020

EU funding available approximately €3.46 billion

Allocation of funds

Of the €3.46 billion allocated to LIFE, €2.59 billion are for the Environment sub-programme, and €0.86 billion are for the Climate Action sub-programme. At least €2.8 billion (81% of the total budget) are earmarked for LIFE projects financed through action grants or innovative financial instruments. About €0.7 billion will go to integrated projects. At least 55% of the budgetary resources allocated to projects supported through action grants under the sub-programme for Environment will be used for projects supporting the conservation of nature and biodiversity. A maximum of €0.62 billion will be used directly by DG Environment and DG Climate Action for policy development and operating grants.

Types of projects

Action Grants for the Environment and Climate Action sub-programmes are available for the following:

- "Traditional" projects – these may be best-practice, demonstration, pilot or information, awareness and dissemination projects in any of the following priority areas: LIFE Nature & Biodiversity; LIFE Environment & Resource Efficiency; LIFE Environmental Governance & Information; LIFE Climate Change Mitigation; LIFE Climate Change Adaptation; LIFE Climate Governance and Information.
- Preparatory projects – these address specific needs for the development and implementation of Union environmental or climate policy and legislation.
- Integrated projects – these implement on a large territorial scale environmental or climate plans or strategies required by specific Union environmental or climate legislation.
- Technical assistance projects – these provide financial support to help applicants prepare integrated projects.
- Capacity building projects – these provide financial support to activities required to build the capacity of Member States, including LIFE national or regional contact points, with a view to enabling Member States to participate more effectively in the LIFE programme.

Further information

More information on LIFE is available at http://ec.europa.eu/life.

How to apply for LIFE funding

The European Commission organises annual calls for proposals.
Full details are available at http://ec.europa.eu/environment/life/funding/life.htm

Contact

European Commission – Directorate-General for the Environment – B-1049 Brussels (env-life@ec.europa.eu).
European Commission – Directorate-General for Climate Action – B-1049 Brussels (clima-life@ec.europa.eu).
European Commission – EASME – B-1049 Brussels (easme-life@ec.europa.eu).

Internet http://ec.europa.eu/life, www.facebook.com/LIFE.programme, twitter.com/lifeprogramme

LIFE Publication / LIFE and the EU Plastics Strategy

Publications Office