Co-funded by
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Circular Economy Success Stories

About SMART CIRCUIT

The SMART CIRCUIT project is designed to accelerate the adoption of digital and technological solutions in the Circular Economy, particularly in Central Europe's manufacturing ecosystem. Its main objectives are:

1. Capacity Building and Knowledge Sharing: To build knowledge competencies and foster dialogue within Digital Innovation Hubs' (DIHs) networks. This involves gathering experts and knowledge on digital/technology-driven circular economy solutions and supporting policy/financing instruments.

2. Enhancing Regional and Transnational Cooperation: The project aims to enhance cooperation at both regional and transnational levels. This involves linking Digital Innovation Hubs across Central Europe to promote knowledge exchange and joint planning of actions. This is to bridge gaps between territory, policy, and industry.

3. Focusing on Key Value Chains: The project targets three key value chains - Electronics/ICT, Textile, and Construction, along with a cross-value chain emphasizing regional specificities. The goal is to integrate circular economy principles within these sectors.

4. Promotion of Circular Economy Strategies: By fostering the exchange of knowledge and best practices, SMART CIRCUIT seeks to contribute to the broader European Circular Economy Action Plan. It aims to enable a resource-efficient and competitive transition in Central European manufacturing.

5. Implementation of Practical Solutions: This includes mapping and disseminating circular digital industrial success stories, organizing regional stakeholder forums (Town Halls), and developing strategic plans and actions to enhance circular practices in industry.

Project Partners

Success Stories

The SMART CIRCUIT project showcases a variety of success stories from different countries, emphasizing the practical application of circular economy principles in various industries. These success stories represent innovative solutions to challenges in recycling, resource efficiency, and sustainable manufacturing processes.

Check the Circular Economy Success Stories from:

Poland Austria Germany Italy Slovenia Hungary Slovakia Czech Republic Croatia

About the success stories from Poland

Poland’s circular economy success stories exemplify a commitment to sustainable practices and technological innovations. Notably, initiatives harness waste heat recovery, achieving up to 90% savings in energy for heating and hot water preparation. Cutting-edge technologies like ERcuper® Water and ERcuper® Air systems significantly reduce energy demands and emissions in buildings. Poland’s dedication to circularity extends to waste management, where strategies focus on efficiency, emissions reduction, and cost savings. The circular principles are also evident in the recycling sector, emphasizing eco-friendly materials and sustainable practices, making Poland a pioneering force in circular solutions.

Circular economy success stories from Poland

Improving energy efficiency in public utility buildings in Krakow - pilot

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Behavioural change
- Complex process to make circular
- Cooperation with authorities

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Energy and waste to energy
- Water

Description of the challenge

KEGW initiated energy conservation efforts, outlining “Climate Standards” for Krakow’s municipal buildings under the city’s energy efficiency plan. Intensive energy audits in major buildings in 2020 pave the way for ongoing thermomodernization efforts to enhance energy efficiency progressively.

Securing external financial resources remains a priority for Krakow’s municipal projects, alongside the challenge of recruiting skilled personnel proficient in managing multifaceted construction, energy, and digital projects. The absence of comprehensive legal regulations compels building managers to address thermomodernization selectively rather than comprehensively.

Monitoring the project’s impact on utility savings and emissions reduction is ongoing. Urban construction investments aim to align with circular economy principles, promoting resource and energy efficiency while managing waste effectively. The city aims for holistic improvements in energy efficiency, adapting buildings to climate changes, and implementing sustainable practices in urban construction.

Main results

Start:
- over 650 municipal public buildings in Krakow,
- media consumption costs exceeding PLN 84 million. annually (data for 2019),
- a static database on media consumption, developed since 2017, allowing for quarterly analyzes and regular reports,
- ad hoc statistical analyzes
- detailed inventory of municipal buildings - over 200 conducted surveys.

Effect:
- reduction of thermal energy, electricity, gas, and water consumption in municipal buildings;
- reduction of building emissions.

The usage of PVC profiles waste in the recycling process

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Definitions of waste
- Quantity issues
- Useful application of recycled materials

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Textiles, appeal and leather
- Circular action for climate neutrality
- Reuse

Description of the challenge

In producing PVC windows, waste is traditionally discarded. Our Green and Circular Economy (GOZ) model transforms this waste into high-quality raw material sold to Primo Profile for recycling into PVC profiles. These recycled profiles, constituting 63% of our window frames, maintain strength parameters similar to non-processed material. Shifting from disposal to a circular model brings added ecological and economic value by giving waste a “second life.”

Maximizing resource reuse aligns with our commitment to the environment. FAKRO PP sought to repurpose waste from plastic window production, significantly reducing waste for disposal and potentially decreasing new PVC profile purchases. This move aligns with circular economy principles, promoting efficient resource utilization.

Moreover, our Nowy Sącz facility employs 21.31% renewable energy in its electricity usage, emphasizing our dedication to sustainable practices and reducing our ecological footprint. Through circularity, we aim to minimize waste, maximize resource efficiency, and contribute to a more sustainable future.

Main results

FAKRO found a solution in collaborating with Primo Profile, selling PVC waste generated in manufacturing for recycling. Primo Profile transforms this into new PVC profiles, repurchased by us for window production. Despite using recycled material, these profiles match the strength of non-processed ones. Our windows, reaching clients across 60+ countries, incorporate this sustainable model. This Green and Circular Economy (GOZ) approach effectively reduces waste and environmental impact. FAKRO’s successful model could inspire other companies toward more sustainable, ESG-aligned business practices.

The use of foam glass from waste glass of different types for construction

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Complex process to make circular
- Lack of investment certainty

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Research
- Ceramics and glass
- Recycling

Description of the challenge

The construction sector, accounting for half of Europe's material consumption, faces increasing environmental concerns and a push for material recycling. Insulation plays a vital role in building sustainability, meeting decarbonization and EU energy efficiency mandates. Recycled thermal insulation with superior thermal properties and a reduced environmental impact is crucial. Foam glass emerges as a popular and eco-friendly thermal insulation, derived from waste materials, boasting durability comparable to brick and concrete. Its inorganic composition and closed pore structure ensure resistance to water vapor, frost, fire, pests, UV radiation, and stability against acids and alkalis. Enhancing foam glass involves cost reduction and improved insulation properties.

Poland currently imports foam glass, prompting a project to develop local production technology for use in floors, walls, ceilings, and process equipment insulation. The focus is on achieving a minimum 90% utilization of secondary and waste materials in production, aligning with circular economy principles.

The project targets specific slab parameters: thermal conductivity (<0.08 W/(mK)), specific gravity (<250 kg/m^3), fire reaction (Class A1), absorbability (<3 wt.%), compressive strength (>1.5 MPa), and flexural strength (>0.5 MPa). This initiative seeks to localize foam glass production, bolster sustainability through recycling, and meet stringent performance benchmarks, advancing eco-friendly construction practices.

Main results

The raw material base of waste glass in Poland has been analysed. A technology for the production of foam glass (formalized) has been developed for the raw material base.
An analysis and prices of supporting apparatus for the industrial synthesis of foam glass were carried out. The study is a process project. Use of implementation for investment
SBŁ - ICiMB foam glass manufacturing technology strengthens its market position. Potential interest among investors for foamed materials. It is expected that the works carried out under this project will contribute to the construction of 2 production facilities in different regions of Poland.

The use of lime ash in the production of concrete blocks

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Cement, steel, chemicals
- Ceramics and glass
- Waste management and secondary raw materials

Description of the challenge

The research focuses on examining Belchatow thermal power plant ashes, aiming to enhance AAC's mechanical properties and achieve thermally insulating autoclaved aerated concrete. Coal combustion generates fly ash and slag, causing environmental pollution and requiring vast landfill space, incurring high costs.

High CaO content in these ashes prevents direct use as building materials. The study aims to utilize them in autoclaved aerated concrete production, leveraging a chosen activator. Ash properties will dictate concrete mixture formulations and foaming agent selection.

Globally, the trend of incorporating ash in prefabricated building components, particularly autoclaved aerated concrete, is on the rise. This trend aligns with sustainable development goals by promoting responsible consumption, efficient resource utilization, and substantial waste reduction by 2030. Growing environmental awareness drives increased sustainability demands across sectors, notably in construction. Integrating ash into construction materials supports sustainable consumption, waste reduction, and advances environmentally conscious building practices.

Main results

The project aims to produce autoclaved aerated concrete (AAC) using activated lime fly ash, resulting in blocks with low thermal conductivity. This aligns with Europe's energy policy for 2040, promoting energy-efficient heating in buildings.
Research shows the feasibility of using limestone ashes in AAC, allowing for the replacement of 40% of silica ashes. Utilizing fractionated ashes in AAC formulations can reduce lime usage by about 20%. The development of Unipol technology enables the application of lime ash in production plants, enhancing scalability by incorporating sand-based processes. This initiative advances AAC production with enhanced thermal properties, contributing to energy-efficient building practices in line with European energy directives.

Refill & Pasta Stations

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Harmonisation of EU legislation
- Initial investments high

02 VALUE CHAINS

- Electronics and ICT
- Packaging

Description of the challenge

In retail, conventional shopping habits involve single-use packaging, resulting in significant waste and environmental harm. This behavior contributes to consumer challenges like excessive purchasing, leading to food waste and storage issues.

The challenge is redirecting consumer behavior toward sustainability by encouraging reusable container purchases. Implementing a convenient refill system requires addressing hurdles such as consumer awareness, behavior change, and product availability.

Circularity in this context focuses on two aspects: reusable containers and paper packaging. Embracing reusable containers eliminates single-use plastics, promoting material reuse and reducing waste generation. Additionally, choosing paper packaging over plastic supports a more eco-friendly approach, as it's biodegradable, recyclable, and renewable, promoting a recycling loop and contributing to the circular economy's principles. Implementing these changes encourages responsible consumer behavior, reducing waste and promoting more environmentally conscious shopping practices.

Main results

Pilot stations were launched in Carrefour and later also in other major retail chains in the cities of Warsaw, Wroclaw and Krakow, when it comes to Refill Station. The Pasta Station pilot was carried out with Carrefour in Warsaw. Refill stations have helped reduce single use plastic waste by a few 1000s in the matter of 1.5 years, with pasta stations, few 100s of plastic packaging waste got reduced in the matter of a few months. We are currently engaged in talks with several retail chains across Europe Additionally, numerous producers from various product categories have expressed their interest. With sufficient funding, Swapp! aims to become the leading solution provider in this industry, providing the most efficient solution for both producers and retailers.

Development and implementation of an energy management system

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Harmonisation of EU legislation
- Low return on investment
- Time-intensive processcertainty

02 VALUE CHAINS

- Electronics and ICT
- Circular action for climate neutrality

Description of the challenge

The Lubella Lublin grain processing facility prioritizes efficient technological processes to deliver market-expected products of quality, quantity, and acceptable prices, ensuring revenue and supply chain fluidity.

Operating as a processing enterprise involves intricate internal (organizational, technological) and external (market impact, resource availability) processes. Additionally, the facility's operations impact the environment by emitting products, waste, and demanding raw materials, labor, and power. This complexity necessitates advanced information systems supporting operational and managerial processes.

This modernization aligns with circularity principles, focusing on sustainable industrial production with low energy consumption. It also emphasizes environmental assessment across the product life cycle: from raw material extraction, processing, distribution, use, to waste management. This approach introduces new business models centered on sustainable practices and efficient resource utilization. The aim is to streamline operations, minimize environmental impact, and promote sustainable industrial practices.

Main results

Multivariate models of electricity distribution within the internal structure of the plant will be developed, as well as algorithms to predict and control electricity demand for the individual units of the logistics warehouse, forklift infrastructure and energy storage. The processual innovation will take place through the development of innovative methodologies for managing intra-logistic processes by integrating energy needs with data on the availability of the energy stored in the energy storage and expected output from renewable energy source. The project will bring multiple economic benefits, such as unpurchased electricity, sale of white certificates or improved energy efficiency. The results of the project may potentially be implemented in other branches of the Maspex Group.

Biopolymer films based on biopolymers

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Cooperation with authorities
- Definitions of waste

02 VALUE CHAINS

- Textiles, appeal and leather
- Education and skills
- Plastics, polymers and rubber
- Research
- Food, water and nutrients

Description of the challenge

The University of Agriculture in Cracow aims to create eco-friendly packaging materials as an alternative to plastic. The Faculty of Food Technology developed biodegradable packaging that decomposes in around 4 weeks, ideal for various products, especially food. These materials, derived from sources like furcular, possess active and intelligent properties. Actively preserving food, they also monitor its condition, reducing plastic and food waste by extending shelf life.

The primary challenge lies in devising a device for producing these biopolymer films, with ongoing efforts to create a prototype. This innovation caters to markets seeking sustainable solutions, aligning with the principles of sustainable development and addressing the growing demand for environmentally friendly packaging materials.

Main results

It is planned to implement the solution not only on the domestic but also on the European market and to sell a license or a patent. Interested companies, with the help of the University of Agriculture, will design equipment for the production of biopolymer films. In accordance with the principles of a circular economy, a tangible result for the University of Agriculture will be the implementation of a solution that will contribute to the reduction of synthetic plastic waste. The University of Agriculture will provide substantive knowledge throughout the entire implementation process. The development of equipment for film production will be able to influence every area of life related to packaging. Thanks to this solution, companies will be able to expand their assortment with new packaging products.

Effective management of water and sewage management

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Harmonisation of EU legislation
- Low return on investment
- Price volatility
- Time-intensive process

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Circular action for climate neutrality

Description of the challenge

Tymbark MWS Sp. z o.o., specializing in food production, has an annual water consumption of approximately 700,000 m3, sourced from its own groundwater intake. Water plays a crucial role in the facility, not just as a component of the finished products, but also for various technological purposes. These include technological cooling, washing processes, and operating the treatment plant, all integral to fruit and vegetable processing and the production of finished goods.

The quality of the water is paramount as it directly affects the quality of both semi-finished and finished products. To address environmental concerns and ensure sustainable operations, Tymbark has been actively working to reduce pollution and minimize water consumption. Strategies include reusing a significant portion of the cooling water for prewashing raw materials and floors, as well as in heating boilers. Surplus water that is not immediately used is channeled to the sewage treatment plant.

As production scales up, the demand for water, especially water that meets strict regulatory standards, also increases. This has led the company to invest in research and development for advanced water management systems. These initiatives include designing, installing, and commissioning systems for recycling wash water generated by the sewage treatment plant. Additionally, there is an ongoing project at the Olsztynek Branch for recycling water and treated sewage from the on-site sewage plant. These efforts underscore Tymbark's commitment to environmental protection and the continuous improvement of its technological processes, aligning with principles of sustainability and efficient resource usage.

Main results

The on-site plant has been retrofitted with a third stage of sewage treatment, ultrafiltration and reverse osmosis to ensure that the treated water meets the standards for use in cooling processes. The investment was preceded by a thorough expert analysis and pilot study concerning water and sewage.

In turn, the on-site sewage treatment plant has been retrofitted with a system for recycling the wash water after it passes through the gravel filters, which allowed us to close the circuit completely.

The project will bring a variety of economic benefits, including reduced generation of sewage and intake of water by about 120,000 m3 and lower environmental fees.

The results of the project may potentially be implemented in other branches of the Maspex Group.

New wastewater treatment plant for the Tymbark factory

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Harmonisation of EU legislation
- Low return on investment
- Price volatility
- Time-intensive process

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Textiles, appeal and leather
- Agriculture, fertilisers and forestry

Description of the challenge

Since 1936, the Maspex production facility, including the Tymbark brand acquired in 1999, has been a leading player in East-Central Europe's food sector. Tymbark, known for juices, nectars, and beverages, is not only a market leader in Poland but also exports to nearly 30 countries.

Facing increased production, Tymbark planned a new wastewater treatment plant to handle the anticipated rise in sewage volume and address operational challenges of the old plant using aerobic activated sludge technology. After thorough analysis, a combined aerobic-anaerobic treatment was proposed for its reliability, ease of operation, cost-effectiveness, and compliance with sewage quality standards.

Embracing circularity, the Tymbark facility implemented several initiatives:

1. Photovoltaic farm: This enhances the facility's energy balance, boosting self-reliance by producing its own energy.
2. Comprehensive on-site waste segregation.
3. Modern boiler room: Outfitted with economizers, these installations enhance boiler efficiency and performance.

These steps are part of Tymbark's longstanding commitment to environmental stewardship and the adoption of advanced technological standards to minimize ecological impact.

Main results

Maspex's circular economy approach, emphasizing long-term efficiency, includes reusing post-production waste, switching to renewable energy, and minimizing waste. The company sources produce locally and powers its facility with an on-site photovoltaic farm and cogeneration system, also treating municipal and local dairy sewage. This synergy fosters local community development. Maspex's digitalization and green transformation include enhancing the Tymbark plant's energy efficiency in Olsztynek, funded partly by the European Regional Development Fund under the Warmińsko-Mazurskie Voivodship's 2014-2020 program. Projects also focus on effective water and sewage management, with R&D aimed at reducing utility consumption through innovative water systems.

Near Zero-Waste, Rapid C-SMC Molding for Complex Hollow Parts

KRAKOW TECHNOLOGY PARK

01 IDENTIFIED CHALLENGES

- Accessing funding
- Definitions of waste
- Harmonisation of EU legislation
- Lack of enforcement
- No circular regulation

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Circular design
- Measuring circularity
- Industrial symbiosis

Description of the challenge

SMC and its advanced variant, C-SMC or Forged Carbon, are established in the market, with glass fibre-based SMC being older than the newer carbon fibre-based C-SMC. The challenges included reducing production time and costs, automating manufacturing, changing raw materials and processes in bicycle frame production, redesigning frames with full structural analysis, maintaining optimal strength-to-weight ratio, and developing eco-friendly, near-zero waste solutions.

C-SMC moulding technology addresses these issues by enabling complex, hollow structures with varied wall thickness, no voids, and minimal finishing. This leads to manufacturing optimization, automation, waste minimization, and energy consumption reduction.

Traditional methods wasted up to 70% material and reduced strength. C-SMC technology offers minimal waste through optimized moulding, fast, reliable, energy-efficient automated processes, near-zero waste production, and up to 75% material savings for hollow structures. This marks a shift towards more sustainable manufacturing in the industry.

Main results

Carbon Design's technology employs closed volume molding, limiting waste to about 1% of the input material and minimizing finishing time. The company is innovating its own Forged Carbon material, combining "Snap Cure" bio-based epoxy resin with recycled carbon fiber. The development began with a thorough needs assessment to identify market gaps and target user requirements. Prototypes, emphasizing carbon efficiency, were rigorously tested for durability and functionality. User and expert feedback refined the design before mass production. The scale-up phase incorporated advanced manufacturing, strict quality control, and sustainable practices, ensuring an eco-friendly production process.

About the success stories from Austria

Austria leads the circular economy with groundbreaking innovations in waste recycling, eco-friendly textiles, and sustainable construction materials. The nation emphasizes circular practices in industrial processes, such as the successful conversion of waste toner powder into a raw material for concrete production. Austrian success stories extend to the textile industry, where companies like Humana Nova prioritize recycling and reuse, offering a comprehensive model of textile waste management. Circular strategies in construction aim to reduce environmental impact, demonstrating Austria's commitment to resource efficiency and sustainable development.

Circular economy success stories from Austria

Cardbox Packaging Pinkafeld GmbH

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Useful application of recycled materials
- Time-intensive process

02 VALUE CHAINS

- Packaging

Description of the challenge

The challenge in food packaging is to keep food fresh while minimising the use of plastic and replacing it with other materials that are less harmful to the environment. Consumers also want to see inside the packaging, which makes it harder to avoid using plastic.
The packaging company Cardbox makes packaging for companies and is constantly trying to make the packaging more sustainable and recyclable. They try to use recycled Cardbox as much as possible (not possible for all applications).

Main results

Alternative materials based on cardboard:
The aim is to produce a sustainable alternative to other packaging materials. For instance, carton packaging has multiple potentials being that its 100% recyclable.

Developing plastic-free products:
Innovative and responsible solutions for all kinds of packaging: such as removing all non-recyclable elements from the carton and substitute them with recyclable ones creating a plastic-free product.

Our packaging industry of today is able to replace PE with biopolymers.

Bio cooperative Burgenland - eGen

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Time-intensive process

02 VALUE CHAINS

- Electronics and ICT

Description of the challenge

By 2024, the share of organic products in Burgenland's kitchens should have risen to 100%. However, this means a lot of work for chefs and buyers, who have to buy from many individual organic farms. This is why the Biogenossenschaft Burgenland eGen platform was set up to ensure a bundled supply, short transport routes and guaranteed delivery.
In the past, it has always been difficult to buy organic products because you have to deal with many different producers and suppliers. The organisation aims to solve this problem.

Main results

The Biogenossenschaft Burgenland eGen platform simplifies sourcing by being a one-stop contact for customers, supplying organic food to large kitchens, communal catering, hotels, pubs, and wine taverns. It operates on a non-profit basis, ensuring fair pricing for producers. Producers benefit from gaining new customers without self-marketing, direct pricing, coordinated logistics, and stable year-round sales. Consumers enjoy a certified organic range from regional sources, reliable replacement deliveries, and the convenience of standardized, consolidated ordering. This platform streamlines the supply chain for both producers and consumers, enhancing efficiency and sustainability in food distribution.

Gugler - Craddle to Craddle

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Time-intensive process

02 VALUE CHAINS

- Pulp and paper industry

Description of the challenge

The initial situation of the company is characterised by the endeavour to integrate sustainability in all business processes, which manifests itself, among other things, through the purchase of green electricity and a sustainable construction method.
The challenge is to make business activities not only sustainable, but also in the sense of a circular economy. This is where the cradle-to-cradle tool comes in, which aims to make products more circular and healthier.
A key element of this approach is the exclusion of toxic substances in printed products, minimising concerns about disposal and establishing a functioning cycle. This is a complex challenge, especially for print products that consist of a variety of chemicals and processing materials.
The greatest difficulty lies in coordinating with all corporate partners and sub-suppliers to obtain information on the chemical components of the products and to work out an optimisation in terms of the circular economy.

Main results

The implementation of the Cradle to Cradle tool was gradual and has since been integrated into a broad portfolio of the family-owned company with 120 employees, which was confirmed by certification for the first time in 2011. This conversion led to an optimisation of the upstream value chain and the exclusion of toxic substances from the products.
The cooperation with all corporate partners and sub-suppliers was crucial here and led to a positive result despite initial challenges.
The knowledge and experience gained could also be of interest to other organisations and contribute to the dissemination of circular economy principles.

Lumitech LED Lighting Solutions and Circular Economy

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Behavioural change
- Harmonisation of EU legislation

02 VALUE CHAINS

- Electronics and ICT

Description of the challenge

An important business field for Lumitech is sustainable lighting. Lumitech has been offering LED solutions since the beginning. These have a very long lifetime compared to conventional lamps (50,000-100,000 hours). This means that the sustainability of the lamps can be increased dramatically. Conventional light-sources usually need a lot of electricity and are not very efficient compared to LEDs.
Therefore, a lot of research has been done to make the lamps more and more efficient. Two other important points are the coolant sector (lamps generate heat, which makes cooling e.g. in freezer cabinets less efficient) and the food retail (meat in the display case that needs to keep well and fresh for longer).
Another point is that conventional fluorescent tubes (T5 and T8) are phased out in the European Union. There must be new solutions for replacing these fluorescent tubes in the future. Refits are offered (see below) so that new certified luminaires can be installed without any problems.
The company engineers in Austria and manufactures in Central-Europe. The customers are mainly in Europe, so there are short supply chains.

Main results

The company focuses on developing highly efficient light sources, such as a linear luminaire delivering 160 lumens per watt. This efficiency reduces heat emission, lowering overall electricity consumption for cooling. They also offer a unique ‘Natural Meat’ light color in food-retail systems that slows down meat greying, significantly reducing waste by doubling shelf life. Their products are designed for easy recycling, with each part separable in just 7-9 steps for sorting. The company provides options for both refit (updating to current LED luminaires) and retrofit (replacing only light sources). Their luminaire design allows for installation in existing housings, promoting efficient use of current resources without the need for ceiling modifications.

Veganis - organic in motion

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Accessing funding
- Complex process to make circular
- Lack of investment certainty

02 VALUE CHAINS

- Manufacturing

Description of the challenge

Veganis GmbH is an Austrian, purely organic production and trading company for high-quality organic fruit and vegetables.
True to the motto “Organic in motion”, the company’s cultivation is based on traditional, passed-down knowledge, with a return to nature in the direction of the future. By thinking naturally and creatively, we embrace innovation when it helps the environment and the quality of our organic food.
Behind Veganis are two young passionate founders who follow their organic path with determination and a focus on the future. Michael Pilsel worked in purchasing and sales in the organic fruit and vegetable sector in various companies in Austria and Germany. Christoph Mick grew up on his grandparents’ vegetable and ornamental plant farm in Upper Austria and, after several other stations, now landed back in working with nature.
Michael and Christoph have built up Veganis GmbH at the Seewinkel location with great attention to detail and created a large network. They are constantly investing in order to realise the big plans for the coming years.
Together with numerous other organic producers, Veganis forms a large organic family that stands up for common values: future-oriented sustainability, environmental awareness and ecology. The top priority is to make organic products of the highest quality available to all Austrians - organic on the move.

Main results

Many Veganis organic products come without any packaging or stickers thanks to laser labelling. This can be seen in the photo below. This makes the company the first in Austria to set a new guideline in terms of waste avoidance for the Austrian food trade. The latest product from our company is Veganis 1-2-Greens, the fresh vegetable sprouts with the highest vital substance power for 365-day self-harvesting in the kitchen.

Wurmkiste

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Behavioural Change
- Initial Investments High
- Insufficient Demand

02 VALUE CHAINS

- Circular action for climate neutrality

Description of the challenge

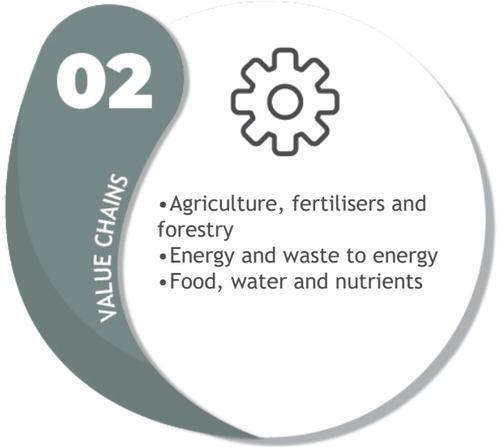
About 1/3 of residual waste consists of organic waste. This waste is unacceptable.
And that's why the company set out to develop solutions that make it possible for people in the suburbs to compost at home - in the middle of their living space. Super simple, fast and with a lot of sense. By composting organic waste, you bind CO2 and create the basis for new life.
We all owe it to our earth to give something back to it.

Main results

Wurmkiste, addressing the issue of organic waste comprising a third of residual waste, developed home composting solutions for suburban residents. Their innovative approach involves worm bins that can be used indoors, seamlessly blending with home decor as functional furniture. These bins house compost worms that efficiently convert organic waste into worm humus, a nutrient-rich soil amendment. This process is both noiseless and odorless, making it ideal for indoor use. By enabling convenient composting, Wurmkiste helps individuals reduce CO2 emissions and contribute to the creation of new life, fulfilling a responsibility to give back to the Earth. This eco-friendly initiative not only manages waste sustainably but also promotes environmental consciousness in daily life.

CO2 Neutrally Produced Pasta - The Environmental Pasta

FORSCHUNG Burgenland



Description of the challenge

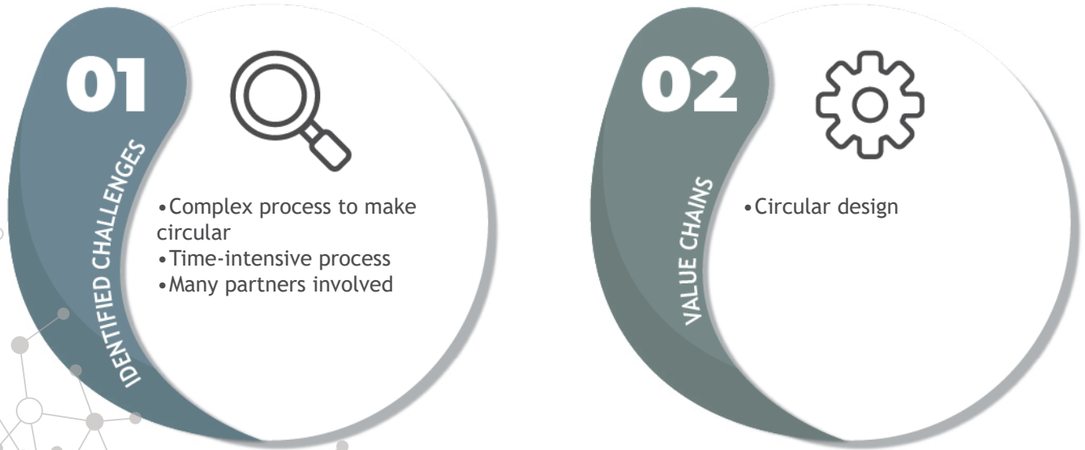
Paper instead of Plastic Packaging
Wolf Nudeln is the first pasta manufacturer in the world to use this new packaging technology. After around 11 years of development work (Wolf has been involved for almost three years), the packaging machine manufacturer Bosch and the paper producer BillerudKorsnäs have developed an alternative to packaging noodles in plastic bags. In the packaging process, sealing material is applied at the points to be sealed and sealed at a controlled temperature after the formed bag has been filled. This means that far less than 5% sealing material is used and can be recycled or disposed of as paper.
Wolf Nudeln is the first pasta producer in the world to use this new technology. Spruce wood from active and regenerative forestry is used to produce the special paper with particularly long fibres. During the growth phase, the forest generates a large CO2 reservoir for our environment. For every tree felled, 4 new ones are planted.
Wolf is the only pasta producer in Austria that produces all its pasta with fresh eggs from its own henhouses. Thanks to the unique energy cycle with our own chicken coop and our own biogas plant since 2010, we are self-sufficient in energy and received the Energy Globe Award for this in 2013.
The provision of electrical and, above all, thermal energy for production does not require any climate-damaging fossil fuels or critical nuclear energy. In addition, the shortest transport routes, the cultivation and harvesting of durum wheat in Lower Austria and the milling and pasta production in Southern Austria contribute to environmental protection.

Main results

Wolf Nudeln stands out as a pioneer in sustainable pasta production, being the first worldwide to use an innovative paper packaging developed by Bosch and BillerudKorsnäs, significantly reducing plastic use. This special packaging, made from spruce wood sourced from regenerative forestry, uses minimal sealing material and is largely recyclable. Uniquely, Wolf Nudeln uses fresh eggs from its own henhouses for pasta, promoting self-sufficiency and quality. The company's energy self-sufficiency, achieved through a biogas plant operational since 2010, garnered the Energy Globe Award in 2013, eliminating the need for fossil or nuclear energy. Their integrated system includes feeding chickens with farm-supplied feed, using eggs in pasta, converting chicken waste into biogas for energy, and using the biogas by-product as natural fertilizer. Additionally, local cultivation and processing of durum wheat in Austria reduce environmental impact, showcasing Wolf Nudeln's commitment to eco-friendly practices.

Circular Print - Circuit for printed plastics

FORSCHUNG Burgenland



Description of the challenge

Printing inks are not designed for processing at elevated temperatures, as required in plastics processing and recycling (usually at 220 - 250 °C). They literally decompose into their components and molecular fragments, especially the printing ink binders and certain pigments. Some of the decomposition products are volatile and therefore often leave more or less disturbing odors (VOCs = volatile organic carbons), while others remain in the system as interfering components that are difficult to mix with plastics and usually tend to migrate.

Main results

In cooperation with the HTL Linz, the commercially available device “M2Watch” was developed as a quality assurance tool, which measures and records the total VOC emissions inline (e.g. from the extruder degassing) and permanently.

Removal of the printing inks would practically only be possible via solvent systems (a type of chemical recycling). However, this generates a new waste stream, causes high costs and also requires a small chemical factory as a recycling plant.

Developed interdisciplinarity, our upcycling process neutralizes impurities, transforming them into inert, recyclable organic filler. Using process technology and reactive additives, we produce high-quality regranulates that comply with REACH, eliminating new waste and reducing industry reliance on new products.

Circular Economy at NiceShops

FORSCHUNG Burgenland

01 IDENTIFIED CHALLENGES

- Complex process to make circular

02 VALUE CHAINS

- Electronics and ICT

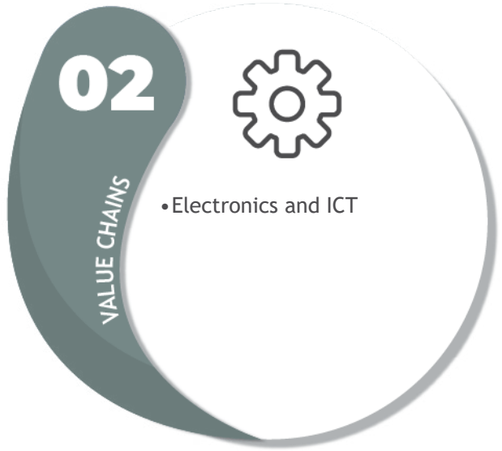
Description of the challenge

The company niceshops works carbon neutral since 2018, and is constantly looking for opportunities to be sustainable and implement circular economy practices. Although it is difficult to implement the circular economy for online shops, the company is trying to implement new projects whenever possible.
An important aspect of online retailing is delivery and packaging. Here the company has looked for the most sustainable solutions to make shipping as sustainable as possible and have the least impact on the environment.
Sustainable solutions have also been sought for the transport of products.

Main results

The brand niceshops implements many circular economy initiatives.
In the city of Graz, same-day delivery is available with bicycle couriers. There is a reusable packaging system for this and these bags are made from an upcycled material of ocean plastic. The material is produced by a Caritas project in Graz. The bags are taken back by the bike courier and reused.
The main site and the logistics centre are mainly heated and cooled with waste heat from the neighbouring biogas plant. By utilising the unused waste heat, the potential of existing renewable energies is used in a meaningful way.
The innovative niceshops packages can be re-used entirely without adhesive tape (see picture below) thanks to a special patent for shipping and returns - a solution that was awarded the Austrian State Prize for the Packaging Industry.

Circular Economy at Fitico



Description of the challenge

Fitico Sportswear stands for unique and stylish sportswear made from recycled fishing nets.
40-60% of the plastic waste in the world's oceans consists of fishing gear. A large proportion of this is ghost nets - old fishing nets that have been thrown into the ocean or have been lost.
Fitico uses these old fishing nets and turns them into beautiful and highly functional sportswear. The secret behind this is a nylon fibre called Econyl®.

Main results

Old fishing nets are collected, shredded, melted down and regenerated into Econyl®, a 100% regenerated nylon yarn with the same purity and performance characteristics as pure quality nylon, which can be endlessly regenerated. Econyl® conserves non-renewable resources and avoids the extraction of crude oil for the production of the yarn. The production of ECONYL® also reduces greenhouse gas emissions and energy consumption.

Austrian BioCycles

PROFACTOR

01 IDENTIFIED CHALLENGES

- Harmonisation of EU legislation

02 VALUE CHAINS

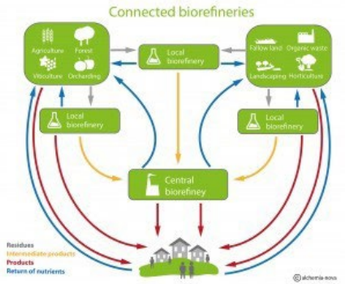
- Agriculture, fertilisers and forestry

Description of the challenge

The project assessed the streams of secondary biomass qualitatively and quantitatively and examined the theoretical substitution potential. It can base this study to a large extent on work that the consortium had already done within other studies. We evaluated processing methodologies against the various conversion technologies of specific conversion rates and drew a comparison between secondary biogenic raw materials generated in Austria and the EU. Following a survey of existing infrastructure for potential biorefineries, we developed a logistics concept for an integrated biorefinery network in Austria and present it as a digital map.

Main results

The biorefinery concepts envisage the production of bio-based products for a variety of uses, together with profitability assessments and economic and ecological impacts determined under varying framework conditions. It also compared conventional production methods of bio-based materials and integrated biorefinery cascades.
The project report is a publishable study defining the technological research needs, as identified in cooperation with experts from various disciplines. This is the short version of ABC and here is the visualisation of all resource conversion pathways to derive from side-streams to all platform chemicals.



FUTURAL

PROFACTOR

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Initial investments high
- Lack of circular infrastructure
- Missing standards

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Circular design
- Research

SMART CIRCUIT | INDUSTRIAL SUCCESS STORIES | 2023

Description of the challenge

FUTURAL aims to address social and environmental challenges in European rural areas through a set of digital smart solutions. In six pilot sites located all over Europe (Spain, Netherlands, Austria, Lithuania, Romania, and Greece), two community-led social, technological, and business innovations from two of the smart solution domains, will be tested and demonstrated.

Main results

FUTURAL is dedicated to creating a sustainable, vibrant rural ecosystem, integrating areas like Circular Bioeconomy, Ecosystem Management, Resilience, Citizen Engagement, Education, and Climate Action. It fosters social change through public-private partnerships and community involvement. Key actions include conducting educational workshops in rural areas, developing platforms for innovative solutions, and establishing a metasearch platform with matchmaking features for smart solutions. FUTURAL emphasizes inclusive business models, ensuring broad accessibility and participation. Additionally, it shapes policy and governance with tailored recommendations, ensuring an environment conducive to sustainable rural development. This holistic approach aims to transform rural communities, balancing innovation with ecological and social sustainability.

Multi-level Circular Process Chain for Carbon and Glass Fibre Composites

PROFACTOR

01 IDENTIFIED CHALLENGES

- Definitions of waste
- Initial investments high
- No circular regulation
- Useful application of recycled materials

02 VALUE CHAINS

- Textiles, appeal and leather
- Reuse
- Waste management and secondary raw materials
- Chemical management
- Recycling

Description of the challenge

MC4 (Multi-level Circular Process Chain for Carbon and Glass Fibre Composites) is a European partnership aiming to establish circular approaches for carbon and glass fibre composites. These materials are essential in numerous technical applications, for which their lightweight properties and high performances are especially valued. However, the European carbon and glass fibre value chains need to be optimized on 2 major levels: the environmental and economical efficiencies.

Currently, up to 40% of the material is wasted in the production process, and after a lifetime of 15 to 30 years, 98% of the material ends up in a landfill with no hope to be recycled. With a yearly use of about 110.000 tons of carbon fibre composites parts and 4,5 million tons of glass fibre composites, the environmental impact needs to be addressed.

In addition to these environmental issues, the current competitive position of Europe in these value chains needs to be improved in order to be less dependent from foreign sources. 80% of the virgin carbon and glass fibre manufacturing is done outside of Europe, and when the manufacturing is done in Europe, its technologies are often licensed from foreign countries.

Main results

Establishing a multi-level circular process for carbon and glass fibre composites, with processes developed for both a short term and a long term impact on the industry
Developing performant and economically realistic processes that are adapted to the specificities of the two value chains
More specifically, MC4 will base the development of the recycling processes on chemical matrix/fibre separation for carbon fibre, and on a new type of resin for the direct re-use of the composite material for glass fibre. As a result, and with the use of a proper quality grading of the recycled material, MC4 will set up processes for reaching a 60% recycling rate within the supply chains, and will ensure the possibility to properly use the recycled materials in different applicative domains.

PVadapt

PROFACTOR

01 IDENTIFIED CHALLENGES

- Initial investments high
- Time-intensive process
- Lack of investment certainty

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Energy and waste to energy

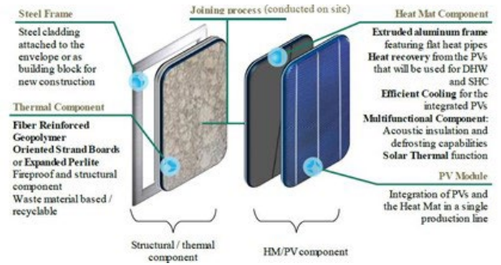
Description of the challenge

The overall goal of the project is the delivery of a prefabricated, modular and multifunctional turn-key BIPV system. This construction method will reduce the complexity and costs of the BIPV systems, maximizing in this way their accessibility. Achieving a substantial reduction of the BIPV costs would trigger the penetration of BIPV in the building sector, contributing therefore to the creation of new opportunities and the diversification of the European PV manufacturing industry. The project is further expected to contribute to the implementation of policies towards Zero-Energy Buildings.

The two component integrated BIPV system will be produced separately and an assembly/joining method will be developed for on-site integration. The Structural & Thermal components feature a construction grade steel frame and a Thermal Component based on three main material formulations. The second part of the system consists of a Heat Mat bonded to PV modules. The combination of the two will produce “building blocks” of sufficient customization to allow components suitable for roof and façade installations, as well as new construction.

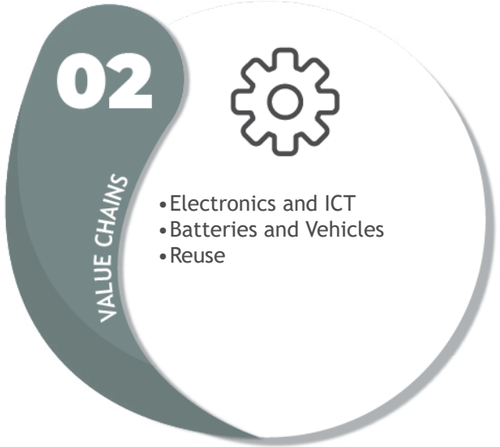
Main results

The first pillar is the delivery of a PV/T component active energy component comprised of a sheet of flat heat pipes (Heat Mat-HM) in a PV module.
The second is the delivery of a prefabricated structural panel with multiple passive functions (thermal, resilience, stability, waterproofing among others).
The third is the delivery of a Smart Envelope System, achieving critical functions such as load prediction and shifting and predictive maintenance.
Finally, producing an environmentally and financially viable result.



Batterylife

PROFACTOR



Description of the challenge

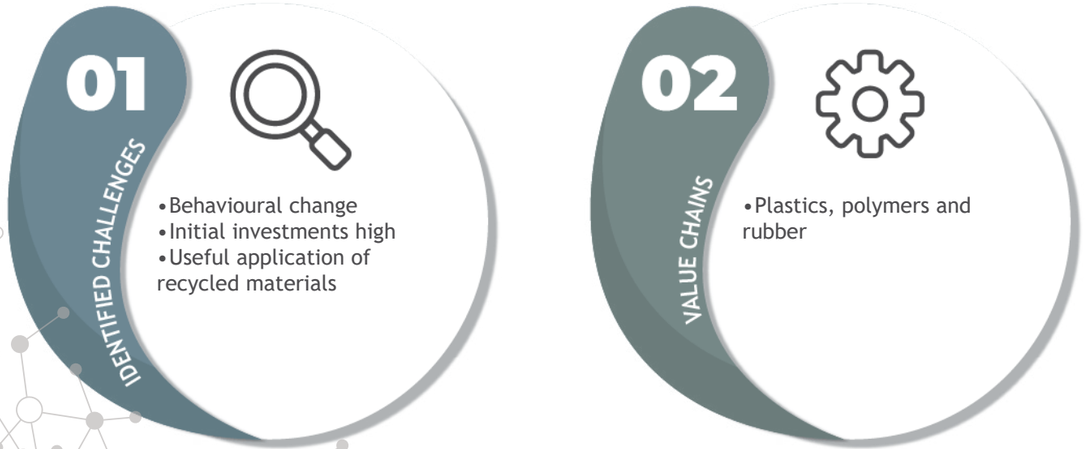
The high acquisition costs for lithium-ion batteries (LIBs) are considered one of the biggest obstacles to the introduction of electric vehicles on the mass market. Aged traction batteries sometimes no longer meet the high requirements for power and energy density. In this context, secondary use is a possible solution to reduce the acquisition costs of electric vehicles and extend the useful life of the batteries. This opens up opportunities to generate additional revenues and improve the eco-balance of electromobility. Promising second-life applications include use as home storage for photovoltaic systems or integration as buffer batteries to cover power peaks in smart charging stations. In order to extend the battery life cycle and enable corresponding secondary use, the project will develop answers to open questions that arise in connection with secondary use.
Secondary use of batteries must be fundamentally and comprehensively scrutinized with regard to second life requirements for reuse concept on pack, stack, module and cell level, with regard to product design, production processes, analysis methods with special attention to economy and ecology. Second Life applications require an understanding of current and future cell chemistry in order to prepare the basic building blocks of energy storage systems for extended life cycles on the one hand. On the other hand, understanding is needed for state analysis at stack, pack, module and cell levels. Qualification of the applicability requires the development of appropriate measuring devices to be able to make efficient statements about the condition of elements. Decisive for the economic reusability of stacks, packs, modules and cells are productive assembly, maintenance and disassembly methods.

Main results

The project focuses on developing a sustainable reuse concept for batteries, considering ecological and economic factors. It involves researching cell chemistry in current and future batteries for secondary use, creating efficient battery qualification methods, and improving productivity in battery manufacturing, maintenance, and reuse. Practical applications will be tested through laboratory demonstrators. Additionally, an ecological evaluation will quantify emission reductions and resource consumption impacts from these approaches. This comprehensive strategy aims to optimize the lifecycle of batteries, promoting sustainable practices and reducing waste in the battery industry.

Bioplastics Roadmap Austria 2050

PROFACTOR



Description of the challenge

Plastics from fossil raw materials are associated with numerous environmental problems. Potential negative effects arise from the promotion of crude oil through the whole chain to the disposal of plastics. Only a small part of the produced plastics is recycled, the main part is deposited, thermally recycled or pollutes the environment. The long endurance of plastic products is a serious problem for ecosystems, as they accumulate in considerable amounts. Plastic wastes are decomposed into micro-particles by weathering, waves and UV rays and are often part of the food chains. In contrast, plastics from renewable raw materials generally increase the independence of raw material imports and are, in most cases, biodegradable. They represent an environmentally-friendly alternative and do not release any fossil CO2 during thermal utilization, which has a significant greenhouse gas potential, as almost 10% of the world's oil production is consumed in plastic production In 2014, around 300 million tonnes of plastics were produced worldwide, of which only about 1.7 million tonnes were plastics from renewable sources. The aim of this study is to develop a roadmap that provides recommendations for action and future research needs in order to achieve a significant increase in the production of bio-based plastics in the EU by 2050.

Main results

This roadmap will be compiled by involving relevant stakeholders and considering expected socioeconomic and climatological developments by 2050 in a broad-based process. The state of the art, economic, regulatory and technical barriers to the use of biopolymers are identified and ways of overcoming them are derived. Including a status quo analysis and a vision 2050 (100% bioplastic products in the EU), which is concretised with experts and stakeholders, a technology path is created, which shows important development steps and technological advances in eight-year steps. New technological developments and eco-innovations on bio-based plastics are identified, their potentials assessed, and recommendations for possible regulating mechanisms as well as a description of the research requirements along a time axis up to 2050 are formulated.

Enzatex - enzymatic processing and recycling of textile waste

PROFACTOR

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Useful application of recycled materials
- Lack of investment certainty

02 VALUE CHAINS

- Textiles, appeal and leather
- Recycling
- Research
- Machinery and equipment

Description of the challenge

In 2018, Austria generated almost 222 thousand tons of textile waste, of which only 23% (i.e. 51·103 t) was collected sorted and 77% (171·103 t) ended up in mixed waste. Used textiles in mixed municipal waste end up almost exclusively in thermal recovery. In total, only about 7% (approx. 15·103 t) of the 222 thousand tons of textile waste is recycled and 10% (approx. 22·103 t) is reused (UBA 2022). A significant increase in the recycling rate of used textiles should therefore be aimed for. Since most textiles consist of two or more fiber types, recycling is not possible efficiently with current technologies.

Main results

The aim of the project is therefore to solve this problem and enable the recycling of polymers from textiles. At the heart of the project is enzymatic hydrolysis, which separates from a fiber mixture those components that are present in small proportions so that the remaining polymer can be made available as a raw material for the textile processing chain. Depending on the polymer, a recycled fiber can be produced in a melt or solvent spinning process, which can then be processed into a yarn and finally into a textile.

KIRAMET - AI based recycling of metal composite waste

PROFACTOR

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Initial investments high
- Lack of circular infrastructure
- Missing standards

02 VALUE CHAINS

- Recycling
- Research
- Machinery and equipment

Description of the challenge

The metal processing industry depends on high-quality metal scrap for its production. Currently, this has to be imported to Austria. July will now see the launch of an FFG lead project that aims to improve the recycling of metal composite waste with the help of artificial intelligence.

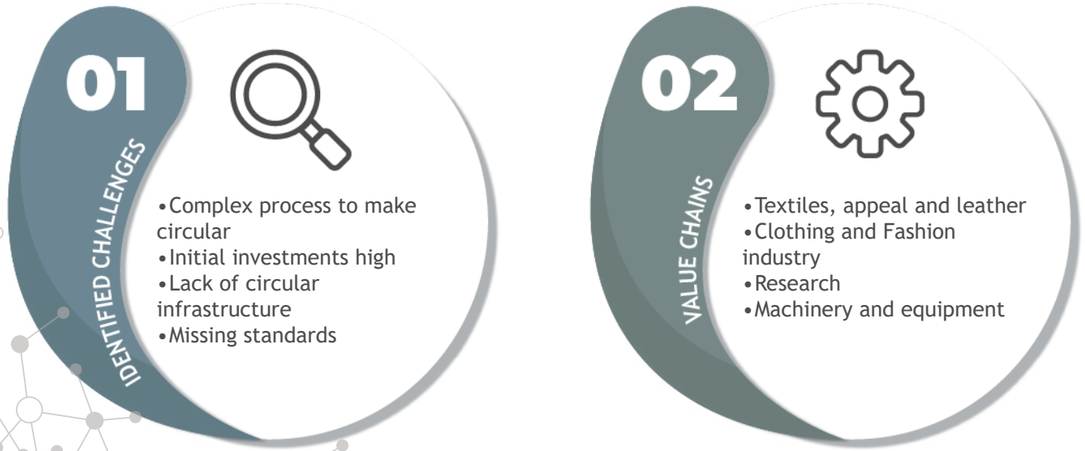
Against the backdrop of the “European Green Deal” and the circular economy package, resource consumption (minus 25 percent) and CO2 emissions (minus 55 percent) must be drastically reduced by 2030, while resource efficiency must be massively increased. In the case of metals, the ecological footprint is particularly high due to the raw materials used, while at the same time they are ideal candidates for recycling. This is precisely where the new FFG lead project comes in, and aims to use artificial intelligence to increase the quality of metallic waste.

Main results

Household scrap and scrap from end-of-life vehicles and waste electrical equipment are characterized by a high metal content and therefore have great potential for recycling. Unfortunately, these metals do not accrue sorted by type, but in the form of plastic metal compounds or alloy mixtures. “Currently, the metals are shredded and exported abroad due to their inferior quality,” explains Dr. Alexia Tischberger-Aldrian, project manager on the part of the Chair of Waste Utilization Technology and Waste Management. At the same time, Austria imports higher-quality scrap, which is very important for metal production.

RE-FREAM: Redefining Urban Fashion through Research and Artistic Collaboration

PROFACTOR



Description of the challenge

Future clothing production is shifting back to Europe with urban manufacturing, where cities become spaces for high-quality, design-centric products. This move bridges the gap between producers and consumers, aligning with the growing demand for transparency in production. Urban manufacturing in fashion counters low-wage country production, utilizing cutting-edge technologies to transform both design and production methods.

The Re-FREAM project, with hubs in Valencia, Berlin, and Linz, is innovating in three areas: Sustainability, electronic textiles, and 3D printing. It invites artists and designers to collaborate on 20 funded research projects to enhance these technologies.

Technological focuses include:

- "Additive Manufacturing" in Linz, optimizing materials with voxel printing for detailed, multifunctional designs.
- "Electronic and Textile" hub developing smart-textile applications, integrating digital production for small-batch manufacturing in Europe.
- "Eco-finishing for Fashion" hub improving environmentally friendly dyeing and washing processes, and advancing laser textile design technology.

These initiatives are redefining fashion production towards sustainability and technological advancement.

Main results

These three hubs in Valencia, Berlin and Linz are building the ecosystem of urban fashion production in their respective focus areas. They connect technology providers, companies, creative and art centers, and production sites. They also provide innovation spaces for exploration, creativity, small-scale production, knowledge and innovation transfer to fashion designers and makers. 3D printing in particular plays an important role - because it also enables the production of environmentally friendly and electronic textiles that are relevant for smart fashion.

Data- and AI-supported human-centred zero defect manufacturing

PROFACTOR

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Initial investments high
- Lack of circular infrastructure
- Missing standards

02 VALUE CHAINS

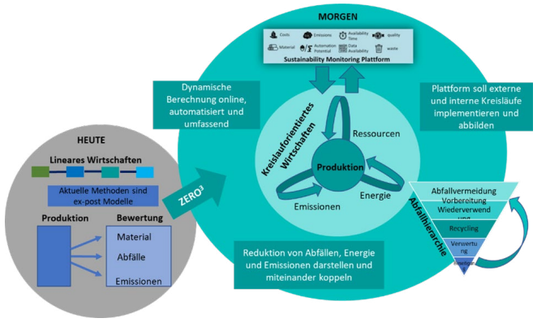
- Electronics and ICT
- Circular action for climate neutrality
- Research
- Machinery and equipment

Description of the challenge

In the automotive supply industry and the process engineering industry, manufacturing processes and the quantities to be produced are usually very predictable. Project runtimes usually extend over several years, making production plannable and international value stream chains for the manufacture of individual parts and assembly modules and the necessary manufacturing processes and accompanying processes such as quality assurance easy to plan. In the electronics industry, short development and product life cycles, new materials and complex physical operating principles for mechatronic products pose major challenges for development and series production. Sustainability and efficiency must be considered from the outset in order to produce as quickly as possible at the optimum from series ramp-up on the one hand and to enable scalable production on the other. In order to obtain production orders from the electronics industry, documentation and proof of the CO2 footprint of the product's manufacture are increasingly required. The more innovative and unique the manufactured products (e.g. freely programmable magneto-rheological haptic control elements), the more difficult this task becomes.

Main results

The project focuses on creating sustainable, scalable production concepts that emphasize human-robot collaboration. This involves using robotics and artificial intelligence (AI) to minimize type variance in production lines, thereby enhancing efficiency and output consistency. A crucial part of the initiative is developing methods for effective knowledge transfer from employees to the production process, integrating human expertise with robotic accuracy. Additionally, the project aims to close data gaps, ensuring all relevant information is accurately captured and used, optimizing production efficiency and reducing errors. This approach aims to synergize human skills with robot and AI capabilities for more efficient and sustainable production.



About the success stories from Germany

Germany stands at the forefront of circular economy advancements, showcasing excellence in electronic waste recycling, waste-to-energy systems, and circular construction practices. The country excels in managing electronic waste, with a focus on recovering valuable materials like indium from waste LCD screens. Germany's circular initiatives extend to the construction sector, where research explores the use of waste toner powder in concrete production. These innovations align with Germany's commitment to sustainability, resource efficiency, and environmental responsibility.

Circular economy success stories from Germany

Circular economy of technical textiles for snowboards

Fraunhofer IWU

01 IDENTIFIED CHALLENGES

- Quantity issues

02 VALUE CHAINS

- Textiles, appeal and leather

Description of the challenge

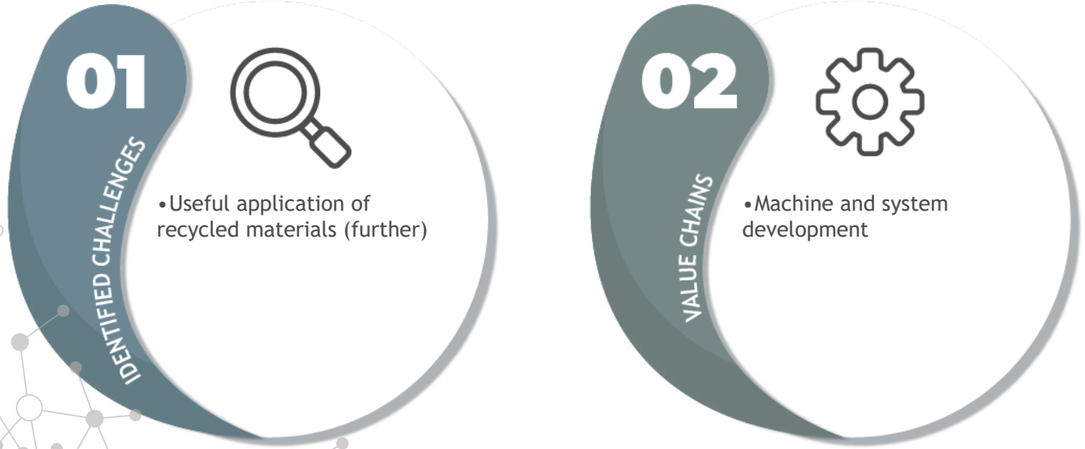
During production of the snowboards cutting waste from technical textiles occur.
This cutting waste shall be used for production of sustainable snowboards.
To realize light snowboards with the needed bending and torsion behaviour, special fibre orientation must be realized. So, the cutting waste must be processed in a special manner.
The idea considers preparation and usage of secondary material.

Main results

Since 2011, silbærg has been delivering mature and technologically unique snowboards with patented A.L.D.-Tech.® to the market. Immediately after the production of the first series, silbaerg won the ISPO BrandNew Award with the A.L.D.-Tech.® and has been producing the fine boards in small series ever since. Silbaerg works continuously to further develop the technology and to improve the sustainability of the products. Currently, topics such as bio-based plastics, reduction of waste in production and natural fibres (flax and hemp) are the focus of research activities.
New markets to be reached.
Transfer to further composite structures possible.

SEAM: High-speed 3D printing, resource-saving and inexpensive

Fraunhofer IWU

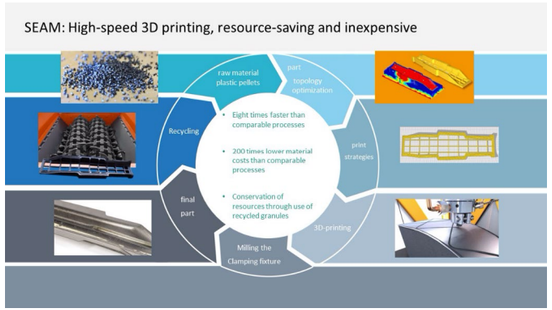


Description of the challenge

Conventional 3D printers usually process expensive materials. Products and tools made from these materials are therefore difficult to return to the material cycle. SEAM (Screw Extrusion Additive Manufacturing) therefore uses cost-effective pellets madefrom PA6 CF, for example, which can be processed into complex structures with a high output volume of up to 18 kg/h. Components and tools printed with SEAM can be shredded, processed and used as secondary material on the SEAM machinery.

Main results

Tools and devices that are used for the production or assembly of plastic or composite products are sometimes only used for prototyping, small batches or have a limited-service life. As a result, many end-of-life tools remain unused and fill the warehouses. The SEAM Technology allows old tools and components made of PA6 CF, for example, to be shredded, compounded and used for further additive manufacturing. This saves resources and minimizes environmental impacts. SEAM Technology can be transferred to many use cases and EoL structures.



Development of the additive manufacturing using secondary metals

Fraunhofer IWU

01 IDENTIFIED CHALLENGES

- Initial investments high

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Mechanical engineering
- Automobile and aircraft applications
- Ship- and railway industry

Description of the challenge

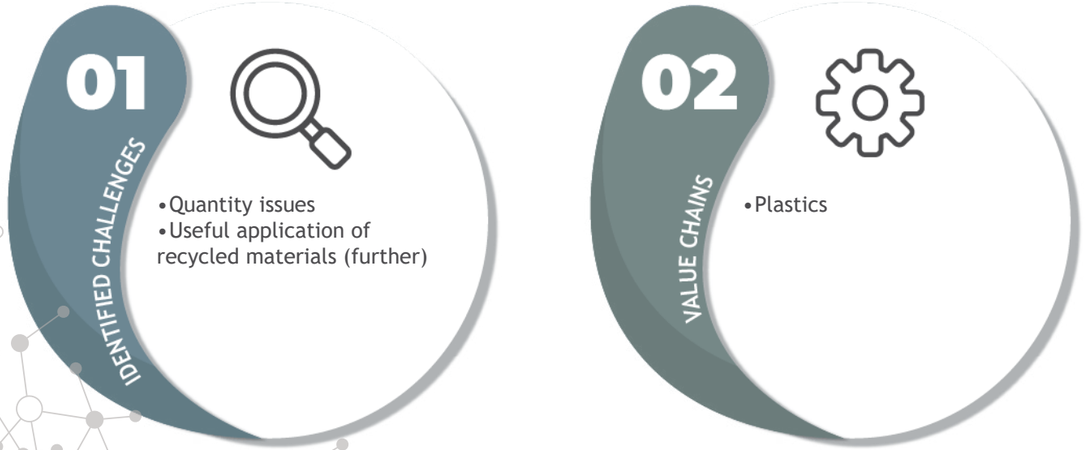
To achieve responsible consumption and production, it is crucial to use and recycle natural resources effectively. This applies in particular to the titanium (Ti) processing industry. Due to its remarkable properties such as strong corrosion resistance, Impact resistance, formability, weldability and biocompatibility, Ti alloys are widely used from e.g., aerospace to biomedicine. The basic goal is therefore the recycling of titanium waste and processing using additive manufacturing.

Main results

Beginning with the recovery, classification and purification of titanium scrap from aerospace and automotive components, the titanium scrap is upgraded and recycled for powder production for Laser Powder Bed Fusion (LPBF) technology.
Process development as well as demonstrator and sample production are monitored. The evaluation of the microstructural and mechanical properties of the samples produced with additive techniques, as well as the economic and environmental analysis will show the competitiveness against primary titanium. Advantage: LPBF can be used for Ti secondary material, which leads to a cost reduction of the components. With equivalent material properties, the secondary material can be used again in aerospace and medical technology.

Innovative sandwich production system for the use of recycled plastics

Fraunhofer IWU

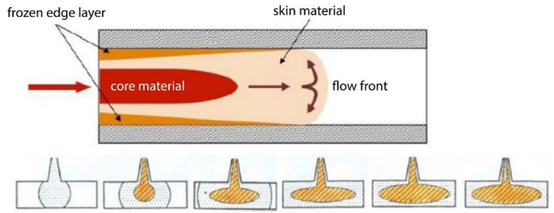


Description of the challenge

Compared to the primary materials, recyclates often have a lower quality (mechanical characteristics) or a different colour. Therefore, these cannot be used for the entire component. The technology and system engineering developed by A&E Production Technology allows recycled materials to be used inside the component and surrounded by a uniform outer layer of primary material. This is done cost-effectively in one step during the injection molding process. The application can be transferred to many injection molded components. The system technology can be used for standard injection molding systems.

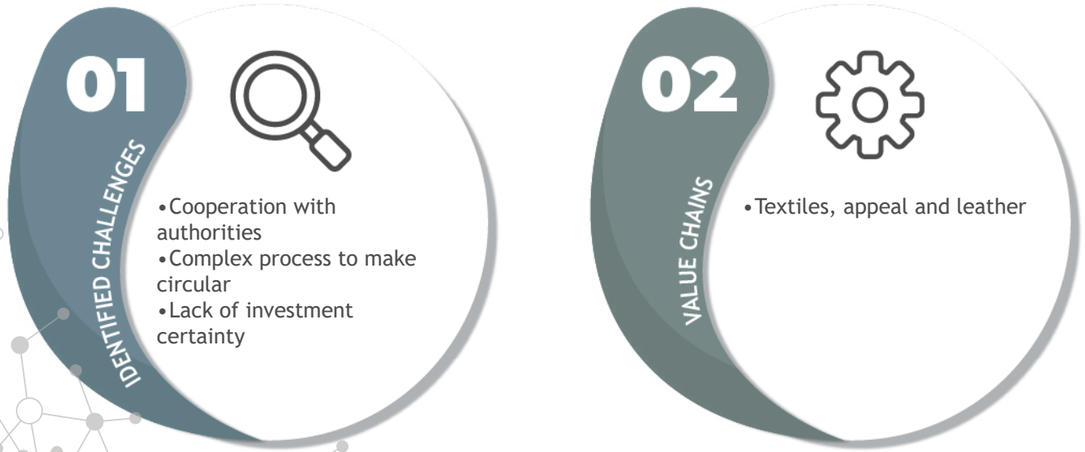
Main results

Processing old plastics into new molded parts
The swelling flow of the melts during injection enables a switch from new material to recycled melts during mold filling, without the molded part surfaces being formed with recycled material (used plastic). The recyclates are surrounded on all sides by new material and can account for up to 60% of the molded part. A&E Production Technology GmbH designs and implements the sandwich process for all commercially available two-component injection molding machines, supplies assemblies for the process and imparts process know-how to users.



Network for circular economy

Fraunhofer IWU



Description of the challenge

In Saxony (East Germany) are over 600 Stakeholders located, who work in the Circular Economy sector. To realize cross-industry and cross-technology cooperations between SMEs, large companies, research institutions and other stakeholders an innovation cluster called „Circular Saxony“ was built. This cluster allows bundle and exchange of Circular Economy know-how, creation and preservation of jobs, initiation of Circular-Economy-project and building of new value chains. Furthermore, the cluster supports the use of secondary material as well as the 10R-strategy. Cluster members receive support in national and international market participation, in setting up new supply chains, producing demonstrators and digitalization and automation as well as public relations. Communication with politicians and associations about framework conditions and strategies is also promoted.

Main results

The Saxon ministries SMWA, SMWK and SMEKUL support the innovation cluster, which works with cluster members in and outside of Saxony. The funding started in March 2022 and is planned for up to 10 years, after which the cluster should be self-sustaining. The goals are now being successfully implemented, new members are being integrated and cooperations are being entered into with circular economy networks.

Mit Kreislaufwirtschaft ans Ziel

CIRCULAR saxony

Repair of batteries

Fraunhofer IWU

01 IDENTIFIED CHALLENGES

- Time-intensive process

02 VALUE CHAINS

- Electronics and ICT

Description of the challenge

Defect bicycle batteries are often replaced by new batteries. This leads to low resource efficiency and environmental pollution.
Liofit has therefore developed processes that allow to repair defect bicycle batteries. Furthermore, healthy battery modules can be used for battery repair, so they get a further life cycle.

Main results

Liofit offers a unique service. Their focus is on repair of batteries including battery management systems and recycling preliminary stages (disassembly, discharging, sorting of components). The company repairs batteries cost-effectively and reliably for all errors, far beyond simply replacing cells. Liofit's specialists repair defect electronics from many manufacturers, replace broken housings and calibrate the battery management system to the new capacity using their own software. Liofit has developed its own solutions for common problems that make their service unique.

Structural health monitoring to extend composite shelf life

Fraunhofer IWU

01 IDENTIFIED CHALLENGES

- Cooperation with authorities
- Lack of enforcement
- Low return on investment

02 VALUE CHAINS

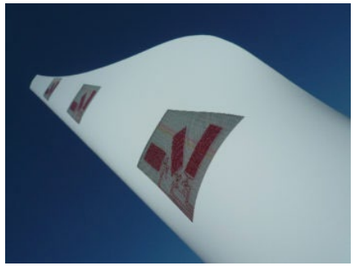
- Textiles, appeal and leather
- Mobility and transport
- Plastics, polymers and rubber

Description of the challenge

Composite structures that have passed through or have completed their usage phase usually cannot be evaluated in terms of their utilization and mechanical condition. By integrating innovative sensors into fibre composite components, conditions can be recorded during and after the use phase. For example, stick sensors are integrated into the rotor blades of wind turbines. Changes in mechanical properties, such as impact damage or wear, can be recorded during operation. The embroidery sensors are adapted to the component contour and designed to meet requirements. The sensors thus allow the service life to be extended and the quality of the fibre composite structure to be evaluated with regard to a further phase of use, repair or recycling.

Main results

LSE specializes in creating customized sensor and actuator systems, ideally suited for integration into fibre-reinforced plastic structures. These are based on functional semi-finished products made using textile technology. The sensors are produced on technical textiles through the Tailored Fiber Placement (TFP) process, primarily using wire materials as sensor components. Depending on the specific application, these systems can measure various parameters like strain, temperature, contact, humidity, or levels, enabling the monitoring of structures and utilizing the data to prolong their service life. LSE has also identified new business opportunities and envisages the transfer of this technology to all composite and hybrid structures, aiming to extend their longevity.



Moisture Regulation in Historic Masonry via Textile Drainage Systems

Fraunhofer IWU

01 IDENTIFIED CHALLENGES

- Behavioural change

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Textiles, appeal and leather

Description of the challenge

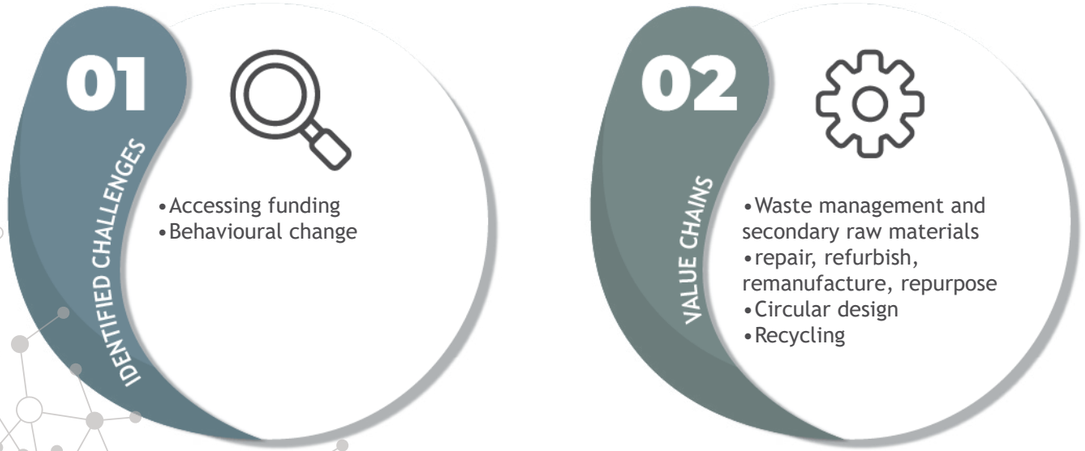
The aim is to develop a sustainable and resource-saving solution for moisture regulation in masonry structures. Previous solutions are characterized by high energy consumption or the use of chemical additives that pollute the environment.
A solution should initially be designed on the basis of fleece-based textile systems and demonstrate its practical suitability in appropriate tests. Based on this, Texulting develops the drainage-capable textile surfaces so that a demonstrator of the textile for the drainage system is available at the end. The particular focus is on the sustainability of the textile. This should be achieved primarily through the use of biologically based or biodegradable fibers.

Main results

Drainable textile surfaces were developed and produced as examples by Texulting. A load test was then carried out on this demonstrator so that optimizations could be carried out. In addition to the development of recycling concepts for the textile, a technological roadmap was developed from the perspective of textile production and the evaluation of the developed product took place. Analyzes for certification rounded off the project. The textiles developed make a significant contribution to the preservation of buildings and the extension of their useful life as well as the conservation of resources.

HolyPoly - We rethink, rework, retell your plastics

Fraunhofer IWU



Description of the challenge

Many of life's wonderful things are made of plastic, from records and keyboards to glasses lenses and table tennis balls. The problem is that every day vast quantities of valuable plastic are destroyed in waste incineration plants and landfills. Some are even lost into the environment with the result that plastics end up in places where no one wants them: the ocean, the North Pole and even our food.

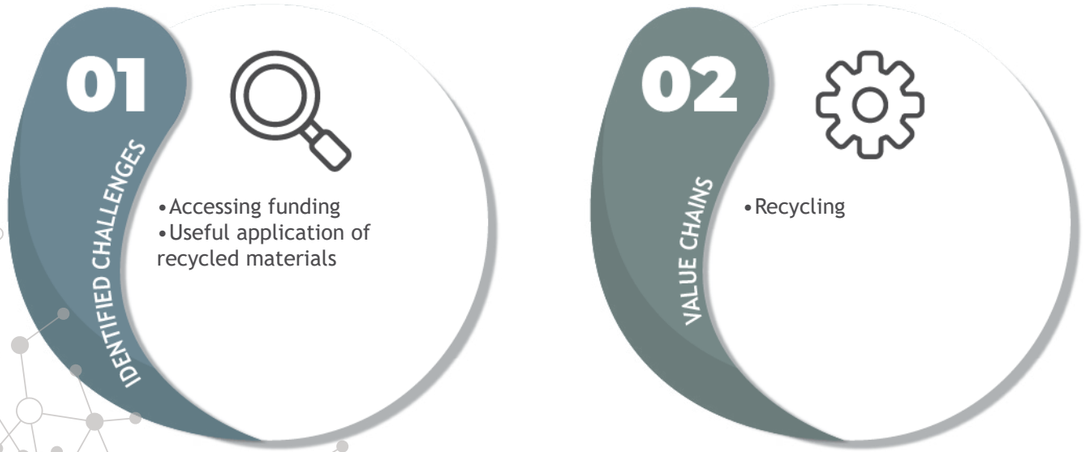
The good news is that plastics are perfect for the circular economy. High-quality technical products, household goods, toys and medical devices can all be made from recycled plastics. Theoretically. In practice, however, just 10 per cent of new products actually use recycled plastic in series production. This is exactly what HolyPoly is working towards changing.

Main results

The HolyPoly story literally began on the street. From 2016 to 2019, a few idealists took Kunststoffschmiede, a mobile DIY recycling project, through the city of Dresden, across the state of Saxony and finally to the European Commission in Brussels. They discovered that there were many obstacles in the way of industrial plastics recycling and that no-one was removing them. The team saw it as their mission to remove these obstacles and founded HolyPoly in Dresden in 2020. They added further specialists to grow their expertise, which in turn improved their ability to remove recycling obstacles for plastics companies.

The first individual reusable system based on renewable raw materials

Fraunhofer IWU



Description of the challenge

Problem identified - solution developed
We have observed that there is no adequate solution for disposable packaging in the food segment that really meets the needs and realities of gastronomy. Our goal was to develop a reusable alternative that adapts to the conditions of gastronomy and not the other way around. In addition to the founding team, there is an advisory board consisting of scientists in the field of sustainable packaging design, chemistry and material technology.

Why we take recycling into our own hands
In Germany, just under 11% of the recyclable materials are currently used as recyclates. That is far too little to rest on the laurels of the recycling process. That's why we're taking matters into our own hands. We take back MealGood bowls after they have been used several times and make sure that the high-quality material is reused as recyclate.

Main results

The first individual reusable system based on renewable raw materials
We use renewable and recyclable raw materials during production and make an active contribution to waste avoidance by using the reusable containers multiple times. The life cycle of our trays is completely resource-saving and economically efficient for catering businesses due to the long-term use of the trays.
The long-term perspective is to even use the recyclat of the reusable trays again, for producing new trays. Therefore we collect used trays after ½ a year from our customers and recycle them on our own.

Smart Blinds and Shutters

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Behavioural Change
- Complex Process to Make Circular
- Initial Investments High
- Lack of Circular Infrastructure

02 VALUE CHAINS

- Textiles, appeal and leather
- Refuse,re-think, reduce

Description of the challenge

Previously the building was equipped with a conventional shading system that operated independently of environmental conditions. This traditional setup is often inefficient, leading to energy waste due to excessive heating or cooling demands. The building also lacked a systematic approach to monitor and optimize energy consumption, resulting in unnecessary resource use and increased costs.
The challenge faces lied in modernizing the existing shading system to make it intelligent and energy-efficient while promoting circularity. The goal was to anticipate and respond to changing environmental conditions, such as sunlight and temperature, in real-time. Additionally, the challenge includes integrating online energy monitoring to track and reduce consumption.
The project involved the retrofitting of an existing KNX shading system with the primary objective of enabling intelligent management of both indoor and outdoor sun protection mechanisms, incorporating data from the DITF weather and radiation data pool.
By retrofitting the shading system to enhance energy efficiency, reduce the need for additional materials and prolonging the life of existing resources, it aligns with circular principles. Re-use existing infrastructure.

Main results

The initial phase comprised an in-depth analysis of the DITF Research CUBUS along with available data sources and sensors for the intelligent operation of the shading systems. To minimize costs and maximize efficiency, new functionalities were implemented within the existing KNX infrastructure.
The retrofit installation of the KNX shading system, coupled with online energy recording, delivered benefits, such as: substantial energy savings by utilizing solar heat gains and losses, improved indoor climate enhancing occupant comfort and productivity, and resource efficiency by extending the life of existing infrastructure. Smart Blinds and Shutters can improve the indoor climate conditions of various building types, from offices to educational institutions and healthcare facilities.

Wireless monitoring of measurement environments

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Accessing funding
- Complex process to make circular
- Lack of investment certainty

02 VALUE CHAINS

- Electronics and ICT
- Refuse,re-think, reduce

Description of the challenge

The initial situation involved manufacturers needing to maintain precise environmental conditions, especially for coordinate measuring machines. Traditional wired monitoring systems were limiting in installation flexibility and energy efficiency.
The challenge faced was the need for maintaining accurate measurements in manufacturing processes. Variations in temperature and humidity could significantly impact precision equipment, leading to errors, waste generation, the need for rework, and increased energy consumption in manufacturing processes.
The latest innovation from ZEISS is the TEMPAR® wireless. It has the same functionalities and advantages as TEMPAR® but is now completely wireless thanks to endiio technology. The sensors are no longer wired and instead transmit their data to the console via radio. There is also no longer any need for a power cable, as the sensors are solar-powered using the endiio energy harvesting concept. This makes them particularly flexible to use and also easy to install, as no special know-how is required for this.
By ensuring accurate measurements, TEMPAR® helps minimize waste generation and rework, conserving material resources and reducing energy consumption in manufacturing processes. In this way, this system contributes to the principles of circular economy.

Main results

ZEISS TEMPAR® was developed for all-round monitoring of the measuring environment. TEMPAR® records and logs values that are relevant for the precision of coordinate measuring machines. This ensures that temperature, temperature gradients and humidity are always within defined limits. In this way, the highest precision is achieved and maximum safety is guaranteed.
This innovation can be implemented across various industries that rely on precision machinery and environmental monitoring systems. The adaptability and simplicity of installation make it attractive to a wide range of users.
The integration of solar-powered sensors reflects a commitment to eco-friendly and sustainable practices, which can resonate with organizations striving to reduce their carbon footprint.

Leveraging metrics to improve energy efficiency in production

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Access to relevant information and assessments
- Complex process to make circular

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Textiles, appeal and leather

Description of the challenge

The initial situation centres around a client operating in the plastic packaging sector, who faced a significant lack of transparency regarding the energy-efficient use of their production machinery. This information gap cast a shadow over their operations, hindering their ability to make informed decisions and maximize productivity. Without a comprehensive understanding of how energy was being utilized in their processes, they were essentially operating in the dark.

The primary challenge at hand was the need to bridge the gap between their energy consumption data and their production planning systems. This lack of synergy made it difficult to optimize machine allocation, which in turn hampered productivity and profitability.

Secondly, there was a pressing need to enhance the energy efficiency of their production processes. This was not just a matter of cost savings; it was also intricately tied to broader sustainability goals. By making their energy usage more efficient, the client aimed to reduce their environmental footprint.

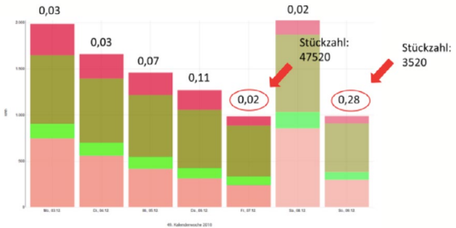
The connection to circularity in their endeavour lay in their pursuit of resource optimization and waste reduction within the plastic packaging industry. The challenge of enhancing energy efficiency in production machinery was a direct contribution to the broader goal of achieving circularity.

Within this context, circularity revolves around creating a more closed-loop production cycle. Efficient energy usage not only reduces operational costs but also serves to mitigate the environmental impact associated with excessive energy consumption.

Main results

The solution planning involved the integration of energy consumption data with production planning systems. This also included establishing an energy efficiency metric derived from energy consumption and production output. Implementation involved real-time monitoring and regular shutdowns guided by identified operational modes to optimize energy use.

Real-time visibility into energy flows empowered a better machine allocation, resulting in significant increases in productivity. Notably, under similar energy usage conditions, production quantities multiplied by over thirteen times. The implementation of proactive shutdowns substantially reduced downtime. Potential transferability to other manufacturing organizations facing energy efficiency challenges connected to operational configurations.



44.000 Stk. mehr bei selber Leistung.

Energy-flexible manufacturing in dynamic electricity markets

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Lack of circular infrastructure
- Time-intensive process

02 VALUE CHAINS

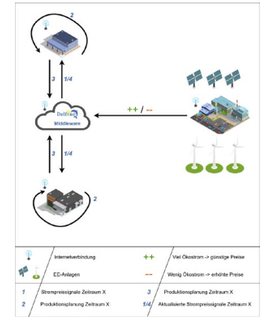
- Electronics and ICT
- Energy and waste to energy
- Housing and urban development

Description of the challenge

The initial situation is characterized by the lack of synchronization between industrial energy demand and the availability of renewable energy sources, which usually depends on weather patterns and environmental considerations.
The challenge faced is the harmonization of production plans with renewable energy fluctuations. This means integrating the use of renewable energy sources, like solar and wind, into the core of industrial operations by adapting industrial processes to these fluctuations in energy supply. In this sense, production plans should respond dynamically to energy supply variations, matching their energy-intensive processes with green energy peaks. Dynamically responding to energy supply variations would minimize the need for energy storage solutions.
The connection to circularity lies in the efficient resource utilization by maximizing the use of sustainable energy resources and reducing the negative environmental impact of industrial operations. This alignment also promotes more circular and responsible energy practices in manufacturing processes. The Delfine project serves as a model for others to follow in their pursuit of intelligent green energy utilization.

Main results

The project was planned featuring an interdisciplinary collaboration involving research institutions, IT and energy companies, and industrial partners. The implementation involved the creation of a Dynamic Demand-Response System for Sustainable Manufacturing, integrating information technology and a service-oriented architecture.
Results include an enhanced understanding of how to harmonize planning with energy fluctuations, especially for energy-intensive industrial processes. Two middle-sized companies have already embarked on the implementation. Obtained results are being shown though a Virtual Reality application.
These alignments between manufacturing and fluctuating energy supply can benefit factories aiming to enhance efficiency, cut energy costs and contribute to sustainability.



Application of the value stream analysis for variant-rich make-to-order production

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Lack of circular infrastructure
- Time-intensive process

02 VALUE CHAINS

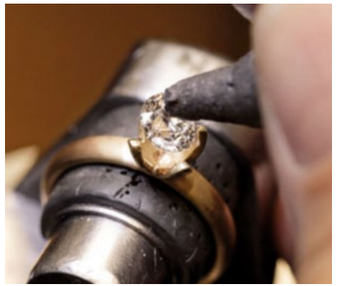
- Electronics and ICT
- Energy and waste to energy
- Housing and urban development

Description of the challenge

The egf Manufaktur is a manufacturer of wedding rings which operates in a make-to-order production environment. They offer a wide range of customization options for customers to create unique wedding rings, including choices for ring profile, alloy, gemstone, and engraving.
This high level of customization presents challenges as it introduces complexity and inefficiencies to the production processes. Successfully delivering so many fluctuating orders of individually tailored rings, while maintaining top-notch quality and on-time delivery, becomes increasingly difficult.
Many companies are familiar with lean management. Unfortunately, there is often still an insufficient implementation of “lean” methods, especially in small and medium-sized companies.
The tool of value stream mapping is primarily known from series production. However, a value stream analysis can also be used in the context of variant-rich make-to-order production and contribute to uncovering improvement potentials and reducing waste.
The data-driven approach presents in this work, in addition to multi-moment recordings and REFA time studies, evaluates data from time recording and product tracking in order to establish a better data basis compared to conventional plant tours.
The optimization of make-to-order production processes through value stream analysis addresses circularity principles in reducing waste coming from widely different requirements. A better adaptability reduces energy consumption and provides a more efficient use of capacities.

Main results

With the support of the Mittelstand 4.0-Kompetenzzentrum Stuttgart, a method was developed to implement value stream mapping in the customized wedding ring production process.
Thanks to the value stream analysis carried out, five concrete measures for optimizing production processes at egf Manufaktur were derived. These include, for example, improvements in the design of workstations but also the adaptation of production control processes. The automation of numerous production steps enhanced material management efficiency and provided a clear path for accommodating high levels of adaptability.
This approach can be tailored to suit any make-to-order manufacturing company that offers a wide range of configuration and personalization options.



High-tech dispensing solutions that achieve 20% resource savings

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Initial investments high
- No circular regulation
- Price volatility

02 VALUE CHAINS

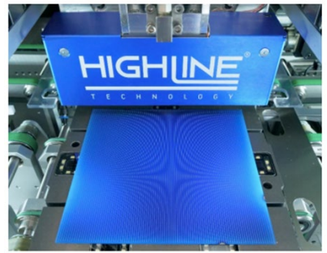
- Electronics and ICT

Description of the challenge

Traditional photovoltaic manufacturing methods, particularly Si-solar cell metallization, are resource-intensive, generated significant waste, and had a substantial carbon footprint. Researchers at Fraunhofer ISE recognized the need for innovation in this field and initiated research into dispensing technology as a potential solution. Later this team founded HighLine and scaled up the dispensing print head and developed substantial know-how on printing pastes and production processes.
The challenge was to bridge the gap between innovative research and its practical implementation for industrial-scale production. The team applied for EXIST-Forschungstransfer of the Federal Ministry for Economic Affairs and Energy and pushed the technology towards industrial maturity.
The adoption of dispensing technology for Si-solar cell metallization aligns with circularity by improving resource efficiency and waste reduction in photovoltaic manufacturing. Moreover, this technology offers a reduction in shadowing losses in solar cells and has a very short ROI for solar cell manufacturers.

Main results

HighLine Technology GmbH aims on commercialization of the parallel dispensing technology, that provides a more efficient printing process and therefore a reduction in the input of resources. In particular silver, which is applied for the conductor lines on the cells and represents a major cost factor in the production.
The current focus is on solar cells. Nevertheless, high-precision printing technology holds the potential to introduce resource savings across the entire semiconductor industry.



Parallel dispensing print-head for application of ultra fine conductor lines
© HighLine Technology GmbH

Sustainability aspects in the development of smart cables with flexible electronics

microTEC Südwest

01 IDENTIFIED CHALLENGES

- High production costs
- Need for innovative solutions
- Global competitiveness

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Refuse,re-think, reduce
- Health and healthcare
- Packaging

Description of the challenge

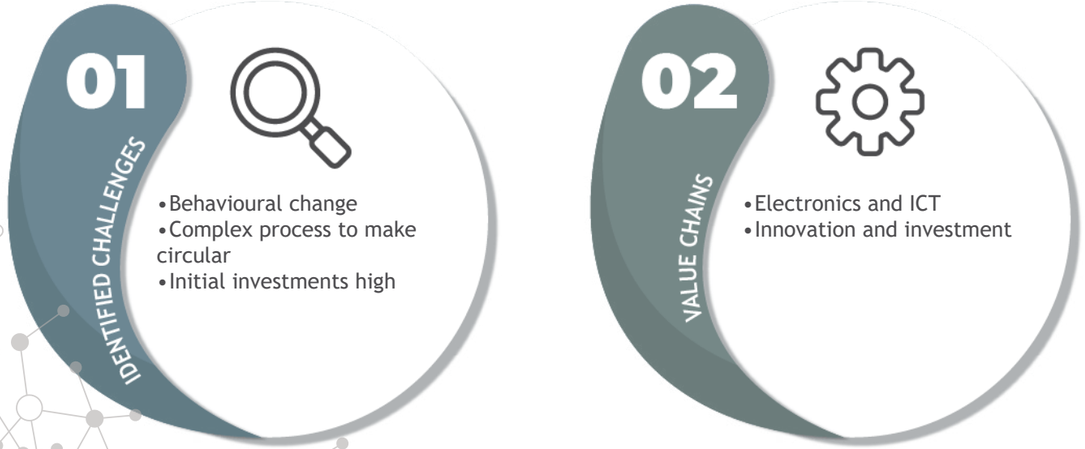
Currently, many electronic devices in healthcare and lighting industries rely on conventional wiring methods that are costly, resource-intensive, and inflexible.
For instance, medical instruments, such as catheters and endoscopes, employ traditional wiring to connect various electrical and optical components. Similarly, LED lighting surfaces often require substantial amounts of copper and have limitations in terms of integration and adaptability. These practices result in high production costs due to complex assembly/manufacturing and high resource consumption.
The primary challenge is to transform the manufacturing of electronic devices in healthcare by incorporating innovative solutions that can reduce costs associated with labour-intensive and resource-intensive conventional wiring methods. Simultaneously, these solutions should introduce greater flexibility in design, enhance adaptability, and seamlessly integrate electronic components.
By optimizing resource utilization, extending the lifespan of electronic devices, and promoting adaptability for more versatile applications, Hyperstripes contribute to the principles of the circular economy.

Main results

The partners will create a technology platform and manufacturing techniques for Roll-to-Roll (R2R) processing and integration of electronic components onto very long (‘endless’) flexible web substrates. This will open the way to higher performance products and new applications, while also reducing the cost and environmental impact of manufacturing. Plus, it will enable Europe to compete globally in the production of flexible electronics, with products such as: smart catheters, smart implants and innovative LED lighting surfaces.

PLANtAR Minaturizedmonitoring sensor systems for plants and agriculture

microTEC Südwest



Description of the challenge

The PLANtAR project focuses on the development of affordable, highly integrated, miniaturized sensors and tightly meshed sensor networks (including nano-sensors and paper-based microfluidic devices), and applied intelligence in three areas: precision agriculture (field/urban), Greenhouse/indoor breeding and farm monitoring. In addition, it aims to reduce the environmental impact and decrease cost of these technologies by ensuring that the sensors are biodegradable and can be ploughed into the soil after their use.
New kinds of electronic sensors, actuators, networks and other digital technologies can increase efficiency and improve environmental sustainability in many agricultural applications. Whether in fields, in greenhouses or in the new domains of indoor and urban farming, digital technologies have the potential to enable holistic monitoring of production and growing conditions. Sensors can provide timely warnings of plant stress and/or diseases. By measuring factors such as soil moisture, EC and content of nitrogen, ammonia, surface temperature, solar radiation, CO2 and detecting pests and plant pathogens, digital technologies can help significantly increase yields per cultivated area.
Its connection to circularity is the reduction of environmental impact and the promotion of resource efficiency in agricultural practices, by reducing water, energy, fertilizer and pesticide use.

Main results

Work in progress: Leaf wetness sensor, biodegradable battery, printed antenna on wood, potentiometric nitrate sensor, printed circuits, soil moisture sensor.
Visionary solutions:
•using bare die ICs to reduce amount of material.
•Electronic layout on thin glass substrate by using industrial printing processes
•Soldering ICs and passive components with standard reflow processes
•Material: thin glass substrate, silicon, ceramic, Ag, Cu, Ni, Sn, Al,
Infineon: Leaf wetness, Temp, CO2-Sensors + ASIC

Maximizing waste heat efficiency through intelligent digital management

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Textiles, appeal and leather

Description of the challenge

In the Freiburg North Industrial Area, Cerdia Produktions GmbH, a chemical company, possessed a substantial waste heat potential of 6 MW, available year-round. Previously, this waste heat was largely untapped, as Cerdia cooled its production processes with well water, which was then released into the environment. This was not only an inefficient use of energy but also an environmental concern. Additionally, the neighboring consumers, including the SC Freiburg Stadium, the New Freiburg Trade Fair Center, an administration building, a bank, a research institute, and a car dealership, required a combined peak heat load of 8.5 MW.

The primary challenge was the mismatch between the available waste heat potential (6 MW) and the peak heat demand from consumers (8.5 MW). Furthermore, the peak load had to be upheld while addressing the diverse heat demands of consumers.

The project's connection to circularity lies in several key aspects:

1.Resource Optimization: The intelligent load management system harnesses digitalization to predict and allocate waste heat more comprehensively, reducing energy waste.

2.Waste Heat Recovery: By capturing and distributing waste heat to neighboring consumers, the project not only reduces the environmental impact of heat dissipation but also contributes to a circular economy by repurposing this otherwise wasted resource.

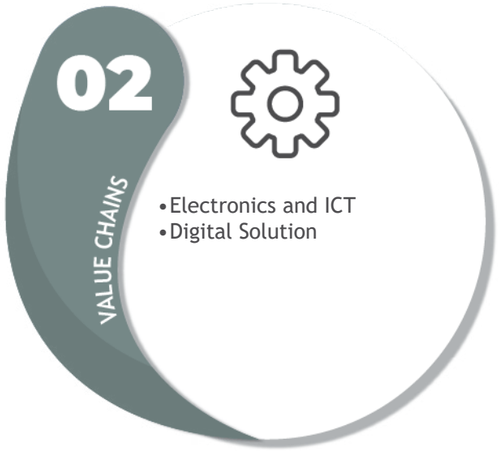
3.Efficiency Gains: The project maximizes the use of existing waste heat potential, reducing the need for additional energy sources, and improving overall energy efficiency.

Main results

The planning phase involved designing an intelligent load management system, which incorporated real-time data, weather forecasts, event schedules, and heat demand predictions. The implementation phase involved the integration of the IoT platform with the heating network and the engagement of heat consumers. This system optimized the utilization of 6 MW waste heat while maintaining a consistent peak load. The intelligent load management system allowed a heat waste reutilization by 15%. Cost reductions were achieved by minimizing emergency reserves. Operational flexibility was maintained with a stable heat supply. This technology can benefit energy-intensive industries with waste heat potential and variable demand patterns, district heating networks, and smart cities initiatives.

Interactive Documents for paperless manufacturing

microTEC Südwest



Description of the challenge

At the start of the project, paper documents were carried along with the workpiece in the process of digiraster, which leads to problems because handwritten changes and markings are only available locally. It takes a long time for documents to reach the person responsible, which leads to insufficient feedback. Documents often disappear in filing cabinets and are difficult to find, which can lead to repeated errors. There is no overview of performed work steps and there is no transparency and traceability.
The Interactive Documents demonstrator aims to make information available for production and on the shopfloor in a paperless and more traceable way. To achieve this, the information available at various points must be better summarized, but in particular information during the manufacturing process (changes, improvements, errors) must be made more securely available for subsequent processes (re-design, repeat order). Previous procedures (entries on paper) must be replaced and made available digitally.

Main results

In the planning, following aspects were taken into account:
•Access to the ERP system and the linking of its data with information from other programs
•Annotation of plans, in order to be able to enter changes and note their history at any time
•Suggestion for improvement: Rapid creation and storage of problem descriptions, including photos
•Order list together with Zeiss
As a result, extensive and easily adjustable tools were created that enable the use of interactive documents on the shopfloor. Through database integration, data can be utilized in other processes and apps.
The segmentation of specific functionalities from the Interactive Documents demonstrator and turning them into specific apps could benefit any company wishing to streamline their operations and documentation processes.

Resource recovery from industrial waste water by cutting edge membrane technologies

microTEC Südwest

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular

02 VALUE CHAINS

- Resource recovery from liquid effluents

Description of the challenge

Industries like steel processing, electroplating, PCB manufacturing, and textiles face challenges due to heavy water use and complex wastewater compositions. These processes typically generate water-acid-metal salt mixtures, necessitating frequent disposal to maintain quality, leading to high freshwater consumption and environmental concerns from wastewater pollution.

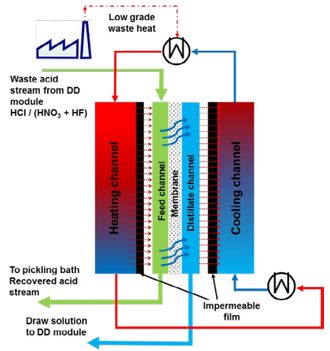
The key challenge is reducing water and energy usage, wastewater production, and environmental impact in these industries. Embracing circularity is essential, focusing on closing material and resource loops, maximizing recovery of valuable materials like acids and metals, and minimizing waste.

The project “ReWaCEM” exemplifies circularity through innovative water treatment solutions. It introduces two advanced membrane technologies, Diffusion Dialysis (DD) and Membrane Distillation (MD), to efficiently recover acids from wastewater streams. These acids are concentrated and reintroduced into industrial processes, diminishing the need for new acids. Concurrently, metal salts in wastewater are precipitated and recycled, facilitating resource recovery.

ReWaCEM has achieved over 90% acid recovery, significantly reducing fresh acid demand, lowering wastewater generation, and diminishing environmental impact. This approach presents a circular solution by closing the loop on resources, reducing waste, and endorsing sustainable practices in metallurgical and related industries. The project addresses wastewater treatment and disposal costs, aligning with the broader objective of transitioning towards a circular, sustainable industrial ecosystem.

Main results

The project implemented and tested treatment plants using Diffusion Dialysis (DD) and Membrane Distillation (MD) to recover and concentrate acids from wastewater. Over 90% of acids were recovered and reused in industrial processes, reducing the need for new acids and enabling the recycling of metal salts from wastewater. This technology is transferable to various industries, including electroplating for acid recycling and plating bath reuse, Printed Circuit Boards for gold and palladium recovery, textiles for freshwater recovery, Zero Liquid Discharge for saline wastewater concentration, and food and beverage for pickling baths and ingredient concentration.



About the success stories from Italy

Italy’s circular economy success stories highlight a diverse range of initiatives addressing waste reduction, sustainable agriculture, and recycling. The country excels in transforming waste materials into valuable resources, contributing to circular practices in various industries. Initiatives in sustainable agriculture, such as the growth of tomatoes utilizing waste heat from a power plant, showcase Italy’s commitment to circularity. Italy’s circular economy achievements underscore a holistic approach to environmental stewardship, fostering economic viability alongside reduced environmental impact.

Circular economy success stories from Italy

PlasTiPremia

Siit

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Definitions of waste
- Useful application of recycled materials

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

In the year of the pandemic, the production of post-consumer recycled plastic increased by 12% while the use of new products grew by 15%. In general, more is recycled. To reach the objectives occurs to increase the recycling capacity.
The results of the separate waste collection achieved by each Ligurian municipality in 2022 highlight an overall percentage of 57.64%, an increase compared to the 55.71% recorded in 2021 and the 53.46% in 2020 (in 2015 the separate waste collection was equal to 38.63%).
Liguria continues a virtuous path started with the 2015 reform, convinced that in a short time there will be a further increase in the quality and quantity of separate waste collection to reach 65%.

Main results

Plastipremia is a circular economy project that rewards citizens who correctly place plastic in yellow bins with discount vouchers to spend in participating shops. The project was born from the collaboration between AMIU Genoa, the Environment Department of the Municipality of Genoa, Corepla and Comieco. Plastipremia was recognized by Corepla as a good circular economy practice and received the “Comuni Ricicloni” award in 2021.
The Project is obtaining great results and it is transferable to other geographical areas.

CLIP CIRCUITO

01 IDENTIFIED CHALLENGES

- Cooperation with authorities
- Useful application of recycled materials

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

The challenge concerns the difficulty between organisations from Italy and France to collaborate at transnational level in terms of innovation.
Lack of awareness between companies of both countries in adopting the principles of circular economy as a competitive factor and as a sustainability guarantee.

Main results

The main objective is to increase the existing transnational collaboration in terms of innovation.
These services aim to:
- Strengthen knowledge of the “Tiers Lieux/Creative Work Spaces” and develop both physical and virtual venues for meeting supply and demand for research/innovation at a cross-border level:
- Structuring paths to support businesses in the border area in knowing how to manage innovation processes and knowing how to relate to different actors in the cross-border innovation ecosystem that they want to create;
- Raise awareness among companies to adopt the principles of the circular economy as a competitive factor and driver of sustainability.

These services are managed via a digital platform which allows for greater ease of use and exchange of information between participants.

EcoeFISHent

01 IDENTIFIED CHALLENGES

- Accessing funding
- Complex process to make circular
- Useful application of recycled materials

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

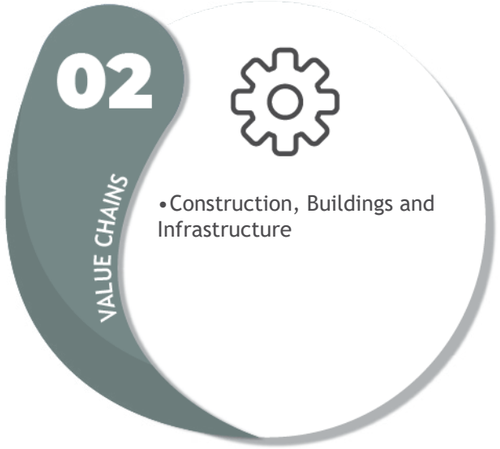
Current major economic and industrial approaches are still linear and closed, focusing mainly on the enterprises core business. As consequence, huge chunks of every business are mostly unrelated from each other. For that reason, EcoeFISHent aims to raise awareness on the circular economy potential, proposing a territorial social economic cluster and a demonstrable and replicable multilevel circular approach, which will create new circular, innovative, profitable, climate neutral value chains connecting blue and green economy.

In order to make possible coexistence between human industrial and economic activities with marine ecosystems and marine protected areas, CVCs are based on a circular economy model, crossing blue economy, industrial manufacturing and agriculture by interconnecting SMEs, administrations, scientific and innovator communities, financial intermediaries, civil society, including citizens and non-governmental organizations in a sustainable and circular way. EcoeFISHent will generate 6 interconnected Circular Value Chains.

Main results

The EU-funded EcoeFISHent project will develop innovative biomass pre-treatment and extraction technologies. Its aim is to enable sustainable and efficient exploitation of fish-processing side streams by obtaining bio-actives and galantine for high value-added food supplements and skin care products, as well as biodegradable and compostable barrier layers for food packaging. Moreover, other fishing industry side streams will be converted into soil fertilisers, oil for biodiesel and chitin for cosmetic applications. Even old fishing nets will find new life through their conversion into polymer-based automotive components and packaging for cosmetic products. The project's overall aim is to demonstrate a replicable systemic and sustainable cluster for territorial deployment of a climate-neutral circular economy.
The project is transferable to other geographic areas.

P.Ri.S.Ma. MED



Description of the challenge

Every year millions of tons of waste end up in the sea or in ports; this phenomenon derives from: poor management and collection of waste, lack of infrastructure, little knowledge of the serious consequences on the natural habitat.

Since the 1970s, the scientific community has paid attention to this phenomenon, known as “marine litter”: “any durable material produced by man and abandoned in the marine environment; waste resulting from human activities whose destiny is to accumulate in the marine environment”.

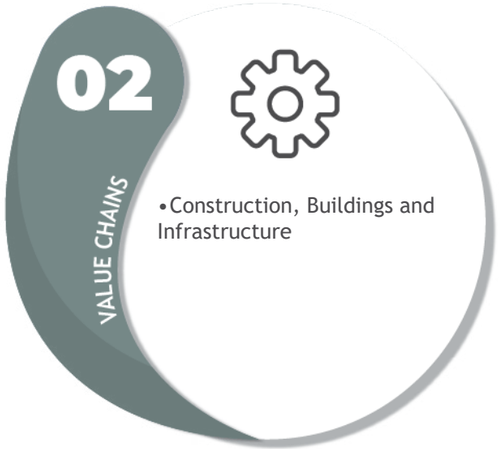
Fishing, aquaculture and recreational waste includes special waste (batteries, engine oils), organic waste (especially undersized, waste), waste collected at sea (plastic, glass, paper and cardboard, fabric, wood, ferrous material).

Currently, this waste has a disorganized management in ports: there are no storage spaces available and there are no operating methods for disposal

Main results

The experimentation of best practices is implemented through the following actions:
1) monitoring and classification pilot action in the whole cooperation area to evaluate, through a specific survey questionnaire that allows to understand the typology and volumes of waste produced and collected by fishing, aquaculture, leisure, methods currently adopted in the ports for their treatment and disposal, verifies the presence of areas intended for collection and storage;
2) four pilot projects for the management of different types of waste:
- Pilot project management/disposal of urban and special waste
- Organic Waste Pilot Project
- Pilot Project for fisheries and aquaculture nets
- Mollusc Farming Pilot Project

Converting Facilities Network for accelerating uptake of climate neutral materials in innovative products



Description of the challenge

Convert2Green will establish an Open Innovation Test Beds (OITB) that enables material suppliers to integrate their innovative, circular and carbon neutral material solutions to the European Key Value Chains: Clean Autonomous Vehicles; Smart Health; Industrial IoT; Low Carbon Industry and Clean Energy. Thus, Convert2Green will provide innovative material suppliers new business opportunities in these value chains.

Main results

Convert2Green will complement the European Open Innovation Ecosystem with services not present in other OITBs by now: (1) Complete Eco-Impact Analysis from Raw Material to Product as a service including LCA, LCC, Safety and Toxicity; (2) TRL4 to 7 Process Chains for Smart Textiles and Processing of Fiber based materials; (3) TRL4 to 7 Process Chain for Electronics on Plastic, Paper and Textiles; (4) Pilot Facilities for recovering critical raw materials from products; (5) Pilot Facilities for Processing of recycled plastics and composites, (6) Pilot facilities manufacturing of (nano)fibers and composites from bio-sources.

CISUTAC

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Harmonisation of EU legislation
- Lack of circular infrastructure

02 VALUE CHAINS

- Textiles, appeal and leather

Description of the challenge

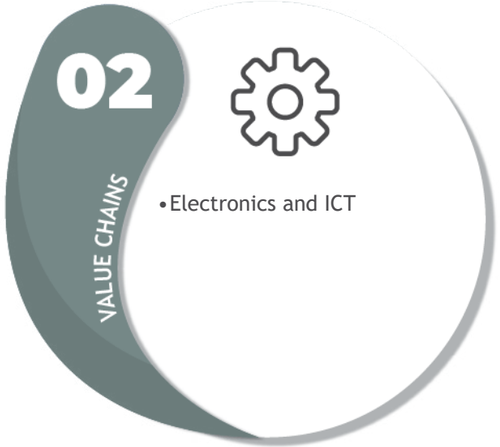
The production and consumption of textile products continue to grow, together with their impact on the environment, due to a lack of reuse, repair and recycling of materials. Quality, durability, and recyclability are often not being set as priorities in the design and manufacturing of clothing. CISUTAC aims to remove current bottlenecks in order to increase textile circularity in Europe. The objective is to minimise the sector's total environmental impact by developing sustainable, novel, and inclusive large-scale European value chains. CISUTAC covers a relevant part of the textile sector and shows how to close loops at product and at material level

Main results

The project focuses on developing short closing loops in textile production across three pilots, targeting two main material groups and three sub-sectors with circularity challenges. Key objectives include implementing enabling technologies for circular textiles, enhancing sorting capacity, and building digital infrastructure. The project aims to deepen sector and consumer understanding of circular textiles, promote circular behaviors, and motivate customers. It includes piloting circular textiles, assisting the sector in transitioning towards a circular economy, assessing sustainability benefits, and delivering training on repair and dismantling. Repair and dismantling services will also be integrated into local reuse shops, emphasizing the practical application of circular principles in the textile industry.

Forum for Emerging Enabling Technologies in Support to the Digital and Green Transitions through Value Sensitive Innovations

Siit



Description of the challenge

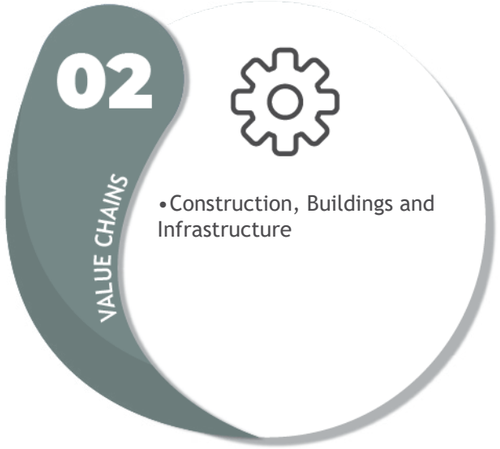
FORGING sets up a Forum and works with leading European experts to uncover the potential of Emerging Enabling Technologies. The Forum breaks linear innovation trajectories to stimulate new technological visions and pathways - attentive to the environment and society, and human-centred in alignment with Industry 5.0. technological frameworks.

Main results

We develop 6 Technological Pathways to transfer ideas and help industry navigate through issues related to the absorption and deployment of the use cases. FORGING methodology will be implemented by catalysing stakeholders' community with 600 active members, from academia to industry, to CSS, to policy makers and to the broader society. We aim to organise 24 co-creation sessions, consultations with 20 policy bodies, 6 scenario workshops and Tech. and Innovation campaigns to drive tech. adoption. The FORGING Playbook and Toolbox will gather a set of facilitation guidance and materials for exploration, reflection, co-creation and evaluation of emerging technologies. These assets, jointly with the FORGING community, will sustain FORGING as a new flagship initiative on emerging enabling technologies.

Promoting a JUST transition to GREEN hydrogen in AFRICA

Siit



Description of the challenge

Eleven members from Africa and Europe are sharing their experiences and know-how to promote the green hydrogen transition of both continents. In this context, also thanks to the support of Hydrogen Europe and the African Hydrogen Partnership, the EU-funded JUST-GREEN AFRH2ICA project will develop a roadmap to guide the deployment of future synergistic investments and policies between the EU and the AU. The project involves stakeholders from both continents engaging them in a training/capacity-building programme (also promoted by a UNESCO Chair initiative led by UNIGE) and encourage innovation/market opportunities supported by an open-innovation matchmaking platform.

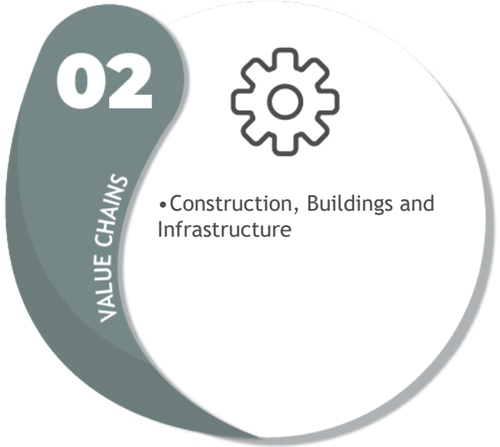
Main results

JUST-GREEN AFRH2ICA will deliver a set of 2030-2040-2050 AU roadmaps aligned with those in the EU. This will further support AU-EU synergistic and environmentally and socially sustainable transition to hydrogen

JUST-GREEN AFRH2ICA

A FRONTrunner approacTransition to a circular & resilient future

Siit



Description of the challenge

The project is centred in the Polish region of Łódzkie. A region that on the one hand, traditionally heavily relies on coal extraction, and on the other hand, has pioneered circular (bio) economy since the early 2000s. The region has always been in the forefront of innovation and has become one of the leading regions in the field of circular economy.

Main results

FRONTSH1P will contributes to further the green and just transition of the Łódzkie region away from its current linear economic foundation, towards the region's decarbonisation and territorial regeneration. It will do so by demonstrating four Circular Systemic Solutions (CSS). Each CSS targets an economic sector that is aiming towards decarbonisation: Wood Packaging, Food & Feed, Water & Nutrients, and Plastic & Rubber Waste. Each developed circular systemic solution will furthermore be highly replicable. A feat that will be proven during the project by their implementation in four other European regions: Campania (Italy), Sterea Ellada (Greece), Norte (Portugal), and Friesland (the Netherlands). Through the development of the circular systemic solutions, FRONTSH1P will create Circular Regional Clusters that involve a wide range of local, regional, and national stakeholders, both from the public and private spheres, guaranteeing that no one will be left behind.

FRONTSH1P

Treatment and recycling of Waste Electrical and Electronic Equipment

Siit

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Initial investments high
- Lack of incentives

02 VALUE CHAINS

- Electronics and ICT

Description of the challenge

Every year in the world more than 50 million tons of electrical and electronic waste are treated in an unknown or not environmentally sound way. Now, more than ever before, modern technologies as robotics and artificial intelligence can be reshaped to be applied to the world of electronic waste treatment and recycling.
The relevant challenge addressed by Hiro TEIA system consists in the dismantling of monitors and flat screen TV sets and in the recovery of electronic material suitable for recycling.
The process takes place using robots of different characteristics, designed and built ad hoc, able to carry out the various steps, such as:
- removing the screws and opening the frame;
- removal of the front frame;
- liberation of individual printed circuit boards and other electronic components;
- sorting of the cards according to the type of materials present on them;
- separation of the individual components.

Main results

TEIA solution was designed and implemented by HIRO, a SME of SIIT network.
The hardware was designed using basic robot components, personalizing them according to the specific needs, while software was completed implemented by the Company.
The tangible results can be clearly represented by the following key indicators characterising the process:
- 99% of valuable materials recycled
- 60 monitors processed in one hour
- 72% time-cycle saved in comparison with manual process

TEIA solution could be, in principle, transferred to other organisation.
Of course such a possibility should be investigated, mainly under the commercial point of view, with HIRO management.

Repair Center Caserta

01

IDENTIFIED CHALLENGES

- Complex process to make circular
- Useful application of recycled materials

02

VALUE CHAINS

- Electronics and ICT

Description of the challenge

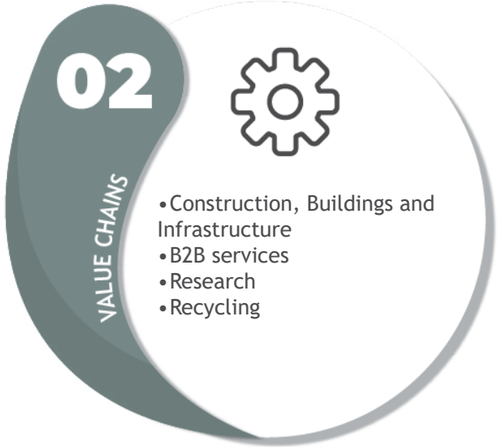
Reliance on electronics comes with steep environmental costs, from mining minerals to disposing of used devices.
As the use of electronic products has grown, the average lifespan of these products becomes shorter. This in turn has resulted in increased volume of discarded and obsolete electronic devices.
Consumers can't resist faster products contributing to growing global waste challenge. In 2019 alone, people discarded 53 million metric tons of electronic waste.
T&G integrated service for the repair and testing of electronic devices contributing to the circular economy concept.

Main results

FOS Group provides Repair Center and Swap & Repair services, thanks to its Stock Warehouse and access to the main warehouses in the world.
FOS Group has the capability to provide a simulation service of the installation of the main telecommunications equipment, within a certain network and downstream of the simulation accepted by the customer, the on-field commissioning service.
The Repair Center guarantees the ability to manage the increase in volume and/or new technologies, to manage technologies outside the Telecommunications area, and also guarantees the commissioning & de-commissioning of complete equipment, on-site intervention by technicians specialists, 3D printers for plastic items and 100% safety procedures and tools.

RETRACKING

COMET



Description of the challenge

Since the early 1960s, fibreglass manufacturing has been a dominant factor in the field of mass production and has been used in various industrial sectors due to its low production costs. The problem of these products' disposal at the end of their life cycles has more and more become a worldwide emergency, as there's still no effective disposal system available.
The challenge has been about the development of a competitive management model compliant with the European regulations for the recycling of fibre-reinforced composite (FRC) waste, which allows for the recycling, analysis, production, identification and traceability of a "secondary raw material" and creates the conditions necessary to move away from a linear economy, and towards a circular economy.
The aim of the project was to help create the conditions to move the area's production sector from a linear economy to a circular economy, proposing a circular economy model for the production of a "secondary raw material" from FRC waste (Fiber-Reinforced Composites).

Main results

The project has developed (1) a technological infrastructure which, through the marking of the product label by inserting an RFID tag, allows the traceability of FRC products and (2) a web cloud platform for the management and monitoring of information relating to the various phases of recycling and transformation. Thanks to the implementation of a pilot project, the functionality of a new circular economy model has been verified to ensure effective management of the recovery, treatment of FRC waste and its transformation into "secondary raw material" to be used for the manufacture of new products that are 100% recyclable. The technologies developed in the project make it possible to monitor new products made from recycled material and enable reverse logistics. This new model was designed to be replicable throughout Europe.

r-MAT (Recycled Material)

COMET

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Initial investments high
- Useful application of recycled materials

02 VALUE CHAINS

- Plastics, polymers and rubber
- Recycling

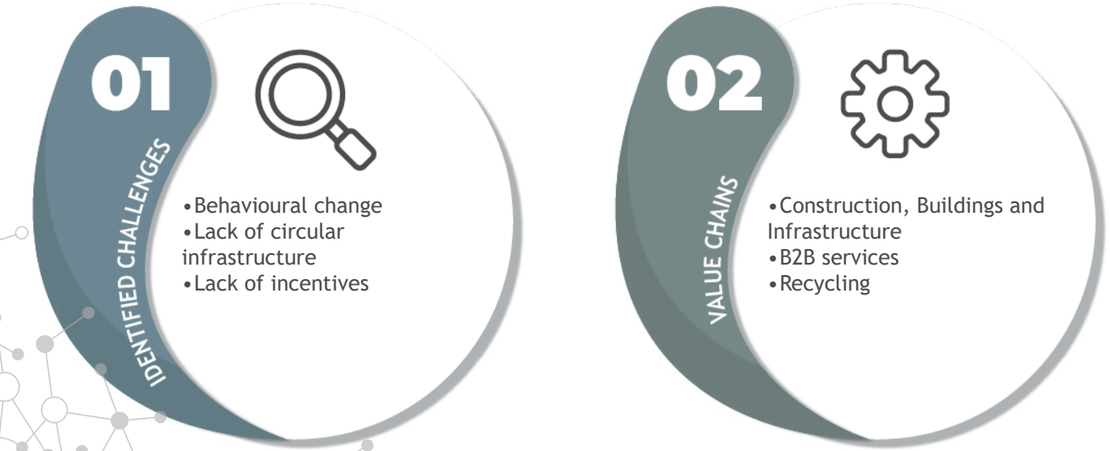
Description of the challenge

The solution receiver main ambition is to be circular and climate positive by 2030; materials are the biggest contributor to its climate footprint, where extraction and processing of raw material represents more than 50%.
Born as a small mould manufacturing workshop in 1966, the solution provider Pezzutti Group today is a strategic partner for its client in the conception, design, development and mass production of customized and finished products made of plastic resins and technopolymers. As a result of a constant investment in R+D+I , the company acquired a consolidated know-how about the processing of recycled PET. One of the main challenges faced in producing articles with such a material is the dependency on well-functioning waste collection practices, which are integral to creating a circular material flow.
Furthermore, the transformation of R-PET is an activity that few producers in Europe do since the processing requires specific conditions, temperatures and humidity with dedicated plants. Pezzutti perceived the opportunities, but it took 4/5 years to build the necessary know-how and facilities.

Main results

The creation of “green products” is a primary objective for Pezzutti: within its facilities it produces packaging among the others, using r-MAT, a recycled PET obtained from the processing of bottles, available thanks to separate waste collection. Today the company processes over 300 million plastic bottles per year, or 15 thousand tonnes.
The process starts from flaking and the subsequent further processing of the material with a line for specific and dedicated injection molding, from which a high quality product is obtained, made of 100% recycled material.
Pezzutti confirms itself among the most virtuous in the sector, among the very few to have the ambitious BRC certification. Sustainability is once again the watchword, the perfect expression of Pezzutti vision in the medium-long term of the circular economy linked to the competitiveness required by the market.

RePalNet “Reused Pallet Network”



Description of the challenge

The ‘business idea’ originates from the need to ‘recycle’ or rather ‘reuse’ the used pallets that manufacturing companies receive with their raw materials and which, once their production process is over, are unnecessarily disposed of. Hence the name RePalNet, which derives from the term ‘REused PALlet NETwork’: a network of companies active in the pallet sector for the recovery and reuse of non-standard pallets. The basic idea is to create a virtual network, an online platform, for the recovery of non-standard pallets by involving various operators, in order to give new life to these pallets and prevent them from being disposed of after their first use. In practice, it is a shared virtual warehouse, managed by a complex computer database, where supply and demand from three main types of businesses meet: 1) companies that recover used pallets; 2) transport and logistics companies; 3) manufacturing companies that handle pallets (that buy pallets to ship their goods or that receive pallets with the goods they buy).
Initially, the recovery of oversized pallets posed some challenges; the company struggled to place particular types of oversized pallets back on the market, with the result that it began to accumulate over time, taking up the space of the warehouse. The key to success in this case was to establish relationships with sector operators in other regions of Italy, by leveraging on existing networks.

Main results

Relen is collecting and sorting standard and non-standard pallets via the RePalNet web platform (www.repalnet.eu).
As an alternative to the disposal or non-use of used pallets, RePalNet has introduced a market for ‘non-standard’ used pallets. Already created for specific requirements, these pallets are recovered, sorted and put back on the market to meet even the most particular demands. On the RePalNet platform, client companies can search and filter the type of used pallets they are most interested in; at the same time, companies collecting used pallets find a usable and well-organised virtual space where they can easily and safely load and sell their used pallets, displaying and managing their own “virtual warehouse” of pallets. By registering, users can upload his own request and obtain an offer for the quantity and type of pallet identified. To date, 1,386,000 pallets have been reused, resulting in the preservation of 105,000 m3 of trees and the reduction of 65,000 tonnes of Co2.

Shelfy

COMET

01 IDENTIFIED CHALLENGES

- Behavioural change
- Initial investments high
- Missing standards

02 VALUE CHAINS

- Electronics and ICT
- Awareness raising
- Circular design
- Food, water and nutrients

Description of the challenge

Changing food system is one of the most impactful things people can do to address climate change, create healthy cities, and rebuild biodiversity. The current food system has fuelled urbanisation, economic development, and supported a fast-growing population. However, this has come at an enormous cost to society and the environment. As stated by the Ellen MacArthur Foundation, three ambitions should be followed "[…] to change the global food system: 1) Sourcing food grown regeneratively, and locally where appropriate 2) Designing and marketing healthier food products 3) Making the most of food". The proposed solution, Shelfy, addresses precisely the latter one, the food waste by improving the shelf-life of the food stored in the refrigerator. Shelfy is a smart device that indeed make food last longer, reduce bacterial load and remove bad odors from the fridge. A small and compact product that allows your food to last up to 12 days longer in the refrigerator.

Main results

Shelfy's secret, as well as all Vitesy branded products, lies in the exploitation of the PCO technology (photocatalytic oxidation), a natural phenomenon based on the particular property of semiconductor materials (tungsten trioxide (WO3), a nanomaterial used to coat the ceramic filter). From a chemical-physical point of view, WO3 has a particular structure that allows it to be activated by the visible band LEDs that illuminate the filter inside Vitesy products. Its use instead of TiO2 guarantees the Vitesy technology greater safety (no UV lights are used), better performance, and less consumption (less than an LED bulb). In this way, we make our photocatalytic technology sustainable and effective. The air purification process based on Vitesy's technology is performed by free radicals that are created when tungsten trioxide interacts with oxygen and moisture present in the air, creating a molecular breakdown. Billions of these two elements are created in billionths of a second and ensure an effective elimination of pollutants and toxic microorganisms present in the air such as viruses, bacteria, odors among the others.

Consorzio Meleretum

COMET

01 IDENTIFIED CHALLENGES

- Behavioural change
- Cooperation with authorities

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Agriculture, fertilisers and forestry
- Awareness raising
- Housing and urban development

Description of the challenge

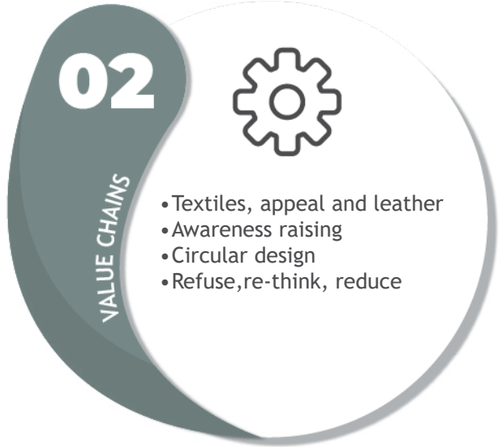
Interest in the cultivation of industrial hemp is growing in Friuli Venezia Giulia Region. In addition to its uses in cosmetics, the textile industry and its possible exploitation for energy among the others, hemp can also be used in construction.
Cultivating hemp for use in the building industry, exploiting the qualities of its fibre: this is the objective of Friuli Venezia Giulia's producers of this ductile plant, but which in the future will increasingly be able to lend a hand to the building industry with strategic solutions for CO2 containment as well.
With this project, the regional administration intends to launch a pilot to cope with the challenge of introducing a (new) biomaterials supply chain. Hemp fibre, which is kilometre-neutral in that it can be produced on the territory, is the key to achieving 100% sustainable building. In addition, hemp has environmental advantages such as the low demand for water for cultivation, the absence of phytosanitary treatments, a high growth rate that absorbs twice as much CO2 as trees, and the possibility of storing it through its fibres in building materials for decades to reduce its concentration in the atmosphere.

Main results

The idea is to make ecological bricks (combining hemp fibre, lime and water) with advantages such as high strength, durability and excellent thermal and acoustic insulation. More precisely, the canapole, the woody, fibrous part of the plant, is used to make bricks. Combined equally with lime and mixed with water, which can also be salted, it creates an exceptional material' for construction.
The eco-brick is a solid insulation material that combines properties of insulation and thermal mass (conductivity and thermal inertia). They might be used in all external and internal insulating masonry constructions in combination with a load-bearing frame made of concrete, steel or wood. Main features include: insulation against cold and heat (guarantees excellent thermal lag values), no moulds and condensation thanks to high breathability, fire and frost resistant, it absorbs and releases excess moisture, sound-absorbing properties.
The central locations of the current project, which has just been launched, are Mereto di Tomba - where the Meleretum consortium is based, bringing together more than 30 regional companies that are cultivating about 15 hectares as a test, aiming to reach 200 hectares when fully operational.

RE49 - Reborn Shoes

COMET



Description of the challenge

Given a second life to old sails and spinnakers, exhausted car tyres, beach umbrellas, beach beds and chairs, denim jeans and cotton, fabric excess inventory and scraps.

Main results

RE49 / The Re-Born Shoes is a line of footwear handcrafted by recycling old sails, parasols, jeans, tyres, beach beds and other materials not born to be shoes. RE49: “49” comes to 1949, the year in which the historic company (Eredi Masolini Raimondo Snc) has been founded, starting recycling fabric scraps and military uniforms to make shoes. “RE” comes from RE-cyle, Return and Re-use, Re-born materials, materials recycled, reused, given a second chance. Materials of animal origin are not used (PETA approved vegan) and company’s production method is 100% carbon neutral. Inserts, laces, tags and packaging are also made with recycled materials. Before being used, all materials are washed and disinfected with the utmost care. All RE49 collections are limited editions, made with the circular economy model, traceable through the Blockchain. All shoes have a microchip, indeed: the costumer can hold its smartphone over the shoe tongue and discover how every stage of our supply chain is sustainable. Through the Blockchain technology the ethical approach of the company and the origin of the materials used can be verified.

Granella®

COMET

01 IDENTIFIED CHALLENGES

- Access to relevant information and assessments

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Cement, steel, chemicals
- Industrial symbiosis

Description of the challenge

In the creation of new steel products, the continuous reduction in the use of raw materials of natural origin, together with recovery/recycling of residual products in internal processes and “industrial symbiosis” practices, is a real objective for companies in the sector, both in terms of the economic opportunities involved and, above all, in terms of reducing environmental impact.
Steel can be recycled and reused because it is a permanent material that maintains its strength, ductility, and formability over time. Steel is considered to have an overall recovery rate of more than 78% and 100% of the products made from it can be recycled.

Main results

Pittini Group, using electric furnace (EAF) technology, produces steel primarily from recycled ferrous materials, emphasizing sustainability and circular economy. Their focus is on reducing waste, managing energy efficiently, and conserving water. The group’s R&D efforts have led to low-impact technologies, with 82.2% of raw materials in 2020 coming from recycled sources. Their “Zero Waste” initiative, starting in the mid-1990s, continually evolves to minimize waste and enhance material qualities through process and plant innovations. Notably, non-finished steel materials are converted into Granella®, a product used in road paving, replacing natural raw materials and reducing environmental impact. Granella® from the Osoppo plant is EPD certified, and annually Pittini recovers 400,000 tonnes of potential residues for this purpose. Some materials are reintroduced into the production cycle or recovered through industrial symbiosis, with only 3% being non-recoverable. Granella® offers improved safety for high-performance asphalt mixes and represents a dual environmental benefit by valorizing industrial residue and reducing natural raw material usage.

r-COMPOSITE™

COMET

01 IDENTIFIED CHALLENGES

- Harmonisation of EU legislation
- Quantity issues
- Useful application of recycled materials

02 VALUE CHAINS

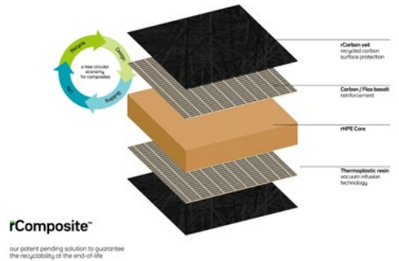
- Construction, Buildings and Infrastructure
- Research
- Waste management and secondary raw materials
- Plastics, polymers and rubber

Description of the challenge

The transition passes not only through energy sources but also the materials that are used, which must be fit for purpose and respect the environment. This is all true for boats, which are in direct contact with the water.
NL Comp aims to solve the problems associated with the use of fiberglass composites for the construction of pleasure sailing boats. The project falls within the development trajectories related to the design and development methodologies of new products, processes and services and to 'green' technologies, i.e. an innovative composite material with the aim of overcoming the current technology of using fibreglass - currently not recyclable - with a new sustainable technology that allows for end-of-life boat recycling that can give rise to a new circular economy in pleasure boating.
Recycling fiberglass composites is not efficient and expensive, for this reason thousands of boats are abandoned in shipyards, fields or sunk.

Main results

The technology behind the project aims to solve one of the biggest problems of the composite industry: the end-of-life. The underpinning concept is to give life to a brand-new circular economy in this sector.
Company's aim is to revolutionize the composite sector with technological innovations, reuse of raw materials and reduction of waste. rComposite is made out of three main components: vegetable fibers, resin and polyurethane.
Fibers: Natural fibers, glass fibers, carbon fibers
Core: Atlas HPE, PET, balsa
Process: vacuum infusion technology
Patent pending solution (technology pending for patent in mid-2023)



Dinamica®

COMET

01 IDENTIFIED CHALLENGES

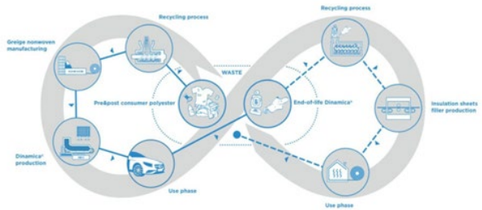
- Accessing funding
- Complex process to make circular
- Lack of investment certainty

02 VALUE CHAINS

- Textiles, appeal and leather

Description of the challenge

The manufacturing process used by Dinamica® makes it possible to extract fewer virgin raw materials since it uses a part of recycled fibres of waste products which would otherwise be sent to landfill sites or incinerated, thereby reducing CO2 emissions and other environmental impacts associated with these processes.



Main results

Dinamica® by Miko is a microfibre produced in part by using recycled polyester (the recycled content varies according to the product line and application) without the use of organic solvents (e.g. DMF and trichloroethylene that can be used to manufacture synthetic materials) but using a water-based process.
Under the microscope, Dinamica® is composed of three layers: face, inner scrim and backing. Submerged in a water solution, the inner scrim attracts small polyester fibres, which are suspended in the liquid, to both surfaces; these are compacted using a water-based needle punching process.
The microfibre is then immersed in a water polyurethane bath, which, in contrast to normal production cycles, does not contain the solvents that are harmful to health and the environment. This process compacts the fibres, making them elastic and resistant.
During dyeing and finishing stage, the production cycles are optimised and monitored managing the energy consumption at best and minimising the waste of chemical products and water which is then drained through our purifier and partially re-used.
In 2019, Dinamica® received the “PETA-approved Vegan” certification, attributed by PETA to companies that undertake not to use raw materials of animal origin in the making of their products.

CdA di Cattellan

COMET

01 IDENTIFIED CHALLENGES

- Accessing funding
- Definitions of waste
- Harmonisation of EU legislation
- Quantity issues

02 VALUE CHAINS

- Agri-food
- Energy

Description of the challenge

A coffee break lasts only a few minutes, but the impact of the waste it generates can last for years. CDA, a brand synonymous with coffee breaks for 40 years, has turned this problem into one of its most innovative projects.
The company, based in Talmassons (Udine), has 75 employees, supplies 650 customers daily and specialises in automatic food and beverage dispensing. For a number of years, it has been participating in a project in partnership with the Animaimpresa Association and the Department of Agricultural and Environmental Sciences at the University of Udine (through the Bluecomb spin-off), which involves recovering coffee grounds and thereby diverting them from landfill.
The challenge is, thus, to give coffee grounds a new useful life and meaning.

Main results

This initiative won the fifth edition of the Good Energy Award, which recognises companies that target untraditional markets whilst respecting the environment. It aims to make it possible for coffee grounds to be reused as an energy source in pyrolytic stoves, which produce heat from biomass: the combustion residues, consisting of vegetable-based carbon, could then be used as a soil improver, turning coffee into an inexhaustible resource.
The case has been chosen by the Italian Ministry of Economic Development as one of Italy's best practices for the Inventory of Business examples for sustainable and inclusive growth, and has been published on the website of the METI, the Japanese Ministry of Economy, Trade and Industry (www.meti.go.jp).

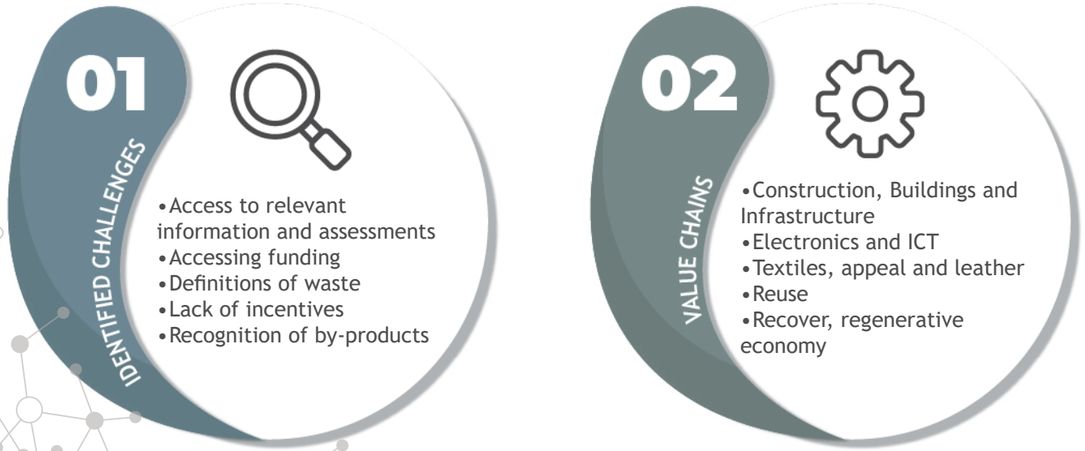
About the success stories from Slovenia

Slovenia's circular economy achievements focus on waste management, circular business models, and eco-friendly product design. The nation emphasizes sustainability in its initiatives, fostering circularity in various sectors. Slovenian success stories include advancements in circular business models and innovative product design, reducing environmental impact and contributing to sustainable practices. The nation's circular economy endeavors showcase a dedication to minimizing waste, promoting resource efficiency, and fostering a greener, more sustainable future.

Circular economy success stories from Slovenia

CIRCI - Implementing circular economy in industrial processes

TECOS



Description of the challenge

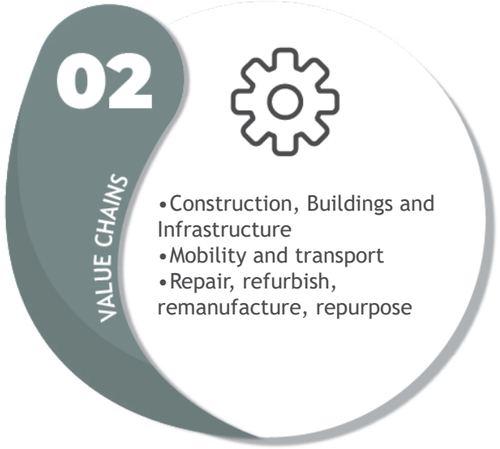
CIRCI addresses in innovative way the challenge of mass side stream materials, and their reuse, by establishing a Slovenian base of side stream materials for the following three industries: plastics, electrical and electronic side stream materials and process industries side stream materials. As the awareness of reuse of side stream materials is still not very well known, and manufacuturing companies do not have the tools to efficiently recycle, reuse, reduce the side stream materials, CIRCI would like to have an overall overview of the three mentioned industries, by establishing the database along with a market place for side stream materials. In future phases we would like to expand the database to other industries in Slovenia. Lastly, we are testing the usability of the database through a simplified voucher scheme system and support to companies on use of side stream materials.

Main results

The project has created a database of side stream materials, involving over 50 companies and institutions and listing over 120 materials. It awarded seven €15,000 vouchers to companies for innovative use of these materials and production process optimization to minimize waste. The project also facilitated four study trips to Norway and Slovenia, providing valuable learning experiences. This initiative successfully established international cooperation between Slovenian and Norwegian companies, leading to joint market and research initiatives focused on sustainable material usage and waste reduction, showcasing a commitment to cross-border collaboration in environmental sustainability.

Recycling of Thermoplastic composites scraps into heat & sound 3d formable insulation boards

TECOS



Description of the challenge

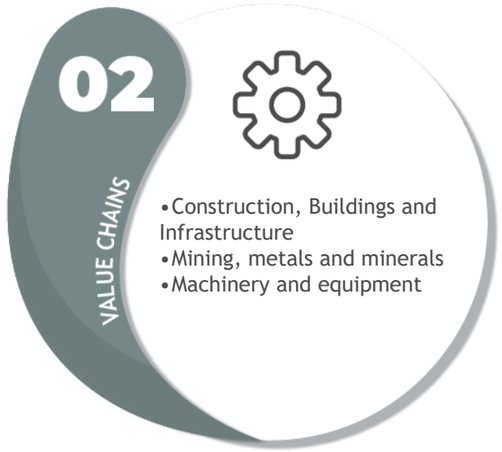
ReThermoForm project will be built on the results of two innovative Eureka projects where CAP has been involved. First one, entitled as MonoComp, second (still running) is TPComp. Due to the fact that TPComp project already delivered first results and some technologies are already mature to be transferred into industrial practice, we are already facing a huge problem with production and accumulation of trimming scraps which are currently denoted as non-recyclable plastic waste. Having stated these facts, we now need to develop a recycling technology to firstly separate and reuse the non-monolithic materials. Duo to diverse composition, we cannot easily (energy and price justified) decompose and recycle our materials with state-of-the-art technologies. Therefore, we have already laboratory developed and tested novel technology where we will mill our diverse scrap inputs into non-woven particles, add some stabilizers and modifiers and try to rethermoform these secondary raw materials into 3D formable prototype products for the caravanning or nautical equipment sector.

Main results

Rethermoformed particles have been successfully utilized and tested in the caravanning industry, specifically for insulation boards in family-style caravans. Additionally, a new product has been developed - an insulation-enforced coffee mug made from recycled plastics. This innovative product is currently in the process of obtaining a patent, showcasing a novel application of recycled materials in everyday products.

Ecological Processing of metal industry waste into construction composite

TECOS



Description of the challenge

Termit d.d. is a mining company for the production and processing of quartz sands and the production of auxiliary casting materials. In the open case mines, they produce around 200,000 tonnes of quartz sand per year. To rehabilitate open case mines, they require an enormous number of materials to replace excavated sands. To rehabilitate those mines the option is to purchase natural materials, transport them, and cause environmental harm elsewhere, or use side stream materials used by other industries, that are unharmful, process it, and use it as construction material. In this case, company opted for using side stream materials from metal casting industry. As they use sands to make moulds and cores for casting metals, they transport them and dispose of the used foundry sands at landfills. With the cooperation and support from ZAG institute, these waste materials are tested, developed and reused for rehabilitating mines.

Main results

Developed new material with minimal environmental impact for rehabilitating open cast mines was developed. The foundry sands were gathered, then at ZAG tested, reinforced and upgraded, their environmental impact has been tested in several natural environments and then used in reuse efforts. The developed solution, significantly reduced costs for TERMIT, and also for Metal casting industry as it was able to dispose of foundry sands without cost. Furthermore, the environmental impact of landfills is reduced in such a way. As the material is enriched with bio composites as well, it will contribute to full rehabilitation of open case mines.

3R culture innovation model implementing briquettes-based charging material made from side stream materials

TECOS

01 IDENTIFIED CHALLENGES

- Accessing funding
- Complex process to make circular
- Low return on investment
- Missing standards

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Textiles, appeal and leather
- Mining, metals and minerals
- Machinery and equipment
- Reuse

Description of the challenge

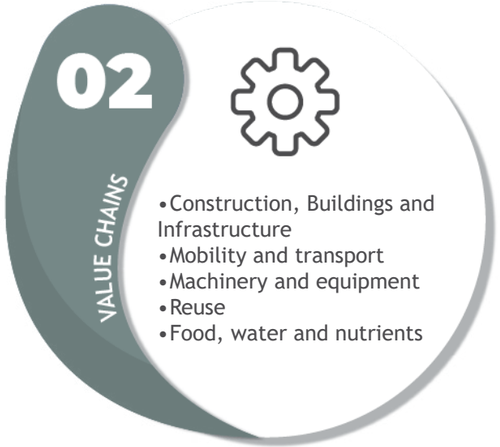
Livar company is being faced with large costs for operating its cupola furnaces on one hand and on the other hand on the large quantities of side stream materials. Thus they will use the side stream materials from production, that is in dust and chips state. First they will develop technology for automatized and cloud collection of dust side stream materials. Than they will go through several phases of briquetting and enhancing the material, to come with optimal charging material for the cupola furnace, which will than be tested based on waterfall approach for charging the furnace cupola. With this, the cost of energy used for chargin cupola furnace will be reduced, but more importantly the whole circularity of the production process will be completed, and waste streams at the plant reduced.

Main results

Using a waterfall system, over seven briquettes were developed and tested, with at least two proving feasible for charging the cupola furnace. The project aims to reduce energy costs by 25% in the cupola furnace production and testing at ELKEM. Additionally, it's estimated that waste streams will be reduced by about 45% following the implementation of this solution, enhancing efficiency and sustainability.

LIFE CITRUSPACK

TECOS



Description of the challenge

In 2016, Europe generated 27.1 million tonnes of plastic waste, with only 31.1% recycled. To address this, CEPLAFIB focuses on enhancing the after-use economy for plastics. The project aims to integrate reclaimed fibers into recycled plastics, improving tensile strength and processing feasibility through common manufacturing methods. It targets mass applications in packaging, automotive, and construction, ensuring comparable performance and cost. The project also explores replicability with different materials and processes and transferability across regions and sectors. CEPLAFIB's goal is to raise awareness about the circular economy, showing potential for a 40% increase in recycling rates and a similar reduction in greenhouse emissions. This supports EU environmental policy, particularly in reducing landfill waste and promoting circularity by 2030.

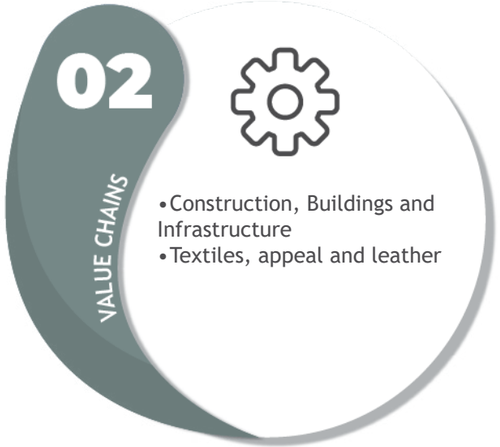
Main results

The project developed new recycled plastic and paper materials for high-value and mass applications, utilizing a global approach that merges manufacturing technologies and various applications. These innovative materials were tested in the packaging and automotive sectors, particularly in caravanning, where they were used as lightweight support materials for flooring. This initiative demonstrates the practicality and versatility of recycled materials in diverse industry applications.

CEPLA FIB

PLANET CARE

TECOS



Description of the challenge

Washing machines are a major source of microplastics found in oceans.
According to research, 6 kg of laundry releases over 700,000 microscopic plastic fibers. By simply installing a PlanetCare filter on your washing machine, you can now stop throwing one light plastic grocery bag into the ocean every week.
In five years, PlanetCare users will stop over 500 tons of microfibre emissions just by filtering their laundry wastewater. The same amount would fill 16 Olympic pools and weigh as much as 105 elephants

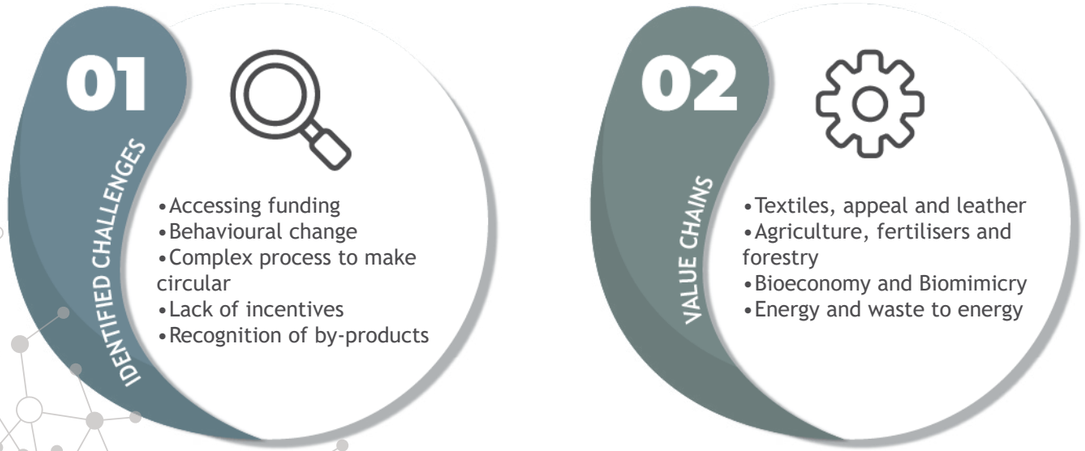
Main results

Since the very first day, PlanetCare team has been driven by our commitment to providing efficient, practical and affordable solutions that will allow every household to stop sending microfibres into the environment.
It is not enough that we believe our filters are efficient. We have had them tested for their fibre retention ability by internal procedures as well as by independent third parties. In all cases rigorous scientific procedures were used.
An important part of this strategy was to employ independent, scientific, state-of-the-art testing all along the way. Results from these tests (and many, many internal tests including constant use in our own homes) have helped us to develop a market leading product that is now offered to our customers and comes with an efficiency guarantee.

PlanetCare

SRIP Networks for transition to circular economy

TECOS



Description of the challenge

The Strategic Research and Innovation Partnership – Networks for the Transition into Circular Economy (SRIP – Circular Economy) in Slovenia is a collaborative network comprising businesses, educational and research institutions, NGOs, and other stakeholders. This alliance, supported by the state, aims to create new value chains based on closed material flows, embodying the principles of a circular economy.
The vision of SRIP – Circular Economy is to enhance the domestic economy's efficiency and competitiveness sustainably, as Slovenia transitions towards circular economic practices. A long-term goal is to establish Slovenia as a global hub for circular economy, known for its expertise, R&D infrastructure, innovative technologies and services, and a supportive regulatory environment. Key goals of SRIP include:
1. Fostering long-term public-private partnerships.
2. Improving the material efficiency index/productivity from 1.07 in 2011 to 1.5 by 2020.
3. Establishing new value chains with closed material flows.
4. Developing new business models.

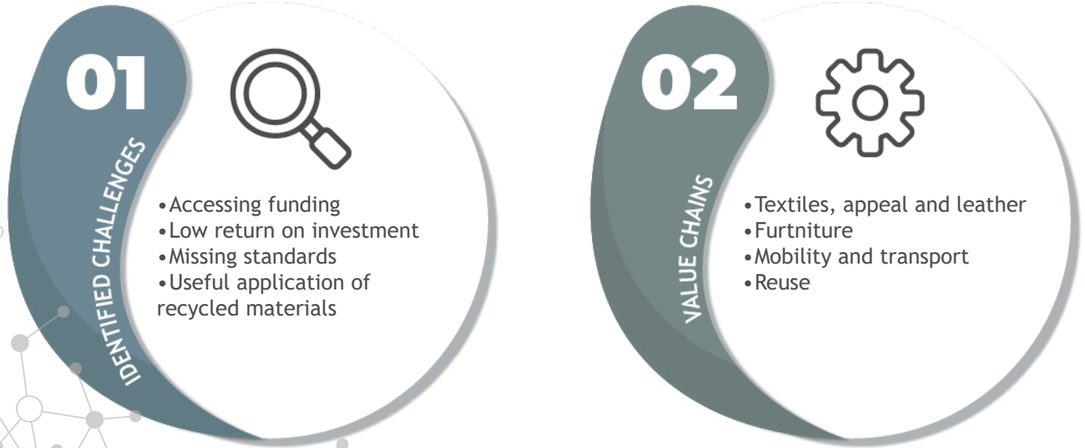
Achieving these objectives will also align with the goals of the Slovenian Smart Specialisation Strategy (S4), which seeks to increase Slovenia's global competitiveness. This involves boosting added value per employee, expanding the share of knowledge-intensive and high-tech exports, and enhancing overall entrepreneurial activity. This collaborative effort underscores a commitment to driving economic growth through sustainable and circular economic practices

Main results

Since its inception, SRIP Circular has successfully connected partners and created value chains, with a notable achievement being the Hydrogen Center. Its objectives include improving access to and use of hydrogen technology research infrastructure in Slovenia and Austria, aiming to establish the Hydrogen Center by 2025. It plans to generate new R&D projects in collaboration with higher education institutions, featuring three demonstration models and facilities, and an educational model. Additionally, it focuses on creating a low-carbon roadmap for Slovenia and Austria, contributing to regional sustainability and technological advancement.

Circular coffee mug for mobile homes

TECOS



SMART CIRCUIT | INDUSTRIAL SUCCESS STORIES | 2023

Description of the challenge

Adria mobil is a world renown company producing mobile homes and recereational vehicles. In their own production there is a lot of plastic parts which generate severe waste. Yearly the average production of plastic waste is 5 tonnes of ABS and 0,5 tonnes of waste paper. In this, they wish to reduce te waste of plastic through several initiatives, and one of them is to reuse plastic and paper waste for different purposes.

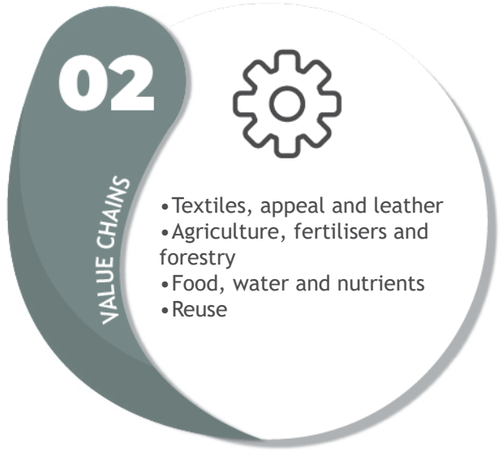
Main results

Using generated plastic tone waste (5 tons per annum of ABS and 0,5 tons of waste paper) for producing high value added cup holder that is used in own production RVs.
Through testing of various composition of materials (plastic and paper waste) a design of new recyclable plastic mug was developed. The plastic mug is made of reinforces ABS plastic waste with scrap paper and reinforced with natural fibers and materials. The plastic mug will be installed in all adria mobile high end RVs as of 2025.

ADRIA

BIOTHOP

TECOS



Description of the challenge

In Europe, 50,000 tonnes of hops are produced on 26,500 hectares. Slovenia, producing nearly 2,800 tonnes on 1,590 hectares annually, ranks as the EU's 3rd and world's 5th largest hop producer. This sector is Slovenia's top agricultural exporter, significantly enhancing its international presence.
Post-harvest, hop plants' above-ground mass is removed. The remaining biomass (leaves, vines) is a potent organic matter and nutrient source. However, the synthetic polypropylene twine (PP) used for supporting hop plants during growth remains entangled in the biomass, impeding its use as raw material and creating environmental issues due to its non-decomposable nature. The project aims to substitute PP twine with biotwine made from polylactic acid (PLA), a renewable, compostable material.

This allows for the post-harvest biomass to be used in composting, producing natural fertilizer or for creating biodegradable products like bio-composites, planting pots, and bottle packaging. Implementing this in Slovenia's Lower Savinja valley will set a precedent for sustainable practices in hop-growing regions globally, potentially boosting the economy through the sale of agro-waste to bioplastic producers and enhancing eco-tourism.

The overarching goal is to align with circular economy principles, aiming to fully upcycle hop waste and improve energy efficiency by 25%. Additionally, this initiative is expected to significantly reduce greenhouse gas emissions compared to traditional plastic production, reinforcing its environmental benefits.

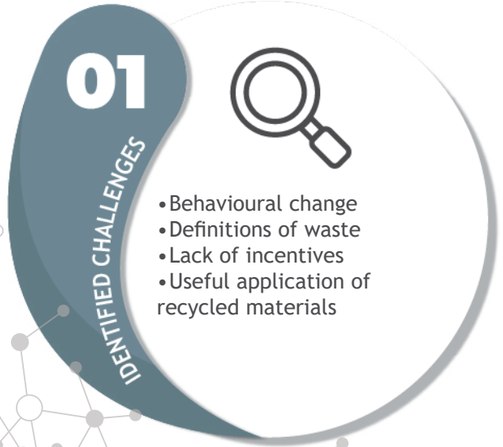
Main results

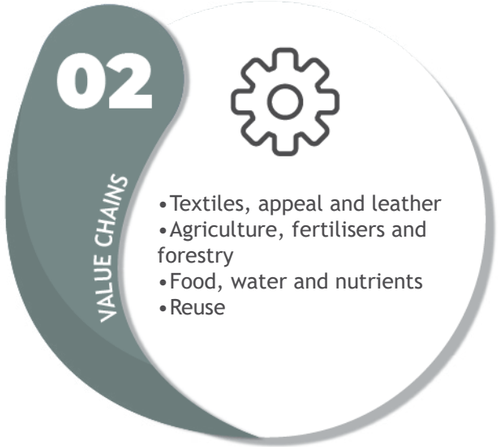
The project developed new responses to hop waste through other ways of handling with hop biomass: composting and transformation in BioTHOP products. Firstly, introducing of biodegradable and on-site compostable BioTHOP PLA twine was urgent to implement in hop production. As a result, BioTHOP methodology positively/environmentally friendly eliminates this waste biomass and nullifies GHG emissions. The emissions were calculated according to the data in the literature: Tripathi S., Singh RN, Sharma S. [2013]. Emissions from Crop/Biomass Residue Burning Risk to Atmospheric Quality. International Research Journal of Earth Sciences, Vol. 1(1), 24-30. If we consider that 45 km of PP twine/ha (equal to 62 kg/ha) is used to train all hop plants on each hectare of the hop fields, and we replace it with BioTHOP PLA twine/ha (equal to 96 kg/ha), which is needed to train all plants per one hop filed hectare each season, we reduce CO2 emissions for 79.48 kg/ha. If we multiply that with the 62.5 ha acreage covered in the project in 2019, 2020, 2021 and 2022 together, the absolute values of the total CO2 emission prevention were 4967 kg.

Four new uses of hop waste were developed namely: hop composte,biodegradable hop packaging for plants, biodegradable hop bottle holder, and hop fibres.

CITRUSPACK

TECOS





Description of the challenge

CITRUSPACK focuses on enhancing sustainability and efficiency in agriculture and industry by turning waste into wealth, thereby growing farmers' and producers' incomes through new value chains. This project emphasizes a circular economy approach, particularly in maximizing citrus juice production waste. The LIFE CITRUS* pilot line demonstrates the use of natural fibers from citrus peels as additives for creating 100% biobased, biodegradable plastic bottles and jars. Additionally, other pulp residues are repurposed as natural antioxidants, pectins, or essential oils in cosmetic creams.
The initiative involves an innovative extraction process to optimize waste management in citrus juice production, aiming to revalue at least 80% of the final fruit agrowaste (orange, lemon, clementine). The goal is to create market-competitive biobased and biodegradable plastics for premium juice packs and cosmetic creams, eliminating dependency on fossil resources.
Another key aspect is reducing food waste through sustainable food transformation processes. The project will develop juice bottles designed for cold pasteurization and high-pressure processing (HPP), extending the shelf life of juice up to 45 days, significantly reducing spoilage.

CITRUSPACK aims for full validation and pre-norm testing approval under a new commercial brand, ensuring market uptake. These products are designed to meet consumer needs and obtain necessary certifications for transparency and trustworthiness. Lastly, the project plans to assess market acceptance through in-store consumer experiences, targeting feedback from at least 1000 consumers.

Main results

At the end of the project researchers and participating companies will offer three solutions with high added value into the packaging and cosmetic sector. The juice bottles will be the first demonstrator.
"These bottles will be manufactured by blown extrusion. We want to test and quantify the acceptance of consumers during the project to reach the market". Carolina Peñalva, Project coordinator and Responsible for Packaging at Aitiip Technology Centre.
Besides being biobased and eco-friendly, bottles will have to comply with very serious technical requirements.
In addition creams with natural additives from these by-products will be fabricated. The packaging will be also reinforced with the same material than the bottles.

About the success stories from Hungary

Hungary is making significant strides in the circular economy, with success stories spanning waste heat recovery, electronics recycling, and sustainable agriculture. Initiatives such as the growth of tomatoes using waste heat from a power plant exemplify Hungary's commitment to resource efficiency and environmental responsibility. Circular strategies in electronics recycling contribute to reducing e-waste and harnessing valuable materials. Hungary's circular economy achievements showcase a multifaceted approach, addressing energy efficiency, waste reduction, and sustainability in various industries.

Circular economy success stories from Hungary

Reuse center in Szombathely

PBN

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular

02 VALUE CHAINS

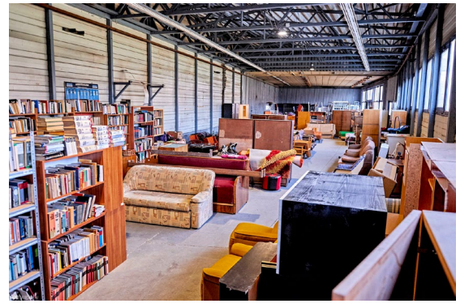
- Reuse
- Public service
- Waste management and secondary raw materials

Description of the challenge

The Reuse Centre (RC) serves two purposes. Firstly, it aims to address the pressing issue of waste generation by promoting the “reuse” of items that are still usable, in good condition, undamaged, fully functional, and not excessively contaminated. By encouraging the reuse of these items, the RC actively contributes to the reduction of waste, fostering an environmentally conscious lifestyle. Secondly, the RC strives to provide valuable assistance to individuals who would otherwise face a significant financial burden when purchasing furniture and equipment. By offering a wide range of items, including sports equipment, kitchen utensils, books, children’s toys, home decorations, non-electrical surplus equipment, and various types of furniture, the RC ensures that those in need can acquire essential items at affordable prices. The affordability of the items available at the RC significantly alleviates the financial strain on individuals and families, allowing them to furnish their homes and meet their practical needs without incurring excessive costs. Through this provision of affordable goods, the RC improves the quality of life for those who may have limited financial resources, enabling them to create comfortable and functional living spaces. Overall, the RC serves as a solution to both environmental and socioeconomic challenges. By reducing waste and offering affordable items, it simultaneously promotes sustainability and provides much-needed support to individuals who would otherwise struggle to afford necessary furniture and equipment. Through its dual mission, the RC contributes to a more sustainable future while positively impacting the lives of its beneficiaries.

Main results

SZOVA Nonprofit Zrt. has opened a Reuse Centre to reduce waste by repurposing usable items in good condition. By recycling these items, we promote an environmentally conscious lifestyle and enhance the quality of life for others. Residents can drop off items at the Reuse Centre for free, and retrieval requires a storage fee ranging from HUF 100 to HUF 10,000. Accepted items include sports equipment, kitchen utensils, books, children’s toys, home decorations, non-electrical surplus equipment, and various furniture. However, the Reuse Centre does not accept waste, electronics, or clothing.



3D printing in the textile industry

PBN

01 IDENTIFIED CHALLENGES

- Behavioural change
- Quality issues
- Complex process to make circular

02 VALUE CHAINS

- Textiles, appeal and leather

Description of the challenge

Within the scope of this success story, the overarching concept was to investigate the potential applications of 3D printing and recycled plastics in everyday textile industry usage. The core notion entailed crafting 3D prints from repurposed filament and affixing them onto t-shirts, subsequently subjecting these shirts to testing during active utilization. In order to evaluate the outcomes, a fitness group was engaged, where it could be reasonably assumed that the test garments would experience impacts and stresses significant enough to facilitate conclusive observations regarding the t-shirts' durability, susceptibility, and practicality, as well as the endurance of the ironed-on logos by the conclusion of the experiment.

Main results

The testing produced a variety of outcomes, reflecting the diverse nature of usage scenarios. However, achieving consistent results was not the main aim. Essentially, the goal to examine the durability and strength of the ironed-on prints was achieved. Logo damages can be categorized into three groups: 1) ironing with minimal use, restoring the shirt to its original state, 2) letters bending and solidifying, and 3) plastic components disintegrating, sometimes detaching during washing. Reports indicate that logo damage was primarily caused by laundering, rather than physical activity.

Dress-coding

PBN

01 IDENTIFIED CHALLENGES

- Accessing funding
- Behavioural change

02 VALUE CHAINS

- Textiles, appeal and leather

Description of the challenge

The Dress-coding initiative is dedicated to strengthening the intricate bond between cutting-edge technologies and the fashion world. Its primary objective revolves around addressing the intricate obstacles encountered by individuals with distinct needs or disabilities when it comes to dressing. By harnessing the power of innovative technologies, they ingeniously craft sustainable garments that not only elevate the quality of life for people with disabilities but also offer ingenious solutions to their individual challenges.

In contrast to conventional methods reliant on pins and measuring tapes to shape clothing, Dress-coding opts for the precision of a 3D scanner and the finesse of computer software. Through this innovative approach, the intricate dance between technology and creativity takes shape. The design process is meticulously choreographed in the digital realm, ensuring a perfect blend of form and function. This intricate synergy culminates in clothing meticulously customized to seamlessly envelop an avatar's proportions.

The resulting attires harmoniously blend form, function, and individuality, with only a prototype and the final incarnation of the garment gracing the tangible realm. The Dress-coding initiative stands as a testament to the power of innovation intertwined with fashion, reshaping the clothing landscape for individuals with unique needs. It inspires a future where technology and creativity unite to enhance the human experience.

Main results

The Dress-coding initiative bridges the gap between advanced technologies and fashion to address clothing challenges for individuals with unique needs or disabilities. Using innovative techniques, they craft customized garments that enhance the quality of life for those facing disabilities and offer tailored solutions. With a team of volunteers, they employ 3D scanning and software to create perfectly fitting clothes for avatars. This sustainable approach minimizes waste. Moreover, they're working on an innovative project to design a fashionable accessory for hearing aids using 3D printing. This initiative showcases how the fusion of technology and fashion can empower individuals, promoting inclusivity and creativity in the process.

Digital Twin

PBN

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Initial investments high
- Lack of investment certainty
- Low return on investment

02 VALUE CHAINS

- Electronics and ICT

Description of the challenge

The recycling module is designed for sorting plastic balls based on color, and the incorporation of MR aims to enhance training, visualization, and process optimization. Mixed Reality (MR) technology is being applied to the recycling module's digital twin simulation environment. MR involves merging real-world and computer-generated elements to provide a lifelike visualization of manufacturing processes. Benefits of MR:
1.Training and Visualization: Workers can observe manufacturing processes in a realistic environment, facilitating quick learning and knowledge transfer.
2.Optimization: MR simulations enable the testing of different machine speeds and conditions, aiding in process optimization without physical constraints.
3.Real-time Monitoring: A live mode allows real-time monitoring of machine performance, offering insights into parameters like speed and color selection.
The MR solution is being developed using Unity 3D software, with a focus on simulating machine operations and optimizing performance. This requires robust hardware for smooth simulation, and a local server is used to collect and process machine data for the application. The recycling module's green initiative involves incorporating solar energy through a portable solar panel and power station. This sustainable energy supply supports the recycling process, reducing environmental impact. The application of MR technology in the recycling module's operations offers significant benefits in terms of training, optimization, and real-time monitoring. This innovative approach not only enhances the efficiency of the recycling process but also contributes to sustainable practices through the integration of solar energy.

Main results

This integration has led to several notable outcomes:
1.Enhanced Training and Visualization: This realistic training platform enables the quick acquisition of knowledge and expertise, enhancing the skills of both new and experienced workers.
2.Optimized Process Operations: Through MR simulations, the recycling module's operations can be tested and optimized without physical constraints.
3.Real-time Monitoring and Data Access: The MR solution provides a live mode for real-time monitoring of the recycling module's performance.
4.Sustainable Energy Integration: The recycling module's green initiative has resulted in the successful integration of solar energy through portable solar panels and power stations.

Hungarocell Green Program

PBN

01

IDENTIFIED CHALLENGES

- Behavioural change
- Harmonisation of EU legislation

02

VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

Masterplast launches its 'Hungarocell Green Program,' becoming the first in the domestic construction industry to implement a circular management system. The unique program focuses on collecting, processing, and reusing unused cut materials generated during the use of Masterplast's Hungarocell polystyrene and XPS products to create new insulation materials.
About the program:
1.Participating trade partners of the program will serve as Masterplast Eco-Points, crucial stations within the circular system. Here, one can purchase Hungarocell polystyrene and XPS products, as well as bags for collecting cut-off residues. These collection bags (600L), priced at 1500 HUF each, are made from recycled materials.
2.Contractors collect clean residues produced from cutting Hungarocell and XPS materials and place them into the provided collection bags. They then return these bags to the Eco-Point. It's essential that only clean Hungarocell and XPS materials are placed in the bags, with no other materials or municipal waste.
3.Following content verification at the Eco-Point, the contractor hands over the collection bags. Masterplast's logistics team gathers the bags from the Eco-Points and transports the materials back for recycling.
4.At the Masterplast facility, we produce insulating Thermobeton using the cut polystyrene. This approach eliminates waste and generates a product from the cut-off residues that further reduces the energy demands of buildings throughout its lifecycle. The recycled Thermobeton product is available for purchase at our trading partners' locations, within the Masterplast Eco-Points.

Main results

The "Hungarocell Green Program" has yielded substantial results in reshaping the construction industry's approach to waste management and resource utilization. By transforming cut-off residues into insulation materials, the program aligns with sustainability goals, reduces waste, and promotes energy-efficient construction practices. The program's success underscores the potential for innovative circular management systems to create a more sustainable future for industries and the environment.

Wood waste as secondary raw material

PBN

01 IDENTIFIED CHALLENGES

- Behavioural change
- Lack of circular infrastructure
- Missing standards
- No circular regulation

02 VALUE CHAINS

- Waste management and secondary raw materials

Description of the challenge

FALCO Zrt. is the only large-scale factory in HU that processes wood waste into versatile materials for furniture manufacturing and interior design: natural and laminated wood chipboard. With a forward-thinking environmentally responsible approach, the role of the wood panel industry and sustainable forestry management is increasingly emphasized in HU. The future material for both the construction and furniture industries is wood, as an environmentally friendly and renewable resource. FALCO Zrt. is committed to making the production of wood panel products as safe and environmentally friendly as possible. One way to achieve this is by ensuring a circular economy. The company increasingly uses wood waste as a raw material from various sources, including sawmills, various sectors of the wood industry, construction and demolition waste, industrial production, packaging, and household waste during clean-up activities. Recycling serves the purpose of ensuring that nothing is wasted from wood, a scarce raw material source. In 2019, a new investment was made to enable the efficient cleaning of wood waste. As a result, the company can utilize a significant percentage of wood waste. The manufacturing process has an annual carbon footprint that is negative (-400,000 t CO2 eq) from an environmental perspective! Considering the renewability of the raw material, the form and manner of its decomposition, and their long-term environmental impacts are all important factors. Taking all of this into account, it is in our common interest for the future that if a product can be made from wood, it is recommended and worth making it from wood.

Main results

Currently, a portion of collected glass waste is recycled (e.g., in glass manufacturing), but a significant portion is disposed of as waste. Glass wastThe company is able to utilize wood waste to such a significant extent that it was awarded the Resource-Efficient Company Award in 2021. FALCO Zrt. also participated in the Mentor Program of the Hungarian Chamber of Commerce and Industry (MKIK), aiming to showcase sustainable and circular economy best practices to SMEs and similar large corporations. As a member of the Circular Economy and Technology Platform, it played a role in developing collection and further processing guidelines for construction industry-related demolition waste.

Reuse of waste generated in the construction industry

PBN

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Cooperation with authorities
- Initial investments high

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

The goal is to create a building material with appreciable strength (compressive strength greater than 1 MPa) and thermal insulating properties (thermal conductivity less than 0.1 W/mK), while maximizing the use of waste materials during production. The primary source materials utilized in production are waste concrete powder and slag from iron manufacturing, which are suitable for alkali activation. This primarily results in the production of alkali-activated cements, commonly known as geopolymers. The thermal insulation effect is achieved through hydrogen peroxide foaming. The resulting product can be shaped as desired (drillable, cuttable) and possesses fire-resistant properties. If the project is successful, it can eliminate previously unusable, very fine fraction concrete waste, significantly reduce waste slag from metallurgy, and decrease clinker production volume. All these factors have significant environmental benefits. The end result is a specialized structural material with its main feature being thermal insulation, eliminating the disadvantages of other materials with similar characteristics (low strength, lack of malleability, susceptibility to mold, etc.). The main risk is the application of untested technology. Producing products with the desired characteristics in laboratory scale is not a problem, but none of the scalability steps have been taken yet. These experiments need to be conducted. Similarly, the use of caustic soda solution required for the technology can be problematic, both in terms of cost and safety. To achieve cost-effective production, all industrial technologies where waste caustic soda is generated must be assessed. A further challenge may be market reluctance to embrace a previously unknown product.

Main results

The practical implementation of the project is currently at the basic research level at the University of Pannon in Veszprém. The research is currently at TRL3, approaching TRL4. The goal is to reach TRL5, which can be achieved with the support of this project. There is currently no market player, so funding cannot be assured from that side. The project's funding requirements and staging are as follows:

- Surveying the possibilities for the procurement of necessary waste materials.
- Refining the requirements for the necessary caustic soda and exploring the possibilities for obtaining waste caustic soda.
- Planning and initiating semi-industrial production.
- Qualifying products and conducting the necessary feedback processes.

It is evident that the project is not at a stage where the exact funding requirements can be determined. The cumulative environmental benefit could be extremely significant since multiple environmental issues are addressed in a single step, yielding a small ecological footprint and high efficiency while conserving natural resources.

Waste glass powder as an additional material for cement

PBN

01 IDENTIFIED CHALLENGES

- Behavioural change
- Complex process to make circular
- Cooperation with authorities
- Initial investments high

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

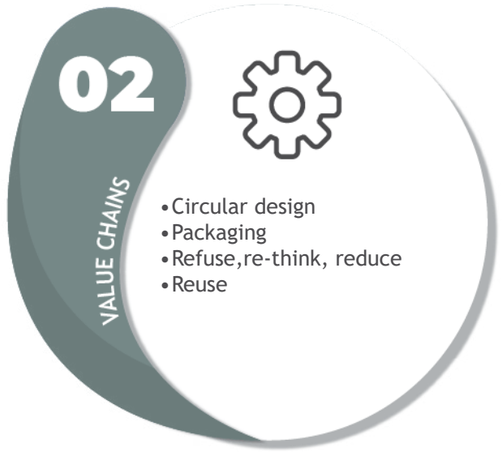
Description of the challenge

The practice is currently at the basic research stage at the University of Pannon in Veszprém. With adequate financial resources to support research and experiments, it can quickly progress to prototype production, advancing from TRL 2 to Level 5. Discussions regarding the production and application of glass waste powder are underway with local companies that distribute binding agents and manufacture concrete elements (e.g., Cemix Hungary Kft., Barabás téglakő Kft.). Collaboration with the Hungarian Cement, Concrete, and Lime Industry Association is ongoing to explore possible standardization. Industrial players are willing to make financial contributions, but securing EU funding for the initiation of activities, research, and practical implementation would be beneficial.
Challenges: Initiating the processes, developing the manufacturing technology, and utilizing it are crucial steps. Additionally, the following resource-intensive tasks need to be addressed: --Conducting a survey of glass waste.
•Organizing more efficient local collection methods.
•Developing qualification criteria and practices.
•Conducting laboratory experiments.
•Planning for semi-industrial production.
•Collaborating with local companies.
The energy and cost implications of cleaning, shredding, and grinding methods for glass waste need to be considered, with a focus on selecting cost-effective methods.

Main results

Currently, in Hungary, glass waste is not used as a cement additive; only research is being conducted in this area. Hungary also holds significant potential for the use of glass waste powder as a cement additive, as it is locally available in every county. Other currently used additives (e.g., slag or ash) are less accessible locally. The project could utilize glass waste powder to produce a higher value-added product by partially substituting cement.
The duration for implementing semi-industrial production is estimated to be 1.5 to 2 years. Industrial-scale production can be estimated in collaboration with partners.

Respray



Description of the challenge

The world's first rechargeable blowing deodorant solution Respray offers a refillable spray deodorant solution for existing deodorant brands. This solution consists of a refillable deodorant bottle and a refilling machine. The machines will be placed in drugstores and supermarkets, where customers can refill their bottles themselves.
They started our first production period in cooperation with Rossmann Hungary. Customers can buy ISANA refillable deodorants in three different scents (Blossom, Cosmic Breeze, Aloe Vera)!

Main results

In December 2019, Andor and Gergő, classmates passionate about the environment and business, conceived the idea for "Respray" to recycle aerosol products sustainably. Securing investments and developing prototypes followed, with significant support from programs like BME Z10 and Hiventures. By 2023, Respray's first refillable deodorant machine was launched in collaboration with Rossmann Hungary, marking a major milestone in their journey towards sustainability and innovation.

Robotic measurement station

PBN

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Lack of incentives
- Missing standards
- Organisational structures

02 VALUE CHAINS

- Electronics and ICT

Description of the challenge

Throughout of the development process our main goal is to create a measurement station that is capable to enhance the level of automation of the production process concerned. The task is the realization of the electronic measurement of PCBs with the utilization of a robotic arm and export of generated data into a database. The planned measurement station will be able to measure electric resistance, voltage (e.g. battery measurement) and power consumption in voltage-free state of the investigated PCBs, will be able to turn on the investigated PCBs and measure voltage under load. In the following the measurements will be adjustable and extendable as long as the measurements can be carried out via a single wire compared to the ground potential.
Before starting an electronic measurement process of a PCB, the position-calibration of the boards has to be carried out manually. The measurement software can be started only afterwards this calibration step.

Main results

The measurement process will be realized by a collaborative robotic arm with a single measurement needle fixed in an actuator on its end. The whole system will be developed in order to be able to incorporate the necessary and\or possible long-run development stages and processes such as the process of an automatic workpiece calibration. In the process incorporated into the present bid the positioning and fixation of the workpieces will be done by 3D printed parts.

About the success stories from Slovakia

Slovakia’s circular economy success stories highlight energy-efficient technologies, waste heat recovery, and innovative waste management. Initiatives like ERcuper® Water and ERcuper® Air systems significantly reduce energy demands in buildings, showcasing Slovakia’s commitment to sustainable solutions. Success in waste management emphasizes efficiency, cost savings, and reduced emissions. Slovakia’s circular initiatives extend to recycling and eco-friendly technologies, positioning the nation as a pioneer in the circular transition, promoting energy efficiency, and fostering a more sustainable built environment.

Circular economy success stories from Slovakia

Smart waste management solutions

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Cooperation with authorities
- Lack of circular infrastructure

02 VALUE CHAINS

- Waste management and secondary raw materials

Description of the challenge

Digitization and streamlining of waste collection
Our goal from the beginning has been to help cities and businesses cope with the biggest challenges of waste management – lack of efficiency and transparency.
Expectations
- Transparency of the waste infrastructure
- Digitization of the waste collection process
- Transparent waste streams
- Savings in kilometers traveled and emissions produced

Main results

In Nitra town, collection trucks were picking up half-empty containers too early, leading to inefficiencies. To address this, sensors were prototyped and added to containers, transmitting data about their fill levels. This data feeds into software that analyzes and optimizes pickup routes and other functions. The resulting smart waste collection solutions include the company's sensors, optimizing waste collection logistics in factories and implementing a Deposit Refund System (DRS). This innovation led to up to 30% cost savings. The approach is now transferable, with the company expanding its services to 40,000 active users in 80 countries. Services include waste and collection monitoring, route planning, factory waste management, and integration of take-back systems and deposit return schemes, demonstrating a scalable solution to waste management inefficiencies.

Turning waste into profit with Europe’s top digital waste marketplace

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Cooperation with authorities
- Lack of circular infrastructure

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Waste management and secondary raw materials

Description of the challenge

Optimized Material Use for a Circular Future
The value of different material streams generated as waste in companies is constantly changing. There is a lack of transparency in the waste management sector, especially regarding the prices of materials. Moreover, new, innovative solutions for problems in terms of recycling waste streams are constantly being discovered and implemented in other countries. To help companies recognize the value of each waste stream and find innovative solutions for its recycling or recovery, Cyrkl has developed this tool

Our goal from the beginning has been to help cities and businesses cope with the biggest challenges of waste management – lack of efficiency and transparency.
Expectations
- Transparency of the waste infrastructure
- Digitization of the waste collection process
- Transparent waste streams
- Savings in kilometers traveled and emissions produced

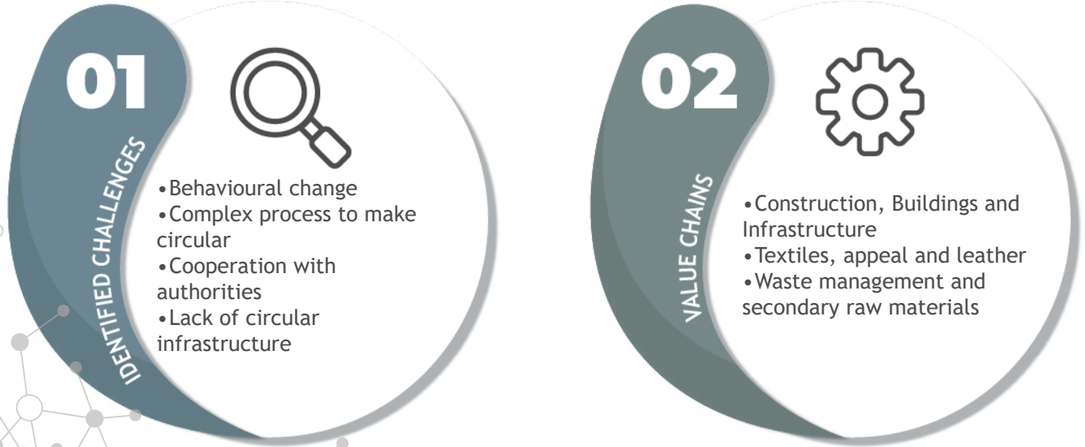
The electronic record of waste and waste containers is in accordance with the document Strategy for managing municipal waste in the city of Bratislava with the aim of transitioning to a circular economy for the years 2021-2026

Main results

Planning and implementation - (market gap: missing exchange or a platform where secondary resources can be traded and thus reduce the transaction costs). They have created a virtual marketplace CYRKL for companies, municipalities and other producers of waste or recyclates. Elements of solution: Analysis of the current waste streams, Verification of the analysis with client, public sector etc., Calculation of environmental and economic impact and circularity level Consequence - Due to large share of projects conducted in the manufacturing industry, Cyrkl has found solutions for plastics, metals, wood, and chemicals, resulting in financial savings of up to 1,3 million euros and potential savings of 600 tons of CO2eq Potential transferability - working on over 350 projects with companies from various sectors thanks to dissemination of Cyrkl platform, including manufacturing, retail & warehouses, and buildings & demolition.

Textile recycling: Turning old T-Shirts into valuable house insulation

TECHNICAL UNIVERSITY OF KOŠICE



Description of the challenge

Our goal from the beginning has been to help cities and businesses cope with the biggest challenges of textile waste management – lack of efficiency and transparency.
The challenge faced: In general, we know that the textile industry is one of the most polluting industries in the world, where up to 80 billion different types of clothing are produced annually. Of this, 80% goes to landfill

The connection to circularity
From waste to insulation - Ecological substitute for glass wool
SK-Tex obtains raw materials from textile sorters such as Textilhouse and Humana, collects scraps from textile companies, but also from citizens and companies that need to get rid of their textiles in an ecological way. The insulation is produced using the most modern, environmentally friendly airlaid method. In this production, modified textile fibers are mixed with adhesive fibers and applied in a pneumatic fleece former to the production belt, which moves the material to the furnace, where the surface of the adhesive fibers is melted by the action of temperature and thus all fibers are interconnected.

Main results

Main results – a flexible insulation boards made of textile fibres connected by special adhesive fibres, recyclable again at the end of lifecycle
Planning and implementation - The team has realized that even as waste, textiles do not lose their basic functions - they managed to develop Ekosen insulation from recycled textiles, intended for diffusion open structures.
Consequences - data-driven waste management, cost savings, emissions reduction, more efficient waste collection, improved waste diversion rates
Potential transferability – use in construction products, use as an ecological substitute (from waste to insulation – glass wool) – textile insulation: possibility to phase-shift the overheating of the structure to not have to use air conditioning, fully recyclable unique building boards HMC Acoustic and HMC Protect: produced by recycling multilayer packaging and paper (residency buildings)

MeriTO: IoT solutions for sustainable power management and CO2 footprint reduction

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Cooperation with authorities
- Lack of incentives

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Waste management and secondary raw materials

Description of the challenge

Reducing carbon footprint through digitalization an analysis of the energy consumption.
Our goal from the beginning has been to help cities and businesses cope with the biggest challenges of energy management – reduce its carbon footprint through an analysis of the energy consumption of buildings in the city administration lack of efficiency and transparency.
Client needs (Adapted to all listed customers / clients): Savings in electricity consumptions, cost saving on energy and reduction of CO2. With exact data from smart metering with high granularity there is potential for new services as predictions in maintenance, non-standard situations detections, automatic actions based on pre-defined conditions in power consumption. Investments in smart metering come to them as unnecessary until they meet sanction in case of exceeding the agreed capacity of energy consumption. The introduction of artificial intelligence and machine learning brings a new perspective on information, predicts costs and identifies non-standard changes in the consumption of individual devices.

Main results

eGreen City, a startup, utilizes real-time energy data, data analytics, and AR to educate about individual and urban energy needs. It enhances SmartGrid networks beyond traditional smart electricity meters by analyzing the life cycle of electrical and electronic devices. The result is data-driven energy management, leading to cost savings, precise energy cost identification, predictive maintenance in manufacturing, and emissions reduction, with CEELABS customers seeing a 6-15% cost reduction. The startup's potential for transferability includes product development for various client segments: MeriTO ANALYTICS, MeriTO CONTROL (Optimization, Monitoring), MeriTO INTEGRATE (Accessibility, Integration), and MeriTO VOLT (Outage Detection).

Revolutionizing energy with smart, waste-free clean energy solutions

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Cooperation with authorities
- Initial investments high
- Lack of circular infrastructure
- Lack of incentives

02 VALUE CHAINS

- Waste management and secondary raw materials

Description of the challenge

The energy industry, lagging behind in adopting modern technologies, faces challenges with inefficient energy production and consumption, energy transmission losses, and financial drawbacks. A key issue is the wastage or counterproductive use of renewable energy sources. To address these challenges, there's a growing need to efficiently manage energy flow, aligning with the increasing demand for energy and the imperative to mitigate global warming impacts. This calls for the implementation of modern, smart technologies.

The transition towards a more circular approach in the energy sector is marked by several key factors. First, there's a data-proven reduction in CO_2 emissions, demonstrating the environmental benefits of these new practices. Tailor-made green technology solutions are being developed to cater to specific energy needs while maximizing the use of renewable sources. Additionally, harnessing one's own green energy sources to their fullest potential is being prioritized, leading to higher energy self-sufficiency. This shift not only addresses the current inefficiencies in the energy sector but also aligns with the principles of circular economy, focusing on sustainable use and maximization of resources.

Main results

Founded in 2017 by energy experts, FUERGY aims to expedite the transition to energy decentralization with a focus on renewables. It has developed solutions for local-level electricity production and distribution decentralization. These solutions ensure electricity is consumed close to its source and balance production and consumption in an environmentally conscious manner. FUERGY offers scalable solutions to reduce electricity waste, including Energy Storage as a Service, Solar + Storage as a Service, Technology Regulation as a Service, Energy Management as a Service, and Energy Dispatch as a Service. These offerings have the potential for wide applicability across various organizations, contributing to more efficient and sustainable energy use.

Advanced lighting control and IoT connectivity using existing power lines

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Cooperation with authorities
- Lack of circular infrastructure

02 VALUE CHAINS

- Waste management and secondary raw materials

Description of the challenge

From the start, the primary goal has been to assist cities and businesses in efficiently managing public lighting, with smart lighting control systems typically saving around 40% of energy. SEAK Powerline Technology, a unique low-frequency powerline communication system, is specifically designed for this purpose.

A major challenge in developing electric vehicle (EV) charging networks in urban areas is the availability of suitable power cabling. While adding new cables is an option, it's often costly and involves extensive street excavation. SEAK's innovative solution utilizes the existing public lighting power grid to integrate charging stations into streetlamps, presenting the most effective method for building a large-scale EV charging infrastructure.

This technology leverages existing 230V power lines to transmit control signals using a patented, reliable, low-frequency method. This approach eliminates the need for additional cables, antennas, radio waves, or repeaters, and can be expanded to include EV chargers. SEAK provides options to augment charging infrastructure affordably within cities, offering three choices: an EV charger integrated into public lighting, a stand-alone EV charger, or a Wallbox EV charger. This system not only streamlines the integration of smart lighting and EV charging infrastructure but also aligns with circular economy principles by maximizing the use of existing resources and infrastructure.

Main results

SEAK's goal has been to help cities and businesses manage public lighting efficiently through smart lighting control. This approach has led to benefits like data-driven waste management, cost savings, emissions reduction, and improved waste collection. Beyond lighting, SEAK's systems also connect to electric vehicle chargers and IoT devices. The company has expanded internationally, operating in cities across Spain, Israel, Ukraine, Slovakia, and the Czech Republic, covering over 70 cities in the latter two. This expansion highlights SEAK's versatility and the potential for its technology to be adopted by various organizations globally.

Essential for efficient maintenance and up-to-date product lifecycle documentation

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Cooperation with authorities
- Lack of circular infrastructure
- Lack of incentives

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Waste management and secondary raw materials

Description of the challenge

In Germany, buildings are responsible for approximately 35% of consumer energy consumption and 30% of CO2 emissions, surpassing both vehicle traffic and industrial activities. This makes reducing energy demands in buildings a key aspect of climate protection legislation. EPLAN addresses the challenge of enhancing efficiency in electrical engineering with software and services that ensure a consistent flow of data and interconnected processes in industrial building automation.

With trends in building automation leaning towards energy management, environmental protection, shorter construction processes, and rapid technological advancement, there's a need for greater efficiency through standardized processes, systems, and components. EPLAN provides the necessary data continuity to support these developments.

A key aspect of EPLAN's approach is the use of virtual prototypes, which excel in collaborative scenarios. These digital twins allow different disciplines involved in product creation to easily comprehend the implications of changes, enabling balanced discussions on new scenarios. This approach facilitates "Design for Manufacturability" and "Design for Testability" scenarios, allowing potential problems to be identified and rectified cost-effectively during the design phase. This comprehensive method not only fosters efficient building automation but also aligns with circular economy principles by optimizing resource use and reducing waste through improved design and planning processes.

Main results

Planning and implementation
The use of a digital twin as a data container is particularly important taking into account the time-space dimension, which is linked to models of life product cycle. Once the digital twin is created and made available in the cloud, it can be used from anywhere (DT then combines information from different sources resources in each phase of the life cycle).
The use of digital prototypes in computer-aided design enriches value creation throughout the entire product lifecycle, fostering innovation and sustainability from design to recycling.
This service/product outlines the benefits of integrating advanced processes and data for improved efficiency, quicker market entry, and enhanced quality. These advantages, including cost-effective risk assessment and increased resource efficiency, can potentially be transferred and adapted by other organizations.

Energia real effective energy recycling ecological and returnable solution

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Access to relevant information and assessments
- Accessing funding
- Behavioural change
- Cooperation with authorities

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Waste management and secondary raw materials

Description of the challenge

Digitization and streamlining waste collection have been pivotal in addressing the challenges of energy waste management in buildings, focusing on harnessing heat from used wastewater or vented air. In Košice, residents of a block of flats faced increasing annual expenses due to rising costs of central hot water withdrawal and heating. With neighboring houses becoming independent, their costs surged, yet the need for hot water and heating remained.

The residents contemplated independence by constructing their own boiler room, but legislative barriers halted this plan, leaving them with high bills for hot water and thermal energy. To address this issue, an effective and ecological solution for energy recycling was proposed. This innovative approach involves taking thermal energy from the drainage system, which was previously used only once and paid for. With this system, residents can consistently have hot water at around 50 degrees Celsius, significantly reducing their reliance on the current hot water supplier and minimizing hot water consumption. This solution not only offers financial relief by lowering energy costs but also aligns with circular economy principles by repurposing waste energy, thereby reducing overall resource consumption and environmental impact.

Main results

In the 2020, the goal for next years was to ensure full water heating and supply of heat to the heating system in the amount of 25% of the annual heat consumption with waste heat, captured with a recovery device which was achieved. The team decided to help the house with installation of o system ERcuper® Water, ensuring repeated energy acquisition from wasting water saving up considerable expenses for hot water people need daily. The clients have been saving to the fullest since October 2018 due to ERcuper® Water. The system in the block of flats saved up to 90% of the energy needed to prepare hot water and 30-60% of the energy needed for heating - representing 60-75% of the total heat costs. Our technology (ERcuper Water and ERcuper Air systems) fundamentally reduces the energy and economic demands of buildings and significantly reduces the amount of emissions produced. Obtaining heat in this way represents a relatively new technology in Slovakia and in the world, transferable to many businesses and organizations.

Industrial metaverse - from vision to reality

TECHNICAL UNIVERSITY OF KOŠICE

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Cooperation with authorities
- Lack of circular infrastructure

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Research
- Ceramics and glass
- Recycling

Description of the challenge

1. Initial situation
Although our age is digital, ultimately, we still need materials, tools and buildings from the real world in which we work and live. It doesn't matter if it's a package, machine, factory or office building, having all the information at your fingertips, it will help you control your device in a smart way.

2. The challenge we face
Various expert systems or IoT sensors are already equipped with reporting tools that allow engineers to gain insight into their sensors and the operation of the actual state of infrastructure. However, most of them are only accessible on specific devices and configurations or provide data only from a specific set of indicators. Standard data collection systems are produced by engineers for engineers.

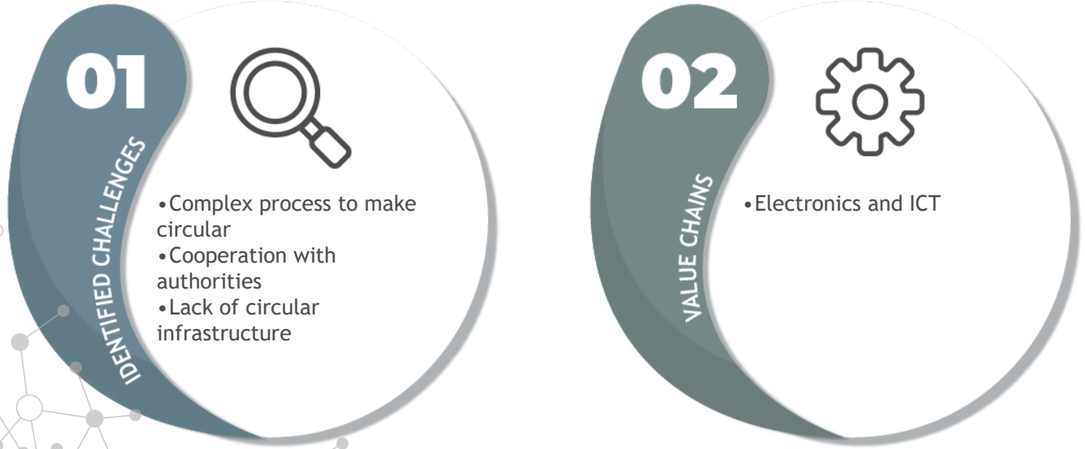
3. The connection to circularity
The twinzo concept is built on user requirements for user needs. It brings user experience standards from modern IT solutions to the world of engineering, which also allows non-technical users to gain an overview of the state of their equipment and the material and energy flows needed to set up circular solutions.

Main results

The twinzo digital twin, developed by INFOTECH s.r.o. since 2014, enhances IoT infrastructure control and supports circularity goals. Launched in 2019 as a 3D live digital twin accessible on any device, twinzo has won Microsoft awards in 2017 and 2019. Currently, it boasts 95 live digital twins, covering over 270 million square meters, with 12,699 location devices and 10,827 IoT sensors. Its potential for transferability is significant, offering businesses and decision-makers enhanced analysis and control capabilities. Twinzo's user-friendly interface allows even non-technical managers to access information easily, bridging the gap between engineering and management and providing real-time insights for effective decision-making.

Efficient waste management: Strategies for business transparency and sustainability

TECHNICAL UNIVERSITY OF KOŠICE



Description of the challenge

From its inception, the primary aim has been to assist businesses in overcoming the challenges of waste management, particularly the lack of efficiency and transparency. The major issue faced by companies is the inability to accurately calculate production efficiency. Often, they rely on estimates or incorrect data due to a lack of proper data collection, cost monitoring, and efficiency measurement against standards. Many businesses lack the necessary know-how and tools for effective waste management and do not integrate these strategies into their processes, resulting in a significant handicap. Generally, management focuses on the overall economic result, considering the issue resolved if it's positive.

Addressing waste in a company first requires its identification. While some wastes are easily recognized, others are more deeply hidden and need a sophisticated approach to be uncovered. Businesses often recognize financial waste but struggle to pinpoint areas for improvement. Market and customer pressures compel them to find ways to perform more efficiently and cost-effectively. An interview with CITO Digital's project manager, Radovan Benkovský, provides insights into the challenges companies face in identifying and managing waste, emphasizing the need for a comprehensive and strategic approach to waste management that aligns with circular economy principles.

Main results

The solution involves a two-phase approach; initially, an introductory workshop identifies waste through collective participation, emphasizing the importance of loss reduction. The second phase entails personalized in-company sessions to specifically analyze wastes and devise elimination strategies, coupled with employee training and the establishment of a continuous motivation model to instill a problem-solving culture. The main benefits our products bring are data-driven waste management, cost savings, emissions reduction, more efficient waste collection, improved waste diversion rates and many more.TestBed 4.0 automates operations, enabling managerial focus on growth and offering a platform for developing tailored smart factory solutions.

About the success stories from Czech Republic

The Czech Republic's circular economy success stories feature advancements in waste management, recycled materials, and circular product design. Initiatives emphasize reducing waste and promoting resource efficiency, contributing to a more sustainable future. Success in the recycling sector showcases eco-friendly practices, while innovations in circular product design align with the nation's commitment to environmental responsibility. The Czech Republic's circular economy achievements underscore a holistic approach, addressing diverse aspects of resource utilization and waste reduction.

Circular economy success stories from Czech Republic

Power Plant Tomatoes from Tušimice

intemac

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Recognition of by-products

02 VALUE CHAINS

- Agriculture, fertilisers and forestry

Description of the challenge

The company AGRO Kadaň, s.r.o. set up a greenhouse in cooperation with ČEZ, a.s. for growing tomatoes on the site of a former coal-fired power plant. The initial idea was to grow vegetables locally so that the harvest would not have to be harvested early and then transported thousands of kilometres from abroad. The area of the industrial brownfield is directly offered for greenhouse farming. AGRO Kadaň, s.r.o. takes waste heat from the power plant to heat the greenhouse and generates electricity.

Main results

By using waste heat from a nearby power plant, the company saves not only money but also the environment. This residual heat would otherwise be discharged unused into the surroundings. Another circular solution is the use of hydroponic cultivation where the amount of water, soil and nutrients that need to be supplied to the plants is reduced. The company uses captured rainwater for watering and can also recycle residual water which is not consumed by the plant. In the future, the plan is also to take CO_2 from the power plant which is also needed to grow tomatoes.

Cellulose Insulation: After its Use Will be Converted to Fertilisers or Fuel

intemac

01 IDENTIFIED CHALLENGES

- Definitions of waste
- Useful application of recycled materials

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

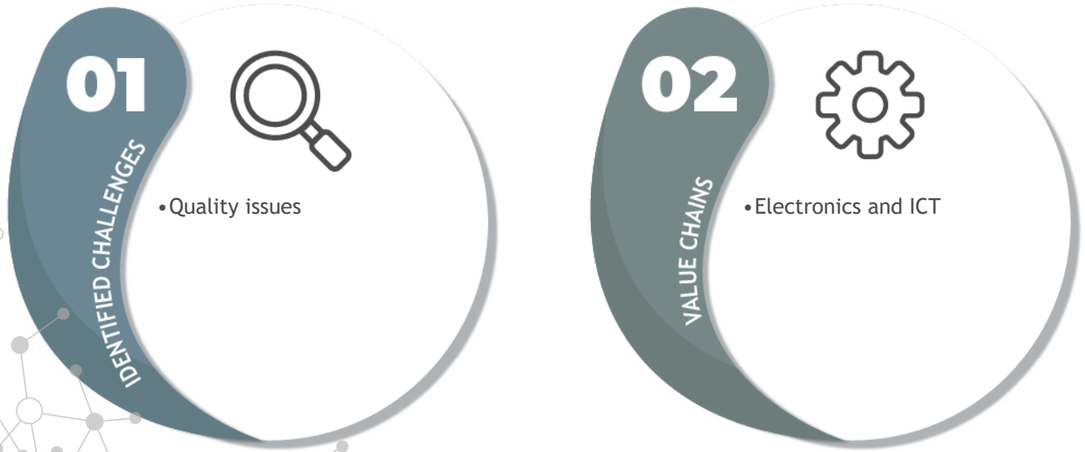
The challenge lays primarily in how to utilise the unrepeatable physical-chemical properties of natural cellulose fibre and manufacture an insulation material from recycled paper which due to its properties, used input material, manufacturing process and utilisation would have a positive impact on the environment after the end of its long life span.
A further challenge was to find an optimal method by which to process recycled paper and produce from it insulation material with high quality technical parameters, using an ecological manufacturing process, ecological application and with a positive impact on the environment after the end of the product‘s life cycle. On the basis of the research, several dozen new methods were proposed for utilising cellulose fibre as an industrial fibre (for road construction, the metallurgical, energy and automobile industry).

Main results

CIUR has been producing the ecological cellulose insulation Climatizer Plus® since 1991 using patented technology. The product combines excellent ecological and technical parameters. The insulation for thermal and acoustic protection of buildings is produced from waste newspaper, with an admixture of mineral salts used also in the foodstuffs industry. Blowing with compressed air is used for application. After the end of the life cycle of the insulation, it can be used as a fertiliser, compost, fuel for biogas stations or can be reprocessed into other material.

Until the Last Breath of Each Printer an Ecological Approach to Printing and Copying

intemac



Description of the challenge

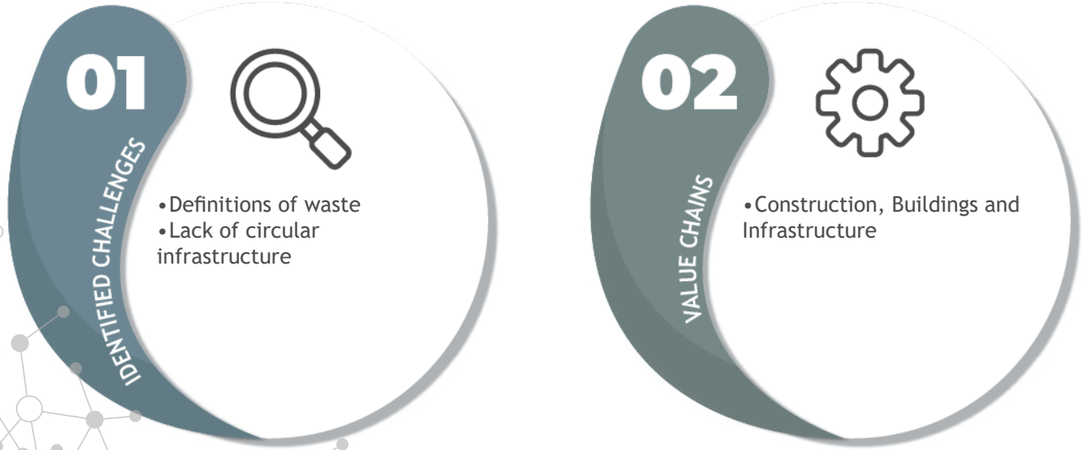
COPYMAT spol. s.r.o. provides print solutions as a service. It covers the requirements for functionality of printers and photocopiers and based on this the company recommends solutions. This covers used but effective machines that have not yet exhausted their potential. Due to these the company attains a reduction of costs and enables clients to invest in the things that are important for their business. COPYMAT spol. s.r.o. often comes across clients who have bought printers on the basis of the acquisition price and were afraid to buy used equipment. However, the operation of these printers cost the clients a lot of money, therefore instead of servicing their equipment, they preferred to throw it out. For this reason COPYMAT spol. s.r.o. started providing printing as a service – it met clients' requirements and at the same time repaired and reused equipment which still provided the required comfort and effectiveness.

Main results

COPYMAT spol. s.r.o. busted several myths about the sale of printers. For example, the one about inbuilt obsolescence devices in every machine. Because after all, the company wouldn't provide a guarantee on a machine if it was manufactured in such a manner as to stop working after a certain time. In addition, among the company's partners COPYMAT spol. s.r.o. was indicated as the firm with the best relationship to the environment.

When Demolition Waste Replaces Primary Raw Materials for the Construction Industry

intemac

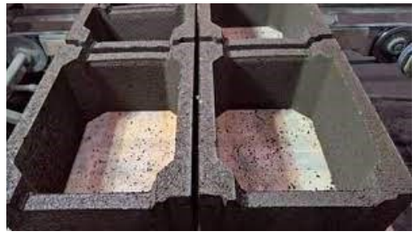


Description of the challenge

The big challenge for ERC-TECH a.s. is to solve the worldwide problem with the utilisation of inert and mineral waste from demolitions, the great majority of which today ends in landfills, and to reuse these raw materials for products and constructions. The company endeavours to ensure sustainable development in the construction industry and brings new business opportunities with the maximum positive ecological impact for individual regions and states throughout the whole world.
ERC-TECH a.s. is a worldwide innovator in the development of concrete and concrete construction elements from 100% recycled aggregates. Its know-how incorporates the processing of recycled compounds from inert demolition waste, especially from concrete, bricks, paving stones, ceramics, sanitary products, concrete/brick compounds, roof tiles and ceramic products, mortar etc. The company bases its business on sustainability, both in the area of environmental protection and social responsibility and from the perspective of economic profitability.

Main results

Instead of mining mineral raw materials and a growth of landfills, ERC-TECH a.s. bases its activities on the reuse of waste construction materials, with the aim of manufacturing such products which in their quality and added value replace primary construction materials. The company's products are used in construction for classes C 8/12 and C 30/37 and higher. Replacing mineral raw materials and the use of 30 % less cement has not only a positive financial impact on the price of the product but also due to reducing CO2 it has a significant benefit for the environment. If 2.4 billion tons of currently unused inert material from demolition waste were utilised, this would reduce the CO2 footprint by 620 million tons every year, with a financial benefit of more than 115 000 billion USD annually.



Second Life for Furniture: What One Person Doesn‘t Need, the Next One Will Welcome

intemac

01 IDENTIFIED CHALLENGES

- Lack of circular infrastructure
- Useful application of recycled materials

02 VALUE CHAINS

- Textiles, appeal and leather

Description of the challenge

IKEA Systems B.V. sells products with the designation “Second Life for Furniture” in the section with discount goods, for the same price at which the company purchased them. “Second Life for Furniture” is a service which offers customers the opportunity to sell IKEA’s furniture they no longer use or need. People can offer this furniture on the website www.druhyzivotnabytku.cz where they can upload photographs of the product and describe its current condition.

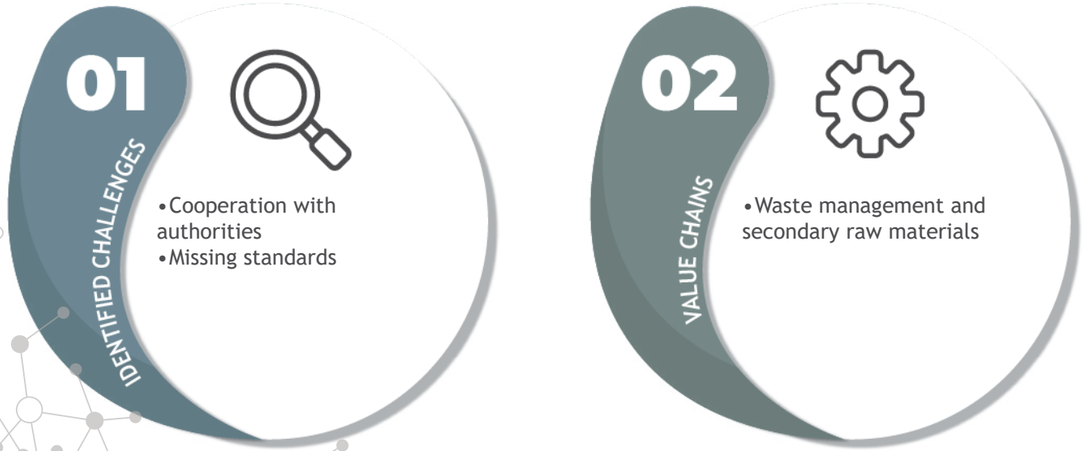
On the basis of their experience with selling furniture, IKEA’s employees propose a price for which they will offer the furniture. The customer obtains a refund card worth the amount of the sale price of the furniture which they can then use for further purchases at IKEA.
The service aims to support the cycle of items from one user to the next one. Customers can sell furniture that would otherwise remain unused in the discount goods corner. Thanks to this system the utility of products is increased, and their life cycle extended.

Main results

The benefit of the project lies in the fact that it avoids the creation of waste and at the same time it minimises it. During the course of one month IKEA Systems B.V. buys and saves on average 350 pieces of furniture. The company receives positive feedback from its customers who subsequently buy this repurchased furniture. On average the company sells the furniture within a day and a half. Due to the positive response, IKEA Systems B.V. has decided to test out the service also at its store in Hungary.

ECONIT - Smart Waste Evidence System for Cities and Municipalities

intemac

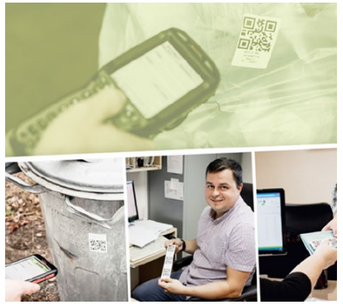


Description of the challenge

The mission of JRK Česká republika s.r.o. is to improve waste management. The company thus developed a software called ECONIT which is used for optimizing the waste management. Through a combination of modern technologies and several years of experience in waste management, the company is increasing the degree of waste separation by means of an innovative and educative solution. On the basis of several physical analyses the company determined that almost 80 % of landfilled waste is composed of components that could be sorted.

Main results

The software ECONET developed by JRK Česká republika s.r.o. is used mainly by municipalities. One of many positive examples is the municipality of Prostřední Bečva. The mayor determined an increase in the quantity of separated waste in all commodities. The quantity of separated plastic increased by 12 %, glass by 73 %, paper by 90 % and in case of drink cartons even by 1 860 %. Thus within one year the municipality saved CZK 334 000 and reduced the quantity of mixed municipal waste by 31 %. The savings generated due to this system paid for all the costs of the system and the municipality is continuing to make savings. The mayor converted these savings into bonuses for citizens. He reduced charges for municipal waste as an expression of thanks for the community‘s excellent cooperation.



Modular Buildings - Build, Refurbish, Dismantle, Rebuild

intemac

01 IDENTIFIED CHALLENGES

- Complex process to make circular

02 VALUE CHAINS

- Construction, Buildings and Infrastructure

Description of the challenge

KOMA MODULAR s.r.o. is a new, alternative branch in the constructi¬on of buildings. A modular building is formed of individual modu¬lar units, prefabricated on a production line. The principles of the circular economy are of absolutely core significance for the functio¬ning of the entire company which is probably best documented by the relocation of the Czech modular pavilion from the international exhibition EXPO in Milan for its further use.

KOMA MODULAR s.r.o. supplies modular kindergartens which the company rents to towns and municipalities. All the clients require is a suitable site, with the possibility of connection to the essential networks. The company takes care of all the installations, servicing during operation and disassembly. The product corresponds to all the construction prescriptions. When the kindergarten is no longer required, the modular building is relocated to a new site.

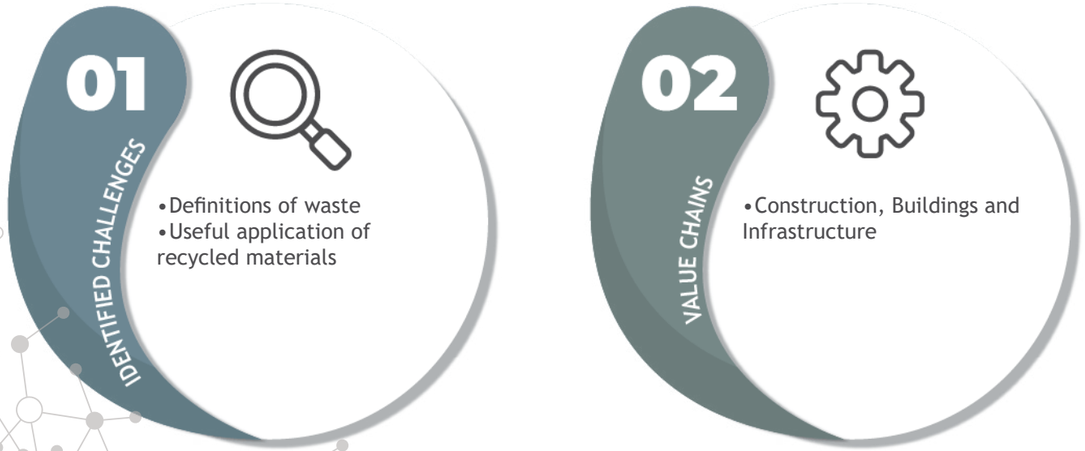
The challenge is to break away from the tried and tested procedures and products of “classic buil¬ders” and to embark upon an innovative construction of premises according to the model of the automo¬tive industry.

Main results

Municipalities can respond flexibly to the current number of children set to attend kindergartens. The task of resolving insufficient places in kindergartens in the Czech Republic is thus shifted from the state to private companies. The assembly of the kindergarten is very quick, specifically within the course of a few weeks. The company also refurbishes individual modules and uses them for constructing modular buildings which serve also for other purposes. This method of acquiring buildings is termed as “off-site building” which appositely captures the character of production of buildings on another site than where they are later placed. And above all, permanent buildings are not constructed for temporary use.

An Idea for the Whole World: When Frying Oil Becomes Bioplastic

intemac



Description of the challenge

At the beginning of the project of NAFIGATE, a.s. there was an idea of limiting waste of foodstuffs and replacing food by waste. After laboratory confirmation that this was possible - and in fact with even better results than upon the use of foodstuffs - scientists and business people joined forces and found an economically highly effective way of producing biopolymer from a waste product that has reached the end of its life cycle (used oil).

Main results

Hydal ranks among “upcycling” technologies and is furthermore inspired by natural processes. Bacteria which produce biopolymer as a store of energy for harder times have been a part of our ecosystem for millions of years. As a result, nature knows not only how to produce this biopolymer, but also to recycle it, since if it is not consumed by the bacteria themselves, it serves as food for other microorganisms. The produced polymer type PHB is therefore 100 % biodegradable. Hence the greatest benefit of the new technology Hydal consists in the fact that it partially enables a solution of problems in connection with pollution of the planet caused by plastics and microplastics.

Feeders for Birds All Year Round

intemac

01 IDENTIFIED CHALLENGES

- Definitions of waste

02 VALUE CHAINS

- Plastics, polymers and rubber

Description of the challenge

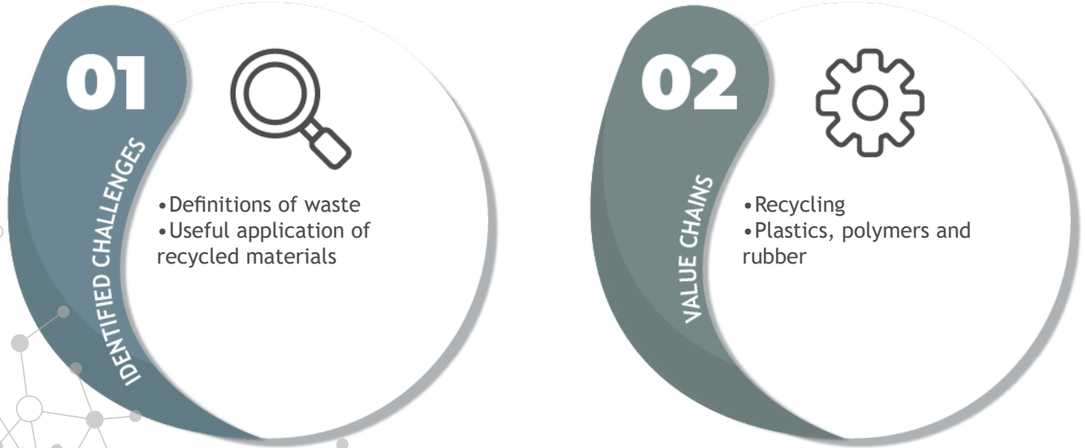
PLASTIA s.r.o. wanted to build a firm on principles which would become the value framework of company as a whole at the same time. Its ambition was to make items in such a way as to make good use of the properties of plastic and suppress the inclination to treat plastic as a single-use material. Another great challenge was how to save investments in moulds by conceiving products in a modular manner. And the challenge was also the endeavour to eliminate the seasonal nature of the use of their products.

Main results

“Feed and drink for birds all in one” - this is a modular product of PLASTIA s.r.o. which by replacing parts of the product changes its use. After the winter a customer replaces the variable part for feeding with the part for drinking and so feed becomes drink. It is therefore not necessary to buy a new product. The feed/drink can be affixed to a railing or stake or suspended.
New opportunities for co-operation with the non-profit sector emerged, in this case with the Czech Society for Ornithology. The project addressed new target groups that are sensitive both to ecology and to the practicality of products. PLASTIA s.r.o. succeeded in creating the so-called new functional optimum in which the customer uses the product or its parts for a far longer time.

Conversion of Waste Plastic Foils into a Raw Material for Further Production

intemac

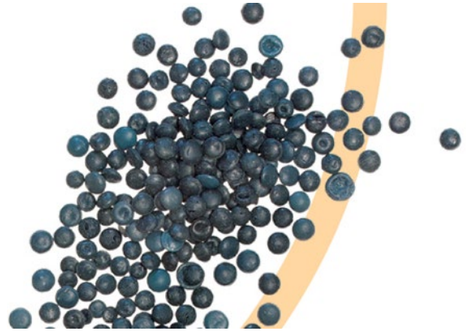


Description of the challenge

In Europe only approximately 25 % of plastics are recycled. The company SUEZ Water CZ s.r.o. is a pioneer in the field of recycling and the circular economy in general. The main challenge was to replace a natural resource with a recycled raw material and to utilise waste material (specifically plastic LDPE foils), for which processing technology was previously lacking in the Czech Republic. This waste either ended abroad or even in incinerators or landfills. The aim was to recycle a specific type of waste plastic into re-granulate of such quality that it would bear comparison with granulate from a natural raw material, namely crude oil. This was made possible primarily due to the chosen technology and thorough sorting of the input material.

Main results

SUEZ Water CZ s.r.o. has managed its rebirth from a waste management company to a circular one, for example due to the launch and successful operation of a new recycling line for waste plastic foils from LDPE (low density polyethylene). Recycling activities generate more than 20 % of the turnover of SUEZ Water CZ s.r.o. while with new investments and innovative solutions this proportion is constantly increasing.



About the success stories from Croatia

Croatia’s circular economy achievements highlight initiatives in textile waste management, innovative recycling solutions, and circular urban development. Success stories include projects focused on reusing textile surplus to create eco-friendly products and recycling waste from liquid crystal displays. Croatia’s commitment to circular urban development is evident in projects that connect cities and stakeholders, fostering a transnational value chain. The nation’s circular initiatives emphasize waste reduction, sustainable materials, and innovative solutions, contributing to a more circular and sustainable economy.

Circular economy success stories from Croatia

1. Collection&Reuse&Recycle of Textile Surplus and Production of eco-friendly textile products
2. Indium Recycling from Waste Liquid Crystal Displays
3. Glass Recycling from waste Liquid Crystal Displays
4. Collect & Recycle & Reuse
5. RUCONBAR (Rubberised Concrete Noise Barriers)
6. Tire recycling
7. Recycling of Polyester Textile Waste
8. Research and development of innovative materials and products from devulcanized rubber
9. City Circle
10. Waste toner powder recycling in construction industry

Collection&Reuse&Recycle of Textile Surplus and Production of eco-friendly textile products

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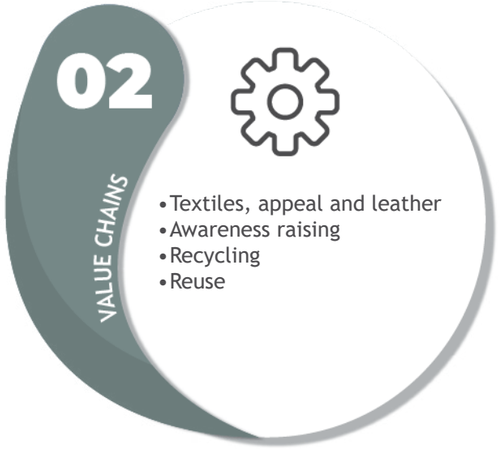

Description of the challenge

Nowadays is the time when discounts signs “scream” in clothing stores and we are bombarded with offers and lower prices and buy more clothes than needed. Recent research has shown that everyday clothes are getting cheaper and thinner. Disposal of textile waste has become a major global problem.
Having in mind that Humana Nova employs people with disabilities and marginalized groups, the challenges internally are related to the management of people (high rate of sick leave, but also lack of legal framework in textile waste management, lack of systematic support for employment of vulnerable groups). In addition, there is a need for a stable base of partners from the private sector and the availability of domestic raw materials and domestic/international distribution channels to completely close the loop. Biggest financial challenge is investing in marketing and market recognition.
SZ Humana Nova accepts and treat all donations of clean and dry household textile surpluses (except carpets, quilts, pillows and similar bulky and non-recyclable textiles). Upon entering the production process, each piece of textile undergoes sorting where it is further distributed into one of three production sections: neat, modern, wearable and such undamaged clothing is prepared for further use and selling in second-hand shop. Furthermore, usable cotton is sorted and prepared to produce industrial rags while everything else is shredded and sold to a partner company for production of geotextiles, insulating materials in construction, etc. Felt is produced in Regeneracija but packed in Humana Nova by persons from vulnerable groups and sold by Regeneracija on the European market.

Main results

Companies order promotional kits (T-shirts, canvas bags, tracksuits) and the materials from which it is sewn are recycled and environmentally friendly. Investing in such a product supports the collection and disposal of textiles and creates new value for the product. Together with educational institutions, associations and local authorities, the textile waste collection actions are organised. In the educational part of the workshops, participants can learn about the comprehensive model of textile waste management of Humana Nova (collection, reuse, recycling, and creation of new products from old textiles, and new products from eco-certified materials).

Indium Recycling from Waste Liquid Crystal Displays

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01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Low return on investment
- Missing standards
- Useful application of recycled materials

02 VALUE CHAINS

- Electronics and ICT
- Waste management and secondary raw materials

Description of the challenge

Waste electrical and electronic equipment (WEEE) is a significant source of valuable raw materials, certain metals, and rare earth elements that are the basis for highly sophisticated IT equipment production.
LCD screens contain a valuable and scarce element called indium, which is found in nature in extremely limited quantities. Waste liquid crystal displays used in televisions, laptops, desktops, and other devices represent a significant share of WEEE and contain 0.12–0.14% of liquid crystals whose main ingredient is indium —tin oxide.
In order to investigate and determine the methods and conditions of indium recycling from waste LCDs, laboratory research was conducted. The influence of temperature, particle size, and retention time in different media with and without ultrasound treatment was monitored to provide the efficiency of indium leaching.
The analysis of the results showed that 98% indium leaching was achieved with granulation samples of 10 × 10 mm at a temperature 40 ◦C/40 min in solution H2O:HCl:HNO3 = 6:2:1 under ultrasound conditions, while aqueous and alkaline media under the same conditions did not show significant efficiency.
Study is conducted with cooperation of authorised company for collection of electrical and electronic waste, Spectra Media Ltd. and can be used as a practical reference for the recycling of indium from LCD panel.

Main results

Considering the current market price of 210-260 USD per kilogram, it may not be economically viable to recover indium. Rare elements such as indium, cobalt and lithium are vital for the production of low-carbon technology and should be regulated by mandatory standards. The European Commission has categorized indium as a key resource, emphasizing the need for intensive efforts in recycling techniques to recover indium from waste LCD screens. Concerns are growing about the supply of these elements in the future, as the transition to green technology, including electric vehicles, solar panels and low-carbon heating, will require far greater quantities of rare elements and other critical raw materials.

Glass Recycling from waste Liquid Crystal Displays

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01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Low return on investment
- Missing standards
- Recognition of by-products

02 VALUE CHAINS

- Electronics and ICT
- Waste management and secondary raw materials

Description of the challenge

The increasing amount of waste electrical and electronic equipment (WEEE) is one of todays concerning problems. Due to every day increasing quantities of WEEE, different methods have been developed to achieve the most efficient extraction and usage of valuable components such as glass, in this matter, which is being generated as a waste in large amount.
Waste LCD glass is generated not only from the production lines of LCD panels but also from electronic devices that have reached the end of their lifespans, worldwide. Consequently, the future demand and the LCD production is predicted to continuously increase and thus also the amount of waste LCDs. The case shows that concrete C20/25 was prepared with waste liquid crystal display (LCD) glass used as a replacement for fine aggregate in percentages 1%, 5% and 10% after a metal extraction processes were carried out prior to concrete production. Materials used were identical to those that are incorporated into the concrete products of real facility in Croatia. Fine (0-4 mm) and coarse aggregates (4-8 mm, 8-16 mm) obtained by exploitation and refining of construction sand and gravel were used as aggregates for concrete preparation.
The construction industry can offer a potential solution for recycling waste LCD glass. The use of LCD glass waste as sand decreases the mechanical strength in general but leads to better workability, durability and volume stability. Thus, waste LCD glass can be used as a new alternative ingredient for concrete, as a replacement for cementitious materials or sand.

Main results

Concrete industry has acquired the credentials of being one of the largest consumers of some of the most vital natural resources since concrete is heavily used as a construction material in modern society and the demand for natural resources is increasing day by day.
The use of recycled LCD glass and the possibility of applying waste LCD glass in concrete and ceramics production is an example of “closing the loop” in recycling.
This study indicated higher compressive and tensile strength values for concrete with LCD as opposed to concrete with untreated LCD. Mixing waste LCDs in concrete, bricks, ceramic tiles, etc. is improving their characteristics and performance thus the satisfactory results can be obtained both from a technical and environmental aspect, according to this research.

Collect & Recycle & Reuse

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01 IDENTIFIED CHALLENGES

- Accessing funding
- Behavioural change
- No circular regulation

02 VALUE CHAINS

- Textiles, appeal and leather
- Reuse
- Recycling

Description of the challenge

In its business process in the circular economy model, the company combines the collection and recycling of textile waste, the production of its own raw materials and the production of finished products intended for various industries, such as construction, the furniture industry and automotive industry.
For its production, they primarily collect and also import raw materials and auxiliary materials for its production needs. They dispose of and recycle 6,000 tons of textile waste annually, and their goal is better cooperation with the scientific community through the discovery of new application possibilities for products obtained from recycled textile waste. Although the textile industry is increasingly emphasizing sustainability, the challenge still exists in the excessive use of non-renewable resources while clothing and other textiles quickly end up in landfills or incineration, which is not an ecological solution.
The textile material is recognized as one of the biggest global polluters of the environment, so there is a big problem in landfilling, while recycling rates are too low.
The company is engaged in the production of technical non-woven textiles from recycled textile materials. This means that through the circular economy model, the entire production process is unified, from the procurement of textile waste, its mechanical recycling, the production of protective and insulating materials in construction.

Main results

The company deals with these topics since 1954 so it has experience, knowledge and market positions which means that they implement the whole process for years, from collecting textile waste, processing it and putting products on the market. Currently, the lower occupancy of production capacities due to reduced economic activity has resulted in a drop-in demand and therefore in a shift in production which, on the other hand opened an opportunity to implement plans to relocate the felt production plant. In the future, increasing the focus on textile recycling and its collection really opens a lot of opportunities for growth, investment and employment. Transferability potential exists as long as companies adapt to changes in the market and monitor short-term and long-term risks.

RUCONBAR (Rubberised Concrete Noise Barriers)

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01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Useful application of recycled materials

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Waste management and secondary raw materials

Description of the challenge

RUCONBAR (Rubberised Concrete Noise Barriers) is a highly absorbing environmentally friendly concrete noise barrier. Its absorbing layer is produced out of recycled waste tyres and concrete.
Basically, it is a concrete product comprised of the absorbing and bearing layers. By applying 40% rubber granules from recycled car tires in the absorbing layer, we get a product which presents an innovation in the area of noise protection and which is unique in the market.
The RUCONBAR concept presents a cost-efficient and environmentally friendly solution for protection from noise, which is at the same time easily applicable.
The RUCONBAR noise barriers were developed within the framework of the project of the same title, recognized by the European initiative CIP ECO Innovation and the Executive Agency for Competitiveness and Innovation.

Main results

RUCONBAR significantly reduces environmental impact, cutting greenhouse gas emissions by 31% compared to similar market solutions. It also lessens the exploitation of non-sustainable resources like gravel, crushed rock, and natural clay, thereby protecting the environment from clay excavation and deforestation. Additionally, RUCONBAR contributes to recycling used car tires. Recognized for its sustainability, RUCONBAR has been awarded the Green Mark - Sign of Excellence. The Zagreb Energy Association acknowledged its innovative approach, granting it the GREENOVATION award for best green technology in Croatia in 2011. At the ARCA 2012 international innovations fair, it received the ARCA Prix award. Further, RUCONBAR was honored with the RailTech2019 Innovation award for Infrastructure, underscoring its significant contribution to sustainable practices and technologies.

Tire recycling

HGK
CROATIAN CHAMBER OF ECONOMY

01

IDENTIFIED CHALLENGES

- Access to relevant information and assessments
- Complex process to make circular
- Useful application of recycled materials

02

VALUE CHAINS

- Construction, Buildings and Infrastructure
- Waste management and secondary raw materials
- Recycling

Description of the challenge

Gumiimpex-GRP d.o.o. is the first company in Croatia that started the recycling of used car tires in 2005. The primary goal is to reduce the harmful impact on the environment while reusing the valuable properties of tires. In Croatia, waste car tires are collected by authorized regional collectors, but Gumiimpex GRP is the only one waste tire recycling plant. All types of car tires (passenger and off-road vehicle tires, van and truck tires, bus tires, agricultural machinery tires, tractors, forklifts, airplanes, and work machinery) are collected. Through modern technology, old, deteriorated tires are processed into granules of various sizes and have further applications in numerous business activities: from construction, infrastructure, transportation, agriculture (livestock and gardening), to sports fields of various profiles, urban environments with landscaped recreational areas, children's playgrounds, and rehabilitation canters.

The annual processing capacity of the waste tire recycling plant is 32,000 tons of used tires of all kinds.

By mechanical recycling, the tires are torn to pieces, and by gradual grinding they undergo a separation process in which the rubber parts, steel and textiles are separated, which are the basic components of the composition of each tire.

In the process of such recycling no further waste substance is created, everything is "usable", and it is extremely important that there are no accompanying emissions into the environment. Research has shown that the mechanical recycling process of waste tires is far more favourable to the environment and nature than incineration for energy purposes.

Main results

Tire recycling is part of sustainable development activities because it converts used products into items with new value. It is important to note that used tires can be fully recycled, and their chemical and physical properties make them valuable raw materials.

The other technology Gumiimpex GRP use to lower tire procurement and consequently save energy is tire retreading. Retreading is a technology that makes used tires reusable by replacing a worn and damaged outer layer with a new tire layer. Gumiimpex today produces more than 7,000 types of rubber-technical products per year, following the latest technology and responding to the needs of the market, and using the outstanding properties of rubber as a raw material.

Recycling of Polyester Textile Waste

HGK
CROATIAN CHAMBER OF ECONOMY

01 IDENTIFIED CHALLENGES

- Complex process to make circular

02 VALUE CHAINS

- Textiles, appeal and leather
- Repair, Refurbish, Remanufacture, Repurpose
- Recycling

Description of the challenge

VIS is an innovative and recognizable company with a tradition in producing textile ever since 1929. Since then, it has become a leading regional manufacturer of promotional parasols and technical textiles. The biggest competitive advantage VIS has is its in-house production of textile, consisting of yarn spinning, weaving, washing, whitening, printing and coating.
VIS decided to level up its production process as well as the final product, adding value to the overall process by textile recycling and producing a new recycled parasol.
The project ECO VIS is supported by the Norway Grants with aim to create competitiveness for the company, new jobs and reduce the carbon footprint.
A global market constantly demands sustainable and recycled products which is particularly reflected in the HoReCa market in which VIS operates so there is a growing need and demand for recycled sun umbrellas and parasol fabrics, moreover, a supplier gets a better rating in the supplier database when offering such product.
The ECO VIS project focuses on the recycling of technical textiles in various ways that would allow the reuse of waste generated in the production cycle, but also offer the world a new way of polyester textile recycling.
The project goes beyond applicable EU standards and increases the level of environmental protection in the absence of EU standards, that aims to develop a “greener” way of recycling polyester textiles and allow the full recovery of waste generated in the production cycle by developing new products that ultimately form a fully recycled parasol.

Main results

The project acquired valuable equipment that enabled construction of a recycling line in which polyester waste was sorted according to defined criteria and, depending on its properties, directed for further processing for fibre reopening or thermoplastic treatment.
Ultimately, we get new recycled yarns, thermoplastic profiles and granules that are widely used, giving VIS an extra level of competitiveness.
The project’s estimated results, with the placement of new products on the market, are an annual decrease of 1.022 tons in the consumption of synthetic yarn, reuse of all textile waste, an annual decrease of 1.000 tons of CO^2 emissions and creation of new green jobs.

Research and development of innovative materials and products from devulcanized rubber

HGK
CROATIAN CHAMBER OF ECONOMY

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Useful application of recycled materials

02 VALUE CHAINS

- Waste management and secondary raw materials
- Recycling

Description of the challenge

Devulcanization is a process that reverses the “vulcanization” of rubber, recycling it so that rubber can be vulcanized again. This process converts rubber waste into a new raw material. Devulcanization can be performed through several techniques, making use of mechanical, thermal, thermomechanical, chemical, microwave, ultrasonic, or biological agents that can be applied alone or combined. To this aim, the devulcanizing agents and the operational conditions, such as temperature, pressure, time, and shear rate must be properly chosen.
The devulcanization process is the missing link to complete the loop of rubber-technical products manufacturing, starting from recycling of waste tires, through devulcanization of recycled rubber granulate to production of new rubber products. Gumiimpex d.o.o. contributed with development of new innovative material and products from recycled rubber with innovative devulcanization technology.
The implementation of project” Research and development of innovative materials and products from devulcanized rubber”, ref.: KK.01.2.1.02.0157 resulted with technology of mechanical procedure of devulcanization, which, in previous research, profiled as the only technology that shows good results, where no chemicals are used, and it is save for environment and it can be apply to industrial production.

Main results

New innovative devulcanize rubber material, researched and developed according to different recipes and adjusted according to market research and customer needs was developed.
New innovative products from devulcanized rubber, researched and developed according to different recipes and adjusted according to market research and customer needs were prepared for commercialization. The new products are in testing phase.

City Circle

HGK
CROATIAN CHAMBER OF ECONOMY

01 IDENTIFIED CHALLENGES

- Complex process to make circular
- Insufficient demand
- Missing standards
- Organisational structures

02 VALUE CHAINS

- Waste management and secondary raw materials
- Recycling

Description of the challenge

Urban centres of peripheral regions in Croatia but also Europe wide lack of innovation for stronger business development due to limited access to global innovation processes and cooperation partners and are in constant search for recent technology transfer and improved services and business models that would enable continuous progress in the long term.
In order to help overcome those challenges, various circular economy models offer options for the sustainable and resource-efficient development for pooling innovation, new technologies, services, solutions and business models.
By providing these with new tools and knowledge related to circular economy, thanks to the implementation of circular economy practices, a new generation of innovative solutions has been introduced in their urban ecosystems. A full CE package for cities transferred knowledge and tools, developed organizational structures, transnational value chains and presented visible benefits to their citizens.

Main results

Participating cities connected and networked their key CE stakeholders (companies, public administration, universities, citizens) by educating them and providing tools for management of an efficient Circular economy process.
Moreover, a transnational value chain and network for key materials was set up – by-products, directed by a jointly developed strategy for circular economy.
Basic principles and basic technology of circular economy has been tested in the area of waste treatment and product reuse. An efficient way of reusing of treated organic waste as manure digestate for hazelnut farming was presented. Thus, the efficiency of the process is yet to be evaluated by further monitoring of the hazelnut growth. The city´s green market was one of the main partner.

Waste toner powder recycling in construction industry

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01 IDENTIFIED CHALLENGES

- Complex process to make circular

02 VALUE CHAINS

- Construction, Buildings and Infrastructure
- Electronics and ICT
- Cement, steel, chemicals
- Waste management and secondary raw materials

Description of the challenge

Substantial quantities of toner cartridges are produced and used in photocopiers and printers every year. Spent toner cartridges are classified as hazardous waste because they contain toner powder, posing risks of flammability and explosiveness during processing and disposal.
In the experiments up to 10% of fine aggregate in concrete was replaced with mixture of waste toner powder and additive that remains from mechanical treatment of waste toner cartridges. The usability of the obtained concrete products was carried out at laboratory and industrial level. The success of the process is valorised through engineering analysis. As the most successful results from the technical and ecological aspect, are concrete with 1 and 3 and 5% of the aggregate replacement with mixture of waste toner powder and additive.
Testing of the usability of the obtained concrete products was carried out at laboratory and industrial level, Laboratory of Environmental Engineering at the Faculty of Geotechnical Engineering and at the local producer of concrete elements, Zagorje Tehnobeton Ltd, respectively.
Furthermore, as the mixture of waste toner powder and additives, this waste must be treated at a hazardous waste treatment plant or disposed of at a hazardous waste landfill. There was no such landfill or facility in the Republic of Croatia that could take over this waste. The leaching test in this experiment has shown that the modified concrete can be classified as inert waste.
This research has proven that it is possible to obtain a value-added product, the waste is converted into a raw material, and at the same time the quantities processed at the hazardous waste facility are minimized.

Main results

Concrete production requires significant quantities of raw materials in the form of cement and aggregates and is characterized by significant energy consumption in production processes. Through this research a value-added product is obtained, and waste is turned into a raw material. At their end-of-life these products can be disposed of on landfill of inert or non-hazardous waste or find another use, such as a recycled aggregate in road construction. The results of this research are of interest to both waste management companies and the treatment of waste toner cartridges, as well as to the construction industry with the aim of reducing environmental impact by replacing some of the original raw materials in concrete production.

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