the recycling company ALBA Group

# resources SAVED by recycling.

**Proactive environmental protection – closed loops make the difference: In 2016, ALBA Group's recycling activities saved around 36.2 million tonnes of primary resources and some 4.3 million tonnes of greenhouse gases.***

resources SAVED®

*Source: Fraunhofer UMSICHT

**ALBA Group**
With its two brands – ALBA and Interseroh – and a total of about 7,500 employees ALBA Group operates within Germany, Europe and Asia. With an annual turnover of approximately 1.8 billion Euros (2016) ALBA Group is one of the leading recycling and environmental services companies as well as raw material providers worldwide.

**Fraunhofer UMSICHT**
Fraunhofer UMSICHT is a pioneer of sustainable energy and raw materials management, providing scientific results and transferring them to businesses, society and politics. Working together with partners, the dedicated team researches and develops sustainable products, processes and services that inspire. We want our developments to be economically successful, socially equitable and sustainable. The balance between these objectives is always at the forefront of our thinking. Based in Oberhausen, Willich and Sulzbach-Rosenberg in Germany, the institute generated in 2016 a turnover of more than 38.8 million Euros with a staff of 465 persons. As one of 69 institutes and research units of the Fraunhofer-Gesellschaft, the leading organisation for applied research in Europe, we are a worldwide network and promote international collaborations.

Dear Readers,

This summer, a giant iceberg calved from the Larsen C shelf in Antarctica. Researchers now fear a significant rise in sea levels within a few years. While it's true that global warming can only be suspected but not proven as the ultimate cause, this event nonetheless illustrates the seriousness of the situation. Around 500 million people now live in coastal regions threatened by flooding – and the number continues to grow.

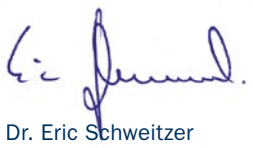
German Chancellor Angela Merkel stated in July this year: "We need economic development that turns all of us into winners while enabling us to respect the limitations of our planet." At the Business 20 summit, the G20 forum for economic dialogue, the German Federal Ministry of Environment also described climate and environmental protection as "important drivers of modernisation for our national economies – that will have positive effects for our competitiveness, the labour market, social cohesion and political stability." Furthermore, embracing this modernisation and sustainability should apply not just to states but also to companies.

At the ALBA Group, we turn this necessity into a fully-fledged circular economy that is about more than high-quality recycling. It starts with the targeted prevention of waste – for example by reprocessing and reusing products or materials – and extends as far as the integrated optimisation of production processes. The goal is always to prevent wastage, conserve resources and minimise the consumption of energy as well as greenhouse gas emissions.

For the last ten years, the Fraunhofer UMSICHT has been investigating the effects of ALBA Group's recycling activities on the environment – and on the climate and natural resources in particular. This brochure presents you with the very latest findings. At the same time, it also offers examples of successful alternative approaches to an integrated closed-loop economy from our day-to-day business. And on the occasion of his long-service anniversary, we interview Fraunhofer researcher Markus Hiebel to find out why there is no alternative to a modern circular economy.

Wherever we are in the world, meeting the challenges of our time means working together for the climate and the environment. If we do so, we will all be on the winning team.

Sincerely,



Dr. Axel Schweitzer Dr. Eric Schweitzer

Chairman of ALBA Group plc & Co. KG

# More than **recycling**: The **end** of wastage.

Global challenges can only be mastered as a joint effort. Accordingly, the 2030 Agenda from the United Nations defines 17 goals that are intended to drive sustainable development internationally – goals that include responsible consumption, economic growth, nature conservation and climate protection. The circular economy plays a key role in achieving these objectives: by using innovative technologies, it reduces the burden on the environment, conserves resources and cuts greenhouse gas emissions while strengthening manufacturing industries. ALBA Group best practices have shown how eco-design, reuse or the sharing economy can supplement recycling and help us to finally turn our backs on the 'throwaway society'.

A look at the data clearly illustrates the need for action. Global warming is proceeding at an ever-increasing pace. The years from 2001 to 2016 were some of the warmest documented in the instrumental temperature record. Experts predict that temperatures may rise by up to 4 degrees Celsius by 2100. Scientists agree that the cause of this accelerated climate change is the manmade increase in levels of $CO_2$ in the atmosphere. These levels have risen by over 40 per cent since the start of industrialisation alone, and the leading culprit here has been the burning of fossil fuels such as coal and oil. For this and many other reasons, the 195 participants in the 2015 UN Climate Conference in Paris accordingly agreed to work together to limit global warming to significantly less than 2 degrees Celsius.

And yet: excessive resource consumption by the world's population continues unchecked. Calculations show that even today, 1.6 earths would be needed to adequately cover global demand for resources, arable land, water and forested land. The critical state of resources and climate is also increasingly affecting the planet's oceans. On the one hand, ocean temperatures are rising in step with global warming, with occasionally drastic consequences for marine flora and fauna such as coral die-off along Australia's coastlines. Another problem is the increasing incidence of marine garbage pollution: some 8 million tonnes of plastic waste alone end up in our seas every year. By 2050, some estimates even suggest that the world's oceans will contain more plastic waste than fish.

This trend can only be reversed if a new, more sustainable economic model is adopted in place of our established consumption-driven, throwaway society. Promising alternatives are offered by the circular economy. Even the professional recycling of waste or recyclables reduces emissions of climate-polluting gases while making – potentially huge – resource savings, as shown by the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT in its annual report on the ALBA Group. Yet a modern closed-loop system has much more to offer than material recycling: it can also involve the reuse of still-functional products or their reconditioning for a 'second life' of use. These activities not only measurably conserve resources but also make business sense – and are now increasingly the focus of research conducted by Fraunhofer.

The ALBA Group companies are actively tracking this trend and increasingly focusing their services on the beginning of the value chain, designing entire lifecycles around the principle of sustainability. Accordingly, this year's 'resources SAVED' brochure not only documents the positive environmental effects of recycling activities within the ALBA Group but also utilises a number of case studies from the individual material flows to show how an integrated circular economy can be realised in practice. Here, the abiding challenge is to develop processes for production and consumption that precisely match their target products and materials: the recycling and reuse options available for a mobile phone are very different to those for a transformer, a wooden pallet or a PET bottle.

**Scientific background to the report**
With the report ‘resources SAVED by recycling’ the Fraunhofer Institute UMSICHT investigates on behalf of the ALBA Group how the company’s recycling activities work to save resources and cut greenhouse gas emissions. To do so, the researchers use a highly detailed method developed in-house to compare the resource and greenhouse gas consumption of primary production with that of recycling. The difference between these two calculations gives the relative environmental impact per material flow. Full details of how the Fraunhofer researchers calculate these savings are attractively presented on

www.resources-saved.com

with text, diagrams and video clips. For 2016, the report findings once again show how recycling achieves significantly better results than primary production in all of the areas investigated, both in terms of greenhouse gas emissions and when looking at resource consumption. The report incorporates data for both abiotic and biotic raw materials.

The term ‘abiotic’ refers to non-renewable, unprocessed primary resources such as ores, coal or overburden, which are mined directly out of the earth to produce a usable material. ‘Biotic’ resources on the other hand are renewable primary resources such as wood, which are harvested and used as either materials or fuel.

For the current report, Fraunhofer UMSICHT analysed the following material flows for the ALBA Group: glass, wood, paper/paperboard/cardboard (PPC), metals, plastics, lightweight packaging and waste electrical equipment. The overall report findings aggregate data from ALBA Group’s recycling activities in Germany, Austria, Poland and Slovenia. The individual quantities given on the following pages relate solely to material flows in Germany – owing to the country-specific collection and recycling practices for individual materials.

In 2016, the ALBA Group managed around 4.3 million tonnes of recyclables in a closed loop. The environmental services and raw material provider thereby preserved some

**36.2 million** tonnes of primary resources

from extraction, transportation and processing. By returning recyclables to the loop, the ALBA Group also saved around

**4.3 million** tonnes of greenhouse gas emissions

in 2016 – the equivalent of the annual emissions of a city with 375,000 inhabitants. Some 428,000 hectares of mixed woodland would be needed to capture this volume of greenhouse gases.

# “A **circular economy** is the only viable model **for the future**.”

Markus Hiebel, Head of Department, Resources and Sustainability Management and Sustainability Officer at the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT, talks about the opportunities offered by an all-inclusive Circular Economy.

**Dr Hiebel, you have been analysing the environmental impact of ALBA Group’s recycling activities for ten years. What was initially your biggest challenge and how have things changed over the years?**

The first step was to develop an entirely new methodology that was capable of precisely measuring a product’s climate and resource ‘baggage’. This was a challenge in itself, since we needed all of the relevant data for resource extraction plus figures for logistics and production. Typical questions at the time were: How much soil and rock needs to be excavated? What energy mix is used for resource processing? What volume of $CO_2$ is released by consuming fuel to transport the ores? Over time, we acquired a wealth of expertise and added more and more material flows to our analyses.

**What was the key result of your studies?**

Our key finding, which is backed by evidence-based research, is that high-quality recycling consistently reduces environmental impacts. Even as production techniques become more complex, secondary extraction has a positive effect on both the greenhouse gas balance and resource conservation. And this is true for every material flow that we have investigated for the ALBA Group to date. Every year, we therefore see further confirmation that there is no way around recycling. Since technology continues to advance in this area as well. Yet lifecycle analyses also reveal differences in secondary production: not all recycling is alike.

**So the ecological footprint of recycling-based products can vary? What are the key factors involved here?**

Above all, the ecological backpack of recycling-based products depends on the kinds of processing technologies that are used. Modern, low-emission aggregates reduce the footprint more effectively than those that consume more energy or use power from sources with high greenhouse gas emissions. Another factor is the location, i.e. the country where recycling takes place and how far the input materials have to travel. If a material from Germany is shipped for processing to a country outside Europe, for example, then this can increase the $CO_2$ footprint – especially if the electricity there is still mostly generated by coal-fired power stations. On the other hand, longer routes for material shipments can also be balanced out by the use of more efficient technologies. For this reason in particular, the implementation of a circular economy should always be accompanied by a sustainability analysis.

**Focusing on a sustainable value chain, which extends across all phases in a product lifecycle, what role does recycling-friendly design play?**

Eco-friendly design is one of the biggest drivers for achieving a functional closed-loop economy. For a product to be effectively reusable, repairable and recyclable, it not only needs to be made from recyclable materials but also needs to be designed so that its various parts are clearly marked and easily separated from one another. If not, the only option left for the recycler at product end-of-life is that of 'damage limitation'. A good example is offered by early LCD monitors: the first models used poisonous mercury, which now has to be laboriously separated out and disposed of as hazardous waste. We need to rethink the role of the designer in avoiding such problems. We need manufacturers to work harder in bringing recycling companies on board so that their know-how can be drawn on more extensively for product development.

**What kind of impact does reutilisation – i.e. giving products a 'second life' – have on the greenhouse gas and resources balance?**

Let's take laptops as an example. The innovation cycle for laptops is extremely short, so, like other IT equipment, they are often replaced after only a few years and while still fully functional. Offering these products a second life is desirable simply for ecological reasons. Laptop components are made from many primary raw materials: while some are rare, the extraction of others causes high greenhouse gas emissions and resource usage. Reconditioning these computers for reuse requires far fewer resources and far less energy, however, and this in turn means lower greenhouse gas emissions. In a study we completed for Interseroh, we discovered that the single reuse of a laptop can save 181 kilogrammes of primary raw materials and cut emissions of climate-polluting gases by a further 154 kilogrammes. These findings assume that the PC is used for another three-and-a-half years.

**What untapped potential does the circular economy still have to offer?**

In the final analysis, the circular economy is essentially an alternative economic model. And a model in which increasing numbers of products and materials are naturally and efficiently 'returned to the loop'. This in turn not only creates jobs but also offers job security. Smaller-scale approaches already exist – such as repair cafés or online product lending/swapping platforms organised as part of the 'sharing economy'. There's still a lot of potential, though, and discussions in the international community clearly highlight an increasing awareness of the opportunities offered by the circular economy. To fully exploit these chances, political initiatives will be needed that promote issues such as recycling-friendly design and product labelling. Not least because the throwaway society is itself long past its sell-by date. A circular economy is the only viable model for the future.

# A sustainable driver for e-mobility: **Recycled copper.**

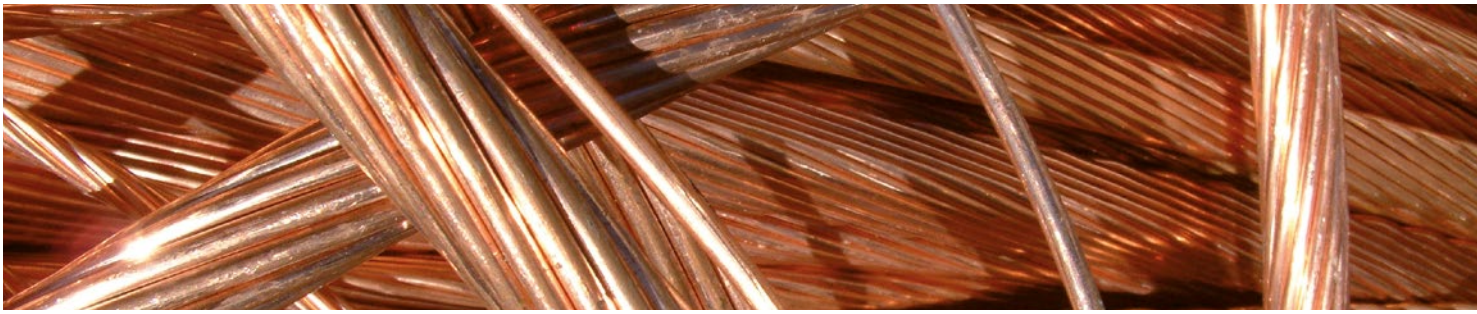
Natural deposits of non-renewable resources such as metal ores are not only finite, but their extraction can also be accompanied by massive disruption to natural habits and ecosystems. In regions such as South America and Africa where copper ore is mined, for example, violations of environmental standards and human rights are commonplace. This is yet another reason why sustainable development also depends on the closed-loop management of extracted metals already present in products. So where can we find the largest deposits of 'urban copper'? And how can these be professionally recycled? We offer a look behind the scenes.

Copper is a much talked-about metal, especially in the context of the booming industry of electromobility. According to figures from the International Copper Association (ICA), up to 20 million electric vehicles (EVs) will be on our roads worldwide by 2020, rising to 70 million by 2025. And each EV contains around 75 kilogrammes of copper – around 50 kilogrammes more than in internal combustion engine vehicles. This higher figure reflects copper's high electrical conductivity, superior malleability and durability, and advantageous thermal properties. With the electric vehicle industry therefore driving consumption for this valuable metal, the ICA expects demand for copper to rise nine-fold over the next decade.

**Mining materials from the scrapyard**

While formerly decommissioned copper mines have once again opened their gates to cope with this rising demand, copper extraction from a closed-loop system is far more sustainable.Like steel and aluminium, copper is almost perfectly recyclable and can be managed in a closed-loop system with virtually no loss of quality or material in the long term. This conserves natural ore deposits, saves resources and energy, and substantially reduces greenhouse gas emissions.

In Germany, almost half of the annual demand for copper is now met from recycled materials – which is why scrapyards are Germany's most important and high-yield copper mines. Stored at these sites are old boilers, pipes and even wind instruments with copper content that can approach 90 per cent. And the growing volume of electrical waste offers a readily available source of urban metals and copper: a piece of old equipment can be anything from 5 to 25 per cent copper. Reclaiming the pure metal from the complex components in this equipment requires industry-specific expertise.



**Challenging but worthwhile: transformer recycling**
ALBA Metall Nord GmbH, an ALBA Group subsidiary based at the Port of Rostock, specialises in the recycling of waste equipment from the electric power industry. One uncommon but nonetheless demanding activity is the dismantling and recycling of end-of-life high-voltage transformers. Large transformers are most often to be found deployed in electricity substations run by electric power companies and are operated for several decades before they need to be retired. These massive units are veritable resource 'goldmines': alongside copper wire coils weighing several tonnes, high-performance transformers also contain vast quantities of steel and oil – all materials that can be returned to the loop with the appropriate technology.

For one recent assignment, the recycling experts from Rostock needed to move an end-of-life power transformer weighing some 70 tonnes and measuring 7 metres wide by 4 metres high from the substation to the company's own scrapyard. Even loading the unit was a challenge: cranes could not be used for lifting at the substation, the entire site is criss-crossed by high-voltage cables. Accordingly, the first step was to pump out the transformer oil – a highly refined oil used to cool the machine core – to reduce the transport weight. This yielded some 17 tonnes of oil that, once purified and filtered, can be used again as transformer oil.

**Recycling ratio: 98 per cent**
Once free of oil, the 53-tonne transformer was then lifted onto a low-loader by a professional loading team. The heavy equipment transporter then drove overnight by motorway, trunk road and several bridges to the scrapyard, where a specially hired 200-tonne crane unloaded the transformer.

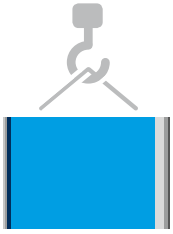
The actual dismantling work – using blowtorches, forklifts and excavators – could now get underway. The first step was to cut away the transformer's steel housing to expose the machine core, mostly consisting of laminations and copper coils. Step-by-step, the recycling specialists then disassembled the transformer core into its constituent parts.

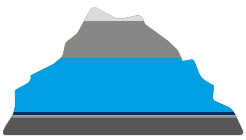
All in all, it was possible to return around 98 per cent of the substances reclaimed from the transformer to the material cycle. The housing was reprocessed by a steelworks – destined for future use in beverage cans or structural steel, for example. The core laminations were simply reused for transformer construction, while the copper coil windings were recycled in a copper mill. In the mill, the material is melted in a bath smelting furnace at around 1,200°C and then reprocessed into new copper sheets wi th a purity grade of almost 100 per cent: a high-quality raw material that is obtained using a resource-friendly method and which is ideal for later use in electromobility.

**resources SAVED: In 2016, the ALBA Group conserved around 26.7 million tonnes of primary resources by recycling over 1.5 million tonnes of metals.**

**1,505,471 t**
**quantity recycled**

Aluminium 113,707 t (7.6%)
Copper 58,516 t (3.9%)
Steel 1,285,510 t (85.4%)
Stainless steel 19,264 t (1.3%)
Lead 3,884 t (0.3%)
Zinc 4,127 t (0.3%)
Brass 20,463 t (1.4 %)





**26,754,830 t**
**Total resources saved**

Aluminium 2,041,041 t (7.6%)
Copper 9,215,685 t (34.4%)
Steel 12,418,027 t (46.4%)
Stainless steel 675,974 t (2.5%)
Lead 36,820 t (0.1%)
Zinc 186,747 t (0.7%)
Brass 2,180,537 t (8.2%)

# A clear-cut case for **refurbishment.**

A new phone is still a status symbol: in Germany alone, around 25 million smartphones were purchased last year. As were 7 million flat-screen TVs, 5 million laptops, and hundreds of thousands of internet radios and Bluetooth loudspeakers. Usage cycles are also keeping step with shorter innovation cycles for home and communication electronics: consumers are accelerating the replacement of old devices with new products, although this equipment is often still fully functional when disposed of. So what could be more logical than refurbishing electrical appliances for a second life before recycling?

It's not exactly eco-friendly design: the electronic parts used in a lot of IT and communication equipment are so complex that their constituent materials can be recovered only with difficulty. Things get even more complicated when products contain toxic substances. LCD monitors – the first-generation flat screens – utilise highly poisonous mercury in their backlighting systems. When thrown away, these screens are therefore classed as hazardous waste, which must be disposed of safely according to EU law. In most parts of Europe, this is achieved by using conventional shredding equipment and a specialised exhaust air system. This technique is also used by many German recycling companies.

**A conservative approach to end-of-life**

The ALBA Group's electrical and electronic waste specialist – ALBA Electronics Recycling GmbH – uses a more sustainable alternative to shredders, however. At its recycling plant in Eppingen, Baden-Württemberg, a semi-automated process is used to remove the fluorescent tubes. As a first step, robotic arms cut open the plastic housing of the LCD flat-screen monitors in a sealed and airtight room. Controlled by computers and sensors, they use milling heads to expose the neon tubes containing mercury. Recycling experts then remove the tubes by hand – protected at all times by an extraction hood with an activated charcoal filter – and ship them to a special waste management company.

Now free of mercury, the rest of the unit can be recycled to maximise resource conservation. The plastic housing and acrylic glass screen can be recycled, as can the copper and aluminium from inside the monitor. This semi-automated plant system from the ALBA Group was developed specifically for flat-screen monitors containing mercury – and even though numbers of these units are limited. In only a few years, the next generation of flat screens – which use mercury-free LED technology – will need to be handled by material recycling systems.

**Too new to be recycled**

For end-of-life products, professional recycling ensures that we can recover as many recyclable materials as possible. However, considering the increasingly short service life of electrical equipment, even more resources can be saved by refurbishment, i.e. the reconditioning of fully functional devices for a second useful life. In the closed-loop model, refurbishment is upstream of recycling and therefore focused even more strongly on the prevention of waste.

ALBA Group subsidiary Interseroh has recently added PC and laptop refurbishment to its service portfolio. This service is oriented primarily on companies who replace their IT and communications equipment with new equipment after only a short period of use. At this point in time, the old equipment is usually still fully functional. Accordingly, one key challenge for the recycling experts is the secure handling of sensitive data on hard disks. Interseroh handles the certified erasure of data as well as the destruction of storage media. Equipment that is defective or no longer usable is separated out and sent for recycling. As a final step, Interseroh then performs tests to ensure that the equipment intended for remarketing is fully functional and has been wiped clean of data.

Refurbishment is especially effective at protecting the climate and natural resources – a fact that has been scientifically validated by Fraunhofer UMSICHT. Figures from the Institute show that a single refurbishment of one laptop can save some 181 kilogrammes of primary resources while reducing emissions of polluting greenhouse gases by around 154 kilogrammes. This corresponds approximately with 1,100 kilometres driven by an average car. Refurbishing a desktop PC is even more effective: savings of primary resources amount to 387 kilogrammes, while greenhouse gas emissions are cut by 229 kilogrammes. The basis for calculation used by the researchers assumes that the equipment's service life would be three-and-a-half years both before and after refurbishment.

**Effective recovery needs efficient collection**

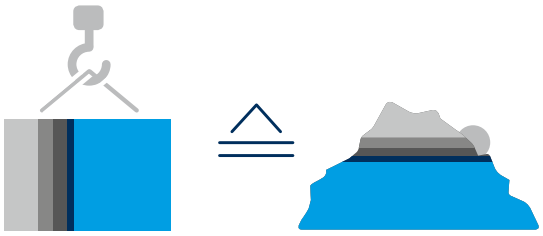
The ALBA Group's tailor-made closed-loop system solutions don't stop at LCD monitors and laptops, but also include small-scale electrical waste like mobile phones. Together with Deutsche Post, the company operates ELECTRORETURN – a dedicated collection and recycling service infrastructure for small electrical appliances. Using the service couldn't be easier: consumers simply put their old phones or other small appliances into a 'Maxi'-sized envelope, attach a shipping label downloaded from the internet and drop it free of charge into a postbox. The equipment envelopes end up in Lustadt, at a plant run by ALBA Electronics Recycling GmbH. Here, the contents are sorted, the quantities recorded and the batches then shipped off for recycling, so that none of the valuable metals such as gold, silver or palladium are lost.

Whether a phone, LCD screen or laptop, the closed-loop management system chosen for electrical waste depends on many factors such as the materials it contains and the equipment type – but also on the available collection infrastructure. Some closed-loop models offer the best results for the climate and resources when they are not 'off-the-shelf' solutions.

**resources SAVED: In 2016, the ALBA Group saved around 1.1 million tonnes of primary resources by recycling over 72,000 tonnes of waste electrical equipment.**

**72,563 t**
**quantity recycled**

Large electrical appliances 15,992 t (22.0%)
Refrigeration equipment 8,756 t (12.1%)
Display screens 5,858 t (8.1%)
LCD monitors 519 t (0.7%)
Small electrical appliances 41,438 t (57.1%)



**1,129,965 t**
**Total resources saved**

Large electrical appliances 296,492 t (26.2%)
Refrigeration equipment 106,473 t (9.4%)
Display screens 55,592 t (4.9%)
LCD monitors 4,256 t (0.4%)
Small electrical appliances 667,152 t (59.0%)

# The fine art of **plastics upcycling.**

Modern life would be hard to imagine without plastics: this high-performance, durable material is to be found in everything from smartphones to airplanes, and from food packaging to home insulation panels. Every year, worldwide production rises to meet this demand. The most recent figure is 322 million tonnes. The flipside of this trend is the vast increase in plastic waste – which in many countries still tends to end up in landfill sites and the environment. For sustainable plastics development, a comprehensive strategy for closed-loop management is therefore necessary.

Technically speaking, 'plastic' is a pretty vague term. The huge variety of applications for plastic is easily matched by variations in its chemical composition – which range from polyethylene (PE) and polypropylene (PP) to polystyrene (PS) and polyamide (PA), polyethylene terephthalate (PET) and polyvinyl chloride (PVC). Professional recycling must therefore first ensure the successful separation of waste into specific types of material. For this reason, the ALBA Group company ALBA Recycling GmbH operates four production facilities for recyclables in Germany, combining the latest environmental technology with ALBA's 50-odd years of experience. Waste delivered to these facilities is sorted into its various fractions by material separators using ultra-modern technology such as near-infrared units, air or magnetic separators. The materials recovered meet the very highest quality requirements and are pressed into bales after sorting to become highly-prized raw materials for recycling.

**Old packaging in the spotlight**

For many years, there has been a particular focus on the recycling of plastic packaging – not least because the packaging industry in Europe is responsible for around 40 per cent of plastics consumption. In Eisenhüttenstadt, ALBA runs a plastics recycling plant that processes around 50,000 tonnes of the material every year into recycled plastics that are now the equivalent of new plastics made from crude oil. This level of quality is ensured by ALBA Group subsidiary Interseroh and its internally developed – and multiple award-winning – 'Recycled-Resource' reprocessing: a complex process in which plastics are re-melted, densified and chemically modified.

One of the most important steps in the Recycled-Resource process takes place in the extruder: in this unit, a rotating worm shaft pushes the input material through a heated cylinder, where it is melted down into a viscous, homogeneous mass of plastic and modified with the use of special additives. The material is then pressed out of a nozzle plate at high pressure, where it is automatically chopped into short lengths and processed into lentil-sized plastic beads – the finished regranulate product. The latest extruder model, which went online last year, can produce around 2.5 tonnes an hour.

**Combined recycling expertise**
Recycled-Resource yields two recycling regranulates of consistently high quality: Recythen and Procyclen. Recythen is especially suitable for manufacturing technical products such as films or pipes, while Procyclen can be customised to suit the manufacturer's material requirements, and has the same levels of impact strength, stiffness and heat resistance as primary granulate made from crude oil. Procyclen is already being used in blow moulding for the production of laundry detergent bottles, for example.

To ensure that its recycling methods are consistently state of the art, Interseroh runs its own centre of competence for recycling plastics in Maribor (Slovenia), which opened in 2016. This centre focuses Interseroh's recycling expertise and know-how, and the R&D work conducted here has been instrumental for the increasingly positive environmental impact of recycled plastic applications. Calculations carried out by Fraunhofer UMSICHT show that the use of Recythen and Procyclen instead of new plastics made from crude oil reduces greenhouse gas emissions by between 30 and 50 per cent. Thanks to their positive environmental footprint, Procyclen products also qualify for the 'Blue Angel' ecolabel.

**Collaborative eco design**
As a rule, the earlier the end of the usage cycle is considered in the value chain, the better the options for closed-loop management of plastics. Designing-in recycling as an actual feature of products and materials is the key concept here, and is behind the German Federal Environment Agency's call for closer dialogue between research and the waste management and packaging industries. The ultimate objective is to coordinate packaging design more effectively with the needs of the recycling industry. This is also the focus of Interseroh's new 'Made for Recycling' service, which the company uses to work closely with its customers to analyse the packaging lifecycle – from production to waste management and recycling. The aim is to design packaging so that it not only fulfils modern product and design requirements but can also be recycled easily to conserve natural resources and protect the climate. The potential for progress in this area remains considerable.

**resources SAVED: In 2016, the ALBA Group saved around 2.8 million tonnes of primary resources by recycling over 850,000 tonnes of lightweight packaging* (LWP) and plastics.**

**854,777 t**
**quantity recycled**

**PP 9,874 t (1.2%)**
PE 146,695 t (17.2%)
**PET 96,745 t (11.3%)**
Mixed plastics 37,824 t (4.4%)
**LWP ALBA 424,749 t (49.7%)**
**LWP Interseroh "Dual System" collections 138,890 t (16.2%)**

**2,761,994 t**
**Total resources saved**

**PP 22,217 t (0.8%)**
PE 535,437 t (19.4%)
**PET 81,266 t (2.9%)**
Mixed plastics 88,130 t (3.2%)
**LWP ALBA 1,325,217 t (48.0%)**
**LWP Interseroh "Dual System" collections 709,728 t (25.7%)**

*Calculations of resource savings are based solely on conventional collection using the German 'Yellow Bin'/'Yellow Bag' system.

# $CO_2$-capture with **multi-use potential.**

Protecting the environment while boosting business – both are possible with a well-managed circular economy. Glass is a good example: recycling saves around 20 per cent of energy consumption compared to making new glass. And waste paper is now used as an input material in over 60 per cent of German paper production. This amounted to around 16.9 million tonnes in 2016. Enormous potential is also offered by wood: this renewable resource is an ever-popular material in building and manufacturing, and also the base material for paper products. Trees can also offer long-term capture and storage for carbon dioxide, giving their wood a decisive role to play in climate protection. One example of this are the wood loops the ALBA Group has established for Euro pallets.

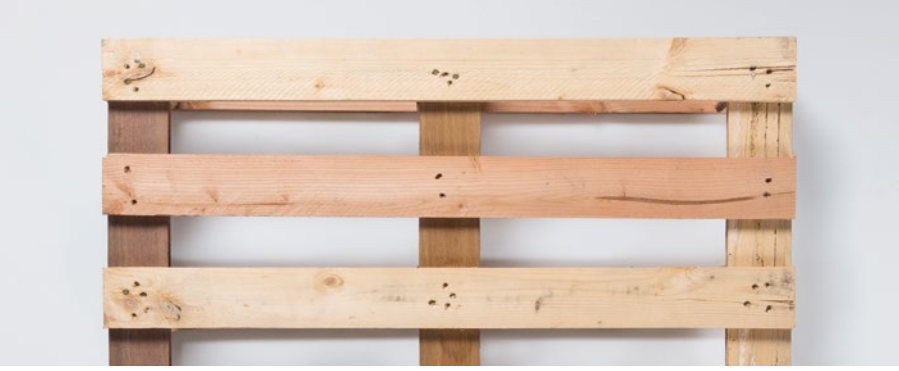
Forests are viewed as the 'Earth's lungs'. And for good reason: for each cubic metre of mature wood, a tree takes roughly a tonne of carbon dioxide out of the air. In return, the tree releases around 750 kilogrammes of oxygen, locking up the remaining 250 kilogrammes of carbon deep in its wood. Thanks to this process, around 1.2 billion tonnes of carbon are stored in German forests. And this natural carbon sink must be preserved. Only after the wood lifecycle has completely run its course, including the service life of wood products, is the carbon released back into the atmosphere as $CO_2$ – by combustion, for example.

**Cascading use keeps wood products in the loop**
So how can we optimise the useful life of wood? A key role is played by long-lasting wood products from sustainable forest management. Equally important, however, is the multiple reuse of products plus their efficient recycling at end-of-life. This multi-stage lifecycle management – known as cascading use – is not only an efficient approach to resources and energy. In the case of wood, it also prevents the premature release of $CO_2$ back into atmosphere. And there are eco-friendly alternatives even at the end of the value chain. End-of-life wood can be used as an alternative fuel source in biomass power plants, which further reduces the environmental impact compared to simple combustion.

During virtually every phase of the wood lifecycle, the ALBA Group has established processes that help to ensure the preservation of natural carbon sinks. The certified wood depot run by the recycling services provider accepts all types of waste wood, processing it for further use based on the wood quality. Untreated or glued wood products are typically recycled into chipboard panels, while coated or treated wood products are turned into wood chips for energy production. If the wood contains pollutants, power stations with special flue gas scrubbers are available. These burn the wood and use their dedicated filter systems to ensure that the toxic substances are not released into the environment.

**Closing the logistics cycle for pallets**
Reuse is always prioritised over recycling, however. An excellent example is the wooden pallet, which is the most common way to move goods in Germany. Pallet production in Germany has recently risen to an all-time high of just under 103 million units. The popularity of the humble pallet is not only a result of its stability and load-bearing capacity. Since pallets are usually made from untreated softwoods, they contain no toxic substances and are therefore easy to recycle at the end of their useful lives.

Wooden pallets are particularly eco-friendly and efficient when deployed as returnable transport equipment (RTE). ALBA Group subsidiary Interseroh provides support for RTE in Germany with its nationwide system for wooden pallet pooling, i.e. closed-loop management. The pooling service covers return and issuing, inspection and cleaning, and all administration work for the pallets. Each pallet is tracked individually within the extensive ALBA Group logistics network. This centralised monitoring of pallet stocks ensures that the volume of pallets in circulation precisely matches the numbers that suppliers actually need. This fully integrated solution for pallets helps to ensure the responsible use of wood as a resource. Each time a pallet is reused, energy and resources are saved, waste is prevented, and the Earth's natural carbon sinks are preserved for future generations.



**resources SAVED – wood, PPC, glass: In 2016, the ALBA Group saved around 4.5 million tonnes of primary resources by recycling over 1.6 million tonnes of wood, PPC and glass.**

**1,605,741 t**
**quantity recycled**

**PPC 1,312,540 (81.7%)**
**Wood 160,439 t (10.0%)**
Glass 132,762 t (8.3%)

**4,463,182 t**
**Total resources saved**

**PPC 3,776,533 (84.6%)**
**Wood 417,141 t (9.3%)**
Glass 269,507 t (6.0%)

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