

ECO-INNOVATION IN THE BASQUE COUNTRY

105 INDUSTRIAL
PROJECTS FOR NEW
CIRCULAR SOLUTIONS



Herri-baltzua
Sociedad Pública del

EUSKO JAURLARITZA
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EKONOMIAREN GARAPEN,
JASANGARRITASUN
ETA INGURUMEN SAILA

DEPARTAMENTO DE DESARROLLO
ECONÓMICO, SOSTENIBILIDAD
Y MEDIO AMBIENTE

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European Union

**European Regional
Development Fund - ERDF**

"A way of making Europe"

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PRESENTATION



Arantxa Tapia

**Economic Development, Sustainability
and Environment Ministry
Basque Government**

The Basque Country is highly dependent on natural resources, which means over 75% of the tonnes of raw materials we consume are imported. On the other hand, raw materials, excluding energy, already accounted for 61% of the budget of Basque companies budgets before the current supply crisis. This situation is echoed in all European regions and countries and structurally affects the competitiveness and sustainability of our economy.

The business need for innovative solutions aimed at reducing raw material consumption while increasing product durability is a matter of urgency. The EU, through the European Green Deal and the Circular Economy Action Plan, has raised to this challenge with the most ambitious commitments and instruments in the last three decades. Now we know that the circular economy is one of the pillars to mitigate climate change, because a reduction of more than 40% of greenhouse gas emissions in Europe can be achieved through eco-design, reducing production waste, or better recycling materials such as steel, aluminium, plastic or cement.

This challenge can only be addressed through public-private partnerships and a commitment to eco-innovation. For this reason, the Basque Science, Technology and Innovation Plan 2030 aligned with the



Every public euro invested has generated an additional annual turnover of 21 euro on the private market

Basque Circular Economy Strategy, establishes eco-innovation and the circular economy as priority areas. One of the main tools to deploy the objectives defined is the Circular Eco-Innovation Programme.

I am honoured to present the results sheets of more than 105 finished projects of the Circular Eco-innovation Programme, a sector-based programme that goes beyond financial aid and, according to most participating companies, also provides strategic criteria, business alliances, essential data and accurate market visibility, through close monitoring carried out by the professional team of the public environmental management agency, Ihobe.

In recent years we have promoted business projects under the Circular Eco-Innovation Programme with a public budget of just over €7 million. According to the successful projects results, companies forecast an additional annual turnover of €130 million, 22 new business lines, almost 200 new jobs, savings of 228,000 tonnes of non-emitted GHG emissions per year and more than 300,000 tonnes of non-discharged waste per year over the next few years. Every public euro invested has generated an additional annual turnover of 21 euro on the private market.

And there is more: these eco-design projects recovering metals, plastics and building materials have developed a collaborative business culture that will facilitate addressing the large challenging circular opportunities arising in the country. More importantly, the results are used to generate local eco-innovation benchmarks and transfer successful circular solutions to our SMEs. Therefore, it is extremely important to start sharing the results of these projects we present below.

Finally, I would like to thank the companies pioneering the projects, industrial partners, technology centres and knowledge-based agents, Ihobe's team, the people responsible for the services rendered by the Deputy Ministry for Environmental Sustainability and the EU's European Regional Development Fund (ERDF) for their involvement and support for this Circular Eco-Innovation Programme which, in the light of the positive results achieved, I am certain we will continue to promote in the years ahead.



INTRODUCTION

This publication gathers the results of 105 projects completed under the Circular Eco-Innovation Programme between 2018 and 2022. The programme, managed by Ihobe, the public environmental management agency of the Basque Government's Department of Economic Development, Sustainability and Environment, promotes eco-design and demonstrates circular economy and strategic eco-innovation in Basque companies.

Although 24% of the new circular solutions developed or demonstrated in these projects are already in operation or available on the market, the results of all the projects completed to date that have been validated by the companies themselves are also included. Each datasheet of this document includes a graphical representation of the environmental, technical, economic, commercial or market viability of each project, identifying the barriers and the needs related to future R&D & Innovation decisions. Thus, new collaborative projects built on previous



This publication gathers the results of 105 projects completed under the Circular Eco-Innovation Programme between 2018 and 2022

experience can be re-launched in line with the lessons learned.

Completed project sheets have been allocated to the target sector of the new material, product or service developed, whereas the sector where an issue or waste originated has been placed at a second level.

Within the nine main sectors, projects are listed in alphabetical order according to the company managing the project, taking into account the fact that over 30% of the projects include other industrial partners and almost all of them involve technological organisations, mostly Technology Centres assigned to the Basque Research & Technology alliance (BRTA) or integrated in the Basque Science and Technology Network, which are mentioned in detail in each datasheet.

In parallel, the public agency Ihobe deemed it necessary to indicate the main driving factor generating each project at the time it started, such

as eco-designing equipment, circular business models, reducing greenhouse gas (GHG) emissions, environmental positioning and transparency, green public procurement, Extended Producer Responsibility (EPR), plastics, best production techniques, costs and supply of raw materials, reduction of waste disposal, or zero pollution.

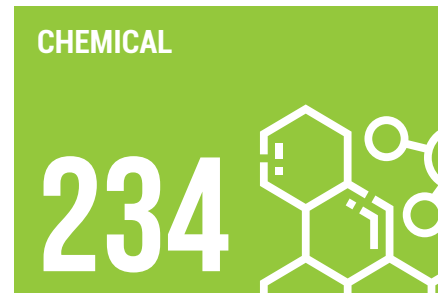
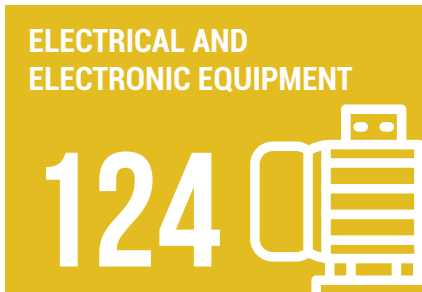
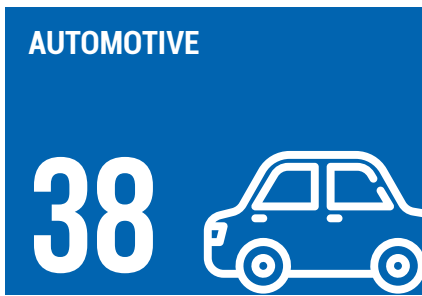
Each sheet contains the project title and acronym, context, aim, technical, environmental and business results obtained, as well as conclusions and lessons learned that may be useful for third parties.

At the time of going to press, more than 50 projects of the Circular Eco-Innovation Programme are still under way and their results sheet will be gradually incorporated in due time, together with other projects with later calls, into the new regularly-updated versions of this document.





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FEASIBILITY

The **Circular Eco-Innovation Programme** distinguishes the maturity of project results according to whether their solutions have reached environmental, technical, economic, commercial feasibility, or are already available on the market.



- ENVIRONMENTAL** The solution proposed significantly improves the environmental footprint of the product, service or process compared to the baseline situation, including Greenhouse Gas (GHG) emissions savings from a life cycle approach
- TECHNICAL** The suitability of the technological solution is demonstrated at a sufficient level of maturity to be implemented
- ECONOMIC** The product, service or process is manufactured, rendered or implemented at an affordable price
- COMMERCIAL** The new solution, yet to be commercialised or implemented, meets customer demands by providing more value than competitors
- ON THE MARKET** The first paid sales or implementation in the company's processes were achieved

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT

The European Commission's new Sustainable Products Initiative (SPI) promotes circularity requirements (CEN Standards 45552-45559) for durable products and equipment and lays down new categories of products and equipment for which regulations with mandatory requirements will be developed under the eco-design directive framework.

https://ec.europa.eu/growth/industry/sustainability/sustainable-product-policy-ecodesign_en



CIRCULAR BUSINESS MODELS

The European Commission's new green taxonomy establishes the preferential circular economy areas to be co-financed, both by the European Investment Bank and by the private financial sector. They include the areas aimed at the de-materialisation and the sustainability of the products, such as reuse, remanufacturing, retrofitting and repairing, and servitization, including pay per use. However, access to this required financing is only possible by showing the commercial feasibility of complex business models where digitalisation and advanced data management become an essential ally.

<https://www.eib.org/en/publications/the-eib-in-the-circular-economy-guide>



REDUCTION OF GREENHOUSE GASES (GHGS)

Emissions trading imposes a tax on major greenhouse gas (GHG) emitters. Introducing new raw materials or changing technologies can substantially reduce those emissions. Emission limits on vehicles and on other means of transport require, among other factors, a commitment to lightening. In turn, buildings aiming at 'zero emissions' need not only more sustainable materials, but also new efficient facilities. Rules regarding fluorinated gases... Several examples of the long list of non-energy regulations require innovation from the private sector to reduce GHG emissions.

https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_es

https://ec.europa.eu/clima/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_es

https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/nearly-zero-energy-buildings_en





ENVIRONMENTAL POSITIONING AND TRANSPARENCY

Achieving market confidence requires a high level of rigour in demonstrating reduced environmental impact of materials, products and services from a life cycle approach based on recognised and independently verified calculation methods. Large international corporations need to show their investors and shareholders the environmental sustainability of their business and above all, the environmental sustainability of their value chain, through independent external recognition. Global supplier evaluation systems (Ecovadis, NQC, CDP-Supplier Engagement Rating...) offer them a service that is less effort-intensive for SMEs in their chains.

https://ec.europa.eu/environment/eussd/smgp/initiative_on_green_claims.htm

<https://www.ihobe.eus/publicaciones/informe-vigilancia-ambiental-estrategica-abril-2022>



EXTENDED PRODUCER RESPONSIBILITY (EPR)

Manufacturers and importers of consumer goods need to take collective or individual responsibility for the environmental impact of their products. New European developments reward eco-design and prevention in the categories already regulated (motorcars, electrical and electronic equipment, batteries, tyres and packaging) and extend this instrument to new typologies (textiles, footwear, different uses of plastic, etc.). This instrument puts pressure on the suppliers of materials, parts and components in the value chains of the above product categories.

https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en

https://ec.europa.eu/environment/strategy/textiles-strategy_en



GREEN PUBLIC PROCUREMENT

The public sector is a major purchaser which accounts for 14% of the European GDP. Almost all European, national, regional and local administrations uphold, albeit on a voluntary basis, green public procurement criteria to a greater or lesser extent thanks to the new regulatory framework established by the European Commission. Public works and construction, urban and inter-urban mobility, waste and water utilities or urban furniture are some of the sectors most affected by this instrument.

https://ec.europa.eu/environment/gpp/index_en.htm

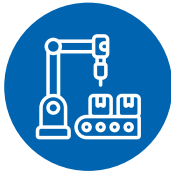


PLASTICS

There is an urgent need to address environmental issues which today cast a long shadow over the production, use and consumption of plastics. The EU Plastics Strategy calls for rethinking and improving how the plastics value chain works, which requires efforts and increased cooperation from all participants involved from plastics producers, recyclers and retailers to consumers. It also requires innovation and a shared vision to encourage investment in the right direction.

<https://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:52018DC0028&from=FR>





BEST PRODUCTION TECHNIQUES

The development of Best Available Techniques (BAT) for sectors with the highest environmental impact potential regularly results in additional emission limit requirements and, from now on, material and energy efficiency requirements for industrial processes. Fulfilling those requirements is a condition required to obtain and maintain an activity licence, called Integrated Environmental Authorisation.

<https://ec.europa.eu/environment/industry/stationary/ied/evaluation.htm#:~:text=The%20aims%20of%20the%20revision,of%20the%20E%20PRTR%20Regulation.&text=The%20IED%20evaluation%20was%20supported%20by%20several%20studies>



WASTE DISPOSAL REDUCTION

The combination of the new recently approved landfill tax with the European binding requirement to reduce waste discharging, and forthcoming regulation to limit or ban recyclable waste dumping, is generating a demand for solutions that avoid or minimise waste generation in production and recycling processes.

<https://www.boe.es/buscar/act.php?id=BOE-A-2022-5809>



RAW MATERIALS COSTS AND SUPPLY

Raw materials, excluding energy, represent over 60% of the manufacturing costs of industries on average, and are almost entirely imported. Global crises cause further fluctuations and uncertainties regarding commodity prices. Greater efficiency in material consumption is therefore the cornerstone of higher industrial productivity.

https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en



POLLUTION MINIMISATION

The European "Zero Pollution" strategy is tightening conditions for the use of chemicals, further restricting the limits of emission and immission of air pollutants to air (e.g. in urban areas) and water (e.g. microplastics and micropollutants). New regulations (e.g. on soils) are also being prepared to protect the health of people and ecosystems.

https://ec.europa.eu/environment/pdf/zero-pollution-action-plan/communication_en.pdf



CHALLENGES



GENERAL

- Cost and time reduction (Industry 4.0).
- Diversification in customers, markets and products/services adapted to new types of vehicles/mobility.
- Improving user experience in mobility.



ENVIRONMENTAL

- CO₂ and GHG emissions (97% occurs during the use phase).
- Energy efficiency and fuel savings (97% of energy consumption occurs during the use phase).
- Sustainable propulsion systems.
- Alternative fuels.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

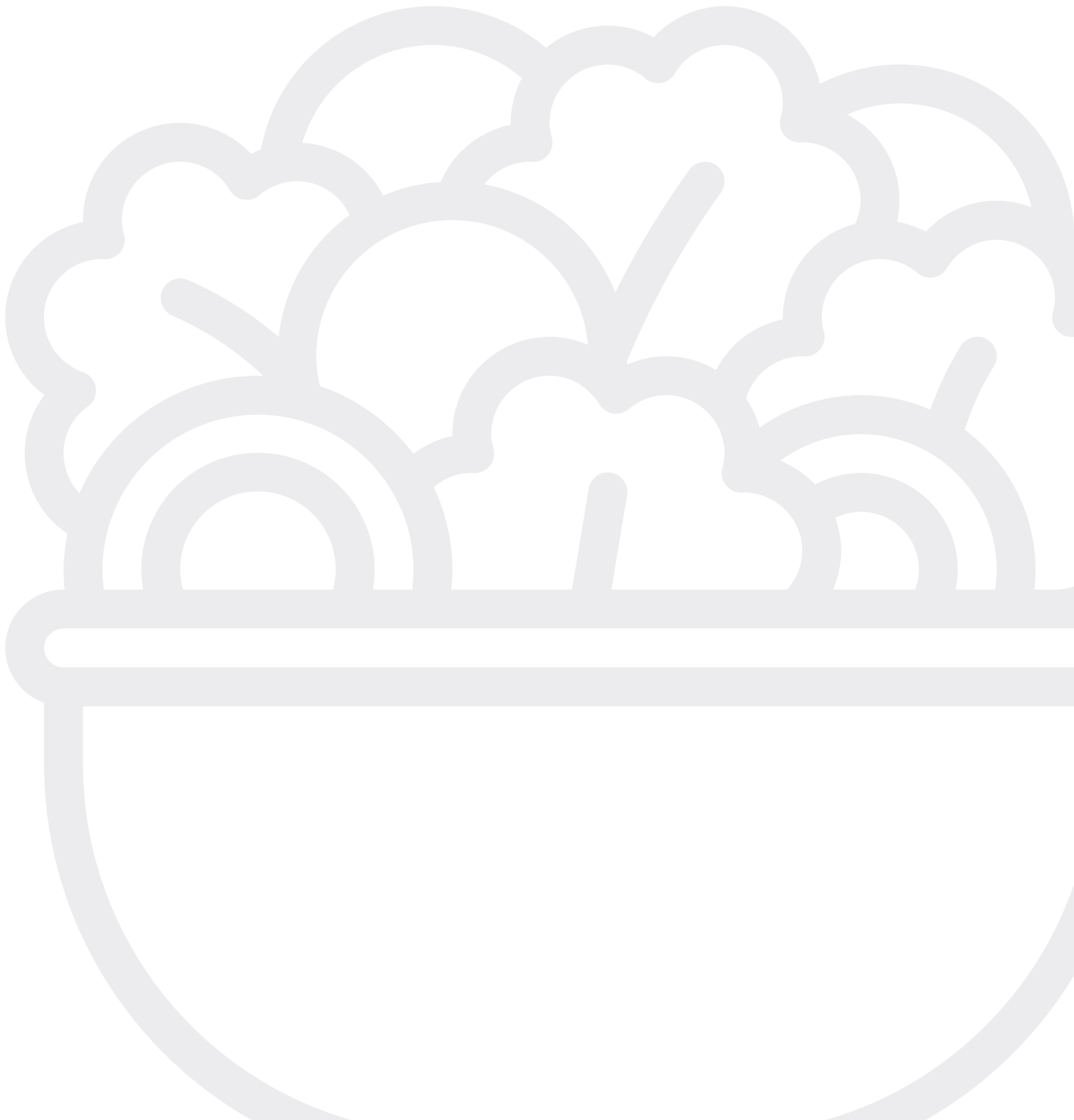
- Eco-design of components.
- Re-manufacturing vehicle parts.
- Improved processing techniques and vehicles.
- Cleaner technologies.
- Vehicle recyclability.
- Environmental drive of the chain.
- New, more sustainable materials.



COMPETITIVE IMPROVEMENTS

- Lighter components.
- Components made from waste.
- End-of-life treatment of parts.
- Reduced use of lubricants.
- Replacement of non-ferrous and lighter metallic materials.
- Semi-automated tooling repair.
- Reduced machining time.
- Environmental impact calculation.
- Energy efficiency of tyres.
- Recyclable and re-manufactured batteries.
- Fuel savings .
- Packaging savings.

FOOD



DRIVING FACTOR



POLLUTION
MINIMISATION



SOSTFEED

REUSING GRAPE STEMS AS A
FUNCTIONAL INGREDIENT FOR
RABBIT REARING

GRAPE STEMS ARE RICH IN FIBRE AND ARE THE ONLY WINEMAKING by-product that is managed as waste in the winery, with the consequent economic cost and associated environmental impact. Rabbit farming, on the other hand, involves a number of risk factors associated with diseases and high mortality rates, with the corresponding economic losses. In an attempt to minimise mortality rates, rabbit farming has traditionally opted for using drugs as a preventive treatment. Literature indicates that efforts to ensure the long-term sustainability of rabbit farming should focus on reducing the impact of feedstuff production, as it is the main contributor to the total environmental impact of rabbit farming.

BAIGORRI, one of the main wine producers in Rioja Alavesa, is leading SOSTFEED, with the participation of AZTI, the Technology Centre specialised in the recovery of by-products, and MIBA Agricultural Cooperative, the leading producer of animal feedstuff in the Basque Country.

COLLABORATORS





OBJECTIVES

- Reuse grape stems generated by the wine industry as a high-value, fibre-rich functional ingredient for animal feed, using the rabbit rearing sector as an example.
- Launching a new economic activity based on circular economy principles for this process.



RESULTS

- A new ingredient was obtained for animal feedstuff in rabbit farming, using grape stems in an amount of 10%, by means of a stabilisation process that combines highly efficient technologies to guarantee nutritional quality and safety.
- Emission savings of 2,000 tonnes of CO₂ equivalent per year by avoiding managing scraps as waste: mortality rate in rabbit farming was reduced by 10%; and 10% of conventional ingredients were replaced with by-products.
- An economic viability report and a business model for launching the new activity are available. Development of a turnkey processing plant.



CONCLUSIONS

- On the one hand, the implementation of this new activity boosts the environmental efficiency and competitiveness of the wine sector by improving sustainable use of resources, minimising waste management costs, and enhancing the environmental image of the sector. On the other hand, it also increases rabbit farming sustainability by providing a sustainable raw material and decreasing dependency on other ingredients.
- Environmental efficiency would be improved if transport distances between the warehouses where the scrapings are generated and the ingredient processing plant, were reduced. As such, on-site dehydration may be the most appropriate solution, although it may increase the cost of processing.
- Involving the entire value chain in the project has been key to guarantee its correct execution. In this case, collaboration with the Basque Federation of Rabbit Farmers was necessary to meet their requirements.
- Given that grape stems are generated seasonally at harvest time, the most realistic objective is to implement this industrial process in the 2023 harvest, as the lead times for the industrial building adaptation and availability of equipment limit the start-up.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



RAW MATERIALS COSTS AND SUPPLY



LANDARE

USE OF PLANT RESIDUES IN THE MANUFACTURE OF CONTAINERS AND PACKAGING

THE PACKAGING INDUSTRY IS CONTINUOUSLY SEARCHING FOR NEW MATERIALS to extend optimal food preservation conditions, avoid food waste, and replace materials that are less sustainable or appropriate for market situations. CEMOSA, the company developing LANDARE, focuses its activity on the transformation of cellulose from paper waste, but the paper market and the quality of the materials received at the plant (around 10-15% impurities) do not offer great stability; in addition, to the progressive decrease in the use of higher quality paper due to the emergence of new technologies. Being able to use alternative materials offering greater diversity of raw materials and a significant improvement in the environmental footprint is of very high interest. On the other hand, FELTWOOD has developed an innovative technology to transform agricultural plant waste into materials made exclusively from plant fibres that are fully compostable, using waste from agricultural processes, and that produce a reusable fertiliser as a by-product. The circular economy consultancy ZICLA has also participated in LANDARE.

COLLABORATORS



ZICLA®





OBJECTIVES

- Define and coordinate a value chain that demonstrates the technical, environmental and economic feasibility of processing agricultural vegetable waste to produce different types of packaging without making significant changes to the GCM moulding process.
- Obtain vegetable waste derived from cultivation or packaging of vegetables (lettuce, artichoke, tomato and courgette plants, etc.) from Basque and Navarre producers.
- Transform waste into material for packaging manufacturing, replacing the current destination of agricultural waste (composting and uncontrolled animal feed or landfill) with a more efficient and value-added process.
- Produce and characterise containers and packaging with a low environmental footprint from the materials obtained, measuring physical-mechanical properties, checking food compliance and even exploring certification possibilities (biodegradability, etc.).
- Launch new containers and packaging on the Basque market as products with low environmental footprint and with the same technical characteristics as other packaging materials, and study market response.



RESULTS

- Estimated generation of viable waste for the work sought of 35,000 tonnes per year in the Basque Country and Navarre.
- Tested feasibility of transforming this waste into raw materials using FELTWOOD's patented process.
- Defined specifications to be met by intermediate raw materials to go into industrial production successfully.
- Prototyping of trays with subsequent industrial production testing and market validation. The trays obtained have yielded positive results.
- Potential to replace 875 tonnes of recycled paper per year with agricultural waste, resulting in 437.5 tonnes of stimulating fertiliser.
- Potential savings of 365 tonnes of CO₂ equivalent per year, even compared to a process already using recycled materials as a raw material.



CONCLUSIONS

- Industrially-viable concentrations of agricultural waste can be achieved in moulded fibre manufacturing.
- The technology has yet to be scaled up to industrial design and improved to increase the percentage of agricultural waste in new moulding mixes.
- The costs of pre-processing waste to obtain valid raw materials in the production process are high and prevent industrial implementation, at least for the time being.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



CLCIRCULAR

REUSABLE IOT DEVICES FOR REAL-TIME MONITORING OF GOODS AND TO REDUCE PRODUCT LOSS

50% OF GOODS ARE TRANSPORTED IN SEA CONTAINERS, AND MORE THAN 50% OF THEM ARE REPORTED AS LOSSES. According to the FAO, one third of the food produced each year is wasted, approximately 1.6 billion tonnes of food, and about 14% of this happens during transport. These losses have a huge environmental, social and economic impact.

The good news is that these losses can be reduced by up to 75% with timely and quality information, but the technologies that enable this are very expensive, and can only be applied to high value-added products. CLCircular offers a real-time monitoring service for the logistics chain, using reusable rentable IoT sensors that collect data on environmental parameters during transport and storage of perishable products on a cloud, to gain visibility and control, allowing processes to be optimised and losses to be reduced. GAIKER Technology Centre participated as a collaborator in this project with CLCircular.

COLLABORATORS





OBJECTIVES

- Develop the world's first reusable thermograph device.
- Reduce the environmental impact of the product in its life cycle, extending the life of batteries and incorporating environmentally-friendly and recyclable materials.
- Reduce manufacturing costs.
- Improve the competitiveness of the organisation by shifting to a new business model associated with device rental.
- Obtain an innovative solution with the potential to be disseminated on a global scale due to its exemplary nature in the circular economy.



RESULTS

- A reusable and affordable device to monitor the cold chain in real time.
- Increased durability of batteries and the device itself, with SIM card replacement facilities.
- Guarantees in relation to information security: real-time information to guarantee safety and quality of products; incorporation of a Blockchain seal to improve transparency and secure communication with corporate clients; and correlation of data to exploit the full potential of big data and optimise logistics.
- Calculation of the impact of operations on CO₂ or food saved in the same system.
- Possibility to create smart labels with additional product or logistics information.
- 90% reduction of environmental impact during the device life cycle, compared to non-reusable dataloggers.
- Reduction of 2.25 kg of scrap per datalogger.
- Reduced perishable product waste (between 70 and 140 tonnes of fruit) per datalogger.
- Reduction of over 20,000 tonnes of CO₂ equivalent per year through electronic and food environmental savings.



CONCLUSIONS

- A completely new solution on the market has been achieved, replacing the purchase of a device with hiring a service: the use of the device is associated with a specific corporate client, guaranteeing real-time data and total confidentiality. Once this service is completed, the device is retrieved, checked and put back into service.
- One of the keys in the development process was to have the support of other companies and bodies from both the public sector (with their grant and funding programmes, training and development of the team), and the private sector (supplier companies and technology centres in the area, clusters, accelerators of companies with an impact, financial bodies and clients to carry out the tests).
- The next phases focus on expanding international commercial action and continuing development and improvement according to tests, recommendations and needs identified in the end customer company.

DRIVING FACTOR



ENVIRONMENTAL
POSITIONING
AND TRANSPARENCY



ELIKAPEF

ENVIRONMENTAL FOOTPRINT
OF FOOD PRODUCTS IN THE
BASQUE COUNTRY

WASTE AND EMISSIONS FROM THE FOOD CHAIN ACCOUNT FOR APPROXIMATELY 10% OF THE EU TOTAL. In 2011, the European Commission stressed that consumers have the right to know the environmental impacts of products and to receive adequate information to easily identify a truly sustainable option. However, the increasing number of initiatives for assessing and reporting environmental performance creates confusion among consumers and additional costs for companies. In this context, the 2013/179/ EU: Commission Recommendation of 9th April 2013 defined common methods to measure and communicate the life cycle environmental performance of products, services and organisations based on a comprehensive assessment of their environmental impact throughout their life cycle, called the Product Environmental Footprint (PEF). Implementing this methodology provides a competitive advantage for those companies that apply it to their products, but there are barriers to its implementation, such as the difficulty of data collection and information management in a globalised value chain.

EROSKI, the distribution co-operative, led ELIKAPEF with the collaboration of AZTI Technology Centre, the industrial software company INGENET, the natural water bottling company BALENZATEGUI, and the wine producer ERREKALDE TXAKOLINA.

COLLABORATORS





OBJECTIVES

- Implement a system and methodology in the food chain that allows the calculation and effective reporting of the environmental footprint of food products in the Basque Country, according to the European Commission directives.



RESULTS

- Development of an innovative tool, pioneering to the extent that the European Commission's Environmental Product Footprint methodology has been in full development in parallel to ELIKAPEF development, which simplifies environmental information collection and facilitates its management for the calculation of environmental footprints and comparison of products and suppliers.
- Definition of certification requirements adapted for verification of the product environmental footprint calculation in the food sector.
- Methodology validation with calculation of environmental footprints of a txakolí wine product and a bottled water from two Basque food SMEs. The results show a better environmental profile for both products than the European benchmark for these categories.
- B2B communication protocol to provide a competitive advantage to companies that do not reach the end consumer.
- Preparation of guidelines for the implementation of best environmental techniques for the wine and water sectors.
- Assessment of consumers' knowledge of some of the main environmental labels. The results show a great lack of knowledge of these labels and that preferences in environmental information communication to facilitate purchasing are combined colour and character systems.



CONCLUSIONS

- ELIKAPEF's work has allowed the consolidation of the value chain and a continuation of the line of work with new initiatives.
- The tool flexibility also allows EROSKI to move forward with the collection of environmental information on products in categories other than those of the project.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



ENV C

ECO-DESIGN OF SINGLE-USE FOOD PACKAGING

THE ANNUAL PACKAGING DECLARATION AND THE REPORT ON PACKAGING

placed on the market annually submitted by GASTRONOMIA BASKA confirmed that the company is close to the limit (21 t) at which it would be obliged to submit a reduction study. Market research shows a growing concern shared by society as a whole, about the use of plastic materials, which is also continuously reflected in European and national legislation and opinion articles. As a result, the use of polypropylene (PP) packaging for food dishing up has been identified as a risk by the company's Environmental Issue Assessment.

GASTRONOMÍA BASKA, promoter of ENV C, focuses its main activity on the preparation and service of prepared meals for different collectives. Other participants in ENV C include GUTIERREZ ANGULO, a packaging and food supplier and LABORATORIO GESSYMA GALEA, for tasting and shelf-life testing.

COLLABORATORS





OBJECTIVES

- Develop more sustainable packaging which facilitates waste management by users.
- Maintain the necessary performance to continue to meet service and quality standards, with a minimum service life of 12 days.
- Reduce the amount of single-use plastic packaging by approximately 15% per year.



RESULTS

- The carton/paper packaging developed meets the requirements for sealing, airtightness, gas barrier, openness and microbiological analysis.
- 15% reduction of single-use plastic packaging placed on the market by replacing it with a manageable packaging in the cardboard/paper container.
- The use of compostable packaging as a solution is discouraged, due to the lack of containers for organic waste management at the delivery points of food distributed (workplaces, schools, etc.).



CONCLUSIONS

- Projections point to an annual growth rate between 5% and 6% for the ready meals market. Consumers' appetite for ready meal solutions is growing, while the catering industry is increasing supply of ready meals, combined with the emergence of new products and formats.
- Extending the shelf life of food prepared in sustainable packaging is essential to reduce food waste, water and electricity consumption in different food handling operations and to reduce emissions at the distribution stage. Research into new materials is fundamental to furthering knowledge in this field.

DRIVING FACTOR



PLASTICS



POLLUTION
MINIMISATION



BIOKORDA

**DEVELOPING BIODEGRADABLE
ROPES FOR TUNA FISHERIES**

RECYCLING HELPS TO CURB WASTE DISPOSAL, but implementing recycling strategies in certain fishing activities is complicated. The fishing method used by tuna freezer vessels is purse seine (64% of the catches), which consists of a plastic net that is extended vertically into the water around tuna. Tuna freezer vessels can fish by free school or by floating objects or fish aggregating devices (FADs), which attract tuna. FAD sets are positive in 95% of cases and as a result thousands of FADs are released into the oceans every year, contributing to increase marine litter, one of the most serious environmental problems faced by our environment today.





OBJECTIVES

- Reduce the environmental impact of ropes left on seabed after the fishing process is finished.
- Use biodegradable materials to manufacture ropes, without diminishing the rope technical properties, thus responding to the demand of the fishing sector.



RESULTS

- LCA of the main environmental impacts of conventional plastic ropes of FADs was conducted: abandonment of ropes at sea and consumption of plastic materials for manufacturing.
- A new product was obtained: the TUNAKO BIO rope, manufactured using a mixture of cotton and tencel (both of natural origin and biodegradable) as raw material, and using braiding with crimp in the manufacturing process.
- A new product was obtained; the NATUKOR rope, with a similar composition, but without crimping in the braiding.
- The yarns used in NATUKOR and TUNAKO BIO come from textile waste from a local supplier. No dyes, coatings or other chemical additives are used; and since they are made of non-plastic materials, the extrusion stage of the production process is eliminated.
- 74% to 93% less environmental impact compared to conventional ropes, depending on the environmental impact category considered.
- 5% contribution to the company's turnover.



CONCLUSIONS

- Since the new ropes are ready to be marketed, a new business line was opened for ITSASKORDA, bringing significant economic benefits for the company and addressing the demand for more sustainable products in the fishing sector.
- BLOKORDA was necessary to achieve major valuable technical expertise on the environmental performance of ITSASKORDA's products, taking into account whole life-cycle perspective, which will be replicable with new products in the future and in other sectors.

DRIVING FACTOR



PLASTICS



POLLUTION
MINIMISATION



CERO GRANZA

**ZERO PELLETS ON PLASTICS
COMPANY FLOOR**

ONE OF THE SOURCES OF MICROPLASTICS THAT END UP IN SEAS AND OCEANS ARE PELLETS used by plastics industries as raw materials, which due to spills or poor cleaning, end up on the floor of different facilities and are transferred to the sea through drainage systems. PLASTIGAUR, a company dedicated to manufacture flexible films for different sectors located in Andoain (Gipuzkoa), wants to tackle the proper containment of these products, and prevent pellets used at their premises from entering waterways and ending up in the sea. Each link in the chain, in this case pellet producing companies, the transport sector, people working in bulk storage units and plastic processing companies, has a role to play in preventing pellet loss.





OBJECTIVES

- Implement a methodology to reduce to zero the amount of chips present on the soil of facilities and completely avoid dumping of this waste stream.
- Avoid the environmental impact, economic cost and occupational hazards that may be caused by spillage of chips.
- Become the first Basque company to obtain an Operation Clean Sweep (OCS) certification, and extend the knowledge and expertise acquired to other companies in the sector.



RESULTS

- Collection of 11,150 kg per year (2020) of dumped raw material, which has been re-incorporated as a recovered resource by a management company. Avoiding such discharge into the environment and the loss of raw material represent emission savings of 23.42 tonnes of CO₂e.
- AENOR Conformity Certification for the OCS Scheme for PLASTIGAUR, which becomes the first packaging company in Spain to achieve it.
- Successful implementation of PASTIGAUR OCS system, involving everyone in the organisation and extending the “zero chips” target to the entire value chain, which was well received by suppliers and hauliers.



CONCLUSIONS

- In order to maintain the long-term commitment of ZERO CHIPS, it is important to establish a system of indicators to control and monitor results, which will determine the need to make corrections and together with the continuous awareness-raising actions planned, will enable the commitment to be maintained. Moreover, by means of an audit, AENOR accredits a follow-up of the correct operation and maintenance of the OCS scheme.
- PLASTIGAUR will collaborate in the preparation of a Guide of Good Practices by IHOBE, where PLASTIGAUR experience as a success story will be made known to the rest of the companies in the sector. It is estimated that plastic processing companies will be able to reduce pellet losses to the environment by 90%.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



FIREPOST

FLEXIBLE PACKAGING FILMS MADE USING 70% RECYCLED PLASTIC

PLASTIGAUR INTENDS TO TAKE ECO-DESIGN TO THE NEXT LEVEL in the flexible packaging sector, with an innovative range of films made using up to 70% post-consumer recycled (PCR) plastic, of reduced thickness and maintaining their functionality. PLASTIGAUR's strategic goal is to be a sustainability benchmark in the sector.





OBJECTIVES

- Reduce environmental footprint of flexible plastic packaging while maintaining the productivity of current products, so that reduced environmental impact and economic growth go hand in hand.
- Develop new plastic films in the range of products currently produced at PLASTIGAUR, by cutting thickness and developing formulations with up to 70% PCR plastic.



RESULTS

- Reduced consumption of virgin plastic raw materials in relation to introducing the corresponding percentage of recycled plastic in each product.
- Reduced corporate environmental footprint for PLASTIGAUR and the products it generates.
- Use of plastic waste generated by the market.
- Lower thickness of flexible film and thus, a reduction in the amount of raw material consumed, the environmental footprint of the product itself, and the amount of waste generated at the end of the life cycle.
- Increased transport efficiency and therefore further reduction in the product environmental impact.



CONCLUSIONS

- FIREPOST transcends the scope of the company and covers the entire plastics value chain, thus increasing the impact of PLASTIGAUR's performance on the circular economy, and follows the 7 Rs of the circular economy model.
- Thus, FIREPOST starts with *Rethinking*, and through eco-design, *Redesigning* the products manufactured; Together with this action, Reducing both thickness and consumption of virgin raw materials; and Finally, *Recycling* whereby a considerable amount of plastic waste that is not properly managed will be recovered. The synergy of all these actions is essential for PLASTIGAUR to adapt to market demand while maintaining the company's sustainability and profitability.

DRIVING FACTOR



PLASTICS



RAW MATERIALS COSTS AND SUPPLY



REFILM

RECYCLED PLASTIC FILMS FOR THE PACKAGING INDUSTRY

THE VALUE OF PLASTIC WASTE DUMPED IN BASQUE LANDFILLS EXCEEDS EUR 12 MILLION PER YEAR. When plastic is not correctly disposed of in landfills, it often ends up in the sea due to poor waste management. Consumers may be liable for improperly disposing of the products they use, but the plastics manufacturing sector must ensure it provides better control over the materials it handles and the processes it carries out, minimising the amount of waste it generates.

PLASTIGAUR, the company behind REFILM, manufactures plastic film for the packaging industry, which generates plastic waste in its production process, which in turn, has both an environmental and an economic impact.





OBJECTIVES

- Develop new films incorporating a specific proportion of recovered material from waste generated by PLASTIGAUR.
- Manage all rejects generated as a result of the activity.
- Increase production process efficiency.



RESULTS

- Films incorporating a specific percentage of recovered material were obtained, with properties that allow their application in the secondary and tertiary packaging sector.
- The technology used can be adapted to manufacture standard products by incorporating recovered material.
- Significant savings in raw materials due to reuse of previously rejected material.
- 24% reduction in the carbon footprint of the production of the new films.



CONCLUSIONS

- REFILM's main challenge is to use recycled material in primary packaging in the food sector, since stringent regulatory requirements are set for food contact materials (FCM) for consumers' health and safety reasons. Material traceability throughout the entire value chain is a necessity to overcome this barrier.
- Many clients are still reluctant to use recycled materials due to lack of quality, availability and adaptability, and major brands tend not to accept recycled materials due to functionality, application, processing or legislation.
- PLASTIGAUR has introduced new films made from recycled material to its catalogue, and they are already being tested by some of its main customers. This market launch enables PLASTIGAUR to recycle a large part of the waste it generates.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



PLASTICS



GREEN PACK

OPTIMISED ENERGY CONSUMPTION IN PET BOTTLE BLOW MOULDING

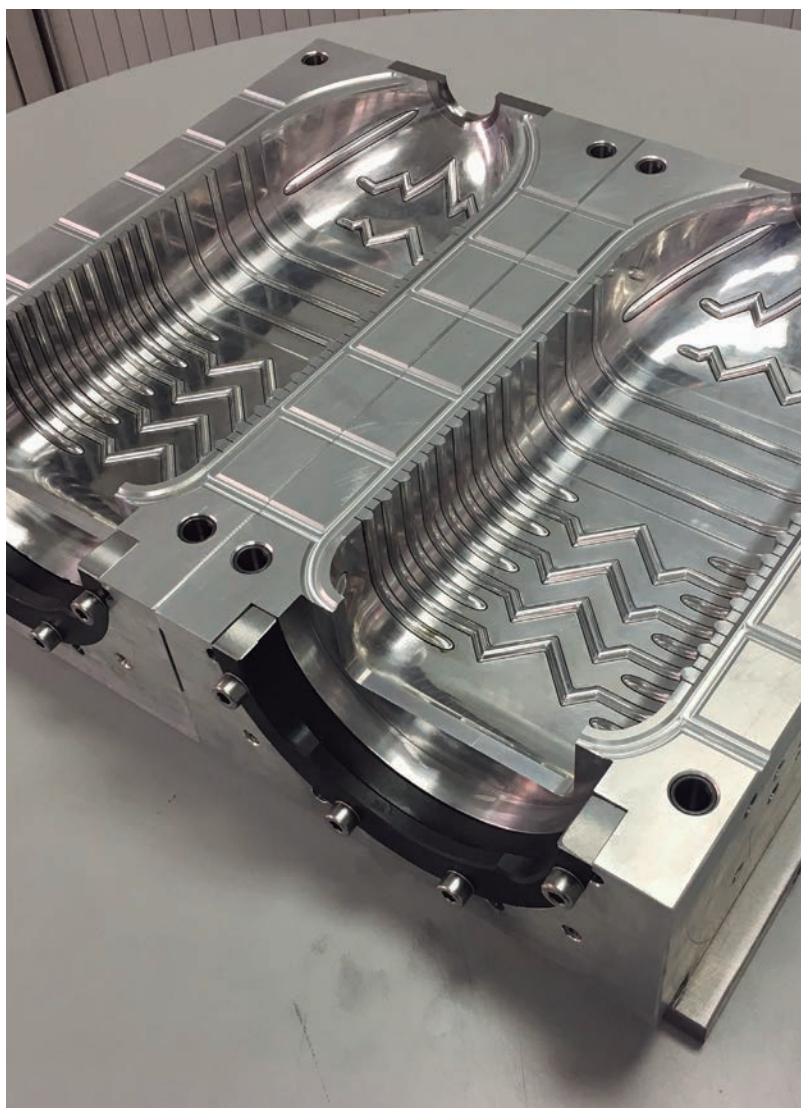
THE PRODUCTION OF POLYETHYLENE TEREPHTHALATE (PET)

bottles can be carried out in two independent stages, whereby the preform injection and blowing are performed on machines that can be optimised separately. The preforms are positioned in a transport conveyor from an automatic feeder. Then preforms pass through a system of furnaces with IR lamps where they are softened and finally stretched and blown with high-pressure air into a mould. This is the technique used for the manufacture of bottles of water, soft drinks, juice, etc.

GREEN PACK is a project managed by UROLA, a cooperative that designs and creates solutions for the manufacture of containers using blow moulding technology, where GALBAIAN, a consultancy specialising in industrial property and the AZTERLAN Technology Centre, have also participated.

COLLABORATORS





OBJECTIVES

- Obtain a new design of PET bottles and moulds to allow the use of high-pressure compressed air to be reduced from 40 to 25 bar in the bottle manufacture, with energy savings of around 37%.
- Eco-design of the bottle manufacturing process by targeting both the container design (allowing it to be blown easily) and the mould itself (increasing the evacuation capacity of the air trapped between the container and the cavity).
- Identify the right geometry of the bottom of the container to be formed correctly without the need for high internal pressure, as the impact of this effect can account for 40% of the project's success rate.



RESULTS

- The mould was developed and manufactured according to eco-design criteria.
- A pilot test was conducted in conditions similar to real conditions in a URBI-2L machine installed in a corporate client facility.
- Low blowing with a capacity of 2,100 bottles per hour would cut electricity consumption by approximately 13.1%. For the functional unit under consideration, this represents a saving of 117.69 MWh, while GHG emissions are reduced by 41 tonnes of CO₂e.
- Environmental disadvantages in terms of depleted mineral and abiotic resources, ecotoxicity (water) and human toxicity (non-carcinogenic).



CONCLUSIONS

- The GREEN PACK solution makes it possible to reduce the size of the compressor at the time of purchase, reducing installed power from 110 kW to 75 kW. The savings obtained in different pressure ranges allow for a two-year payback for the corporate client in the event of replacing an existing mould.
- The need to introduce new machining steps during mould production undermines to a certain degree the overall environmental performance of the solution.
- Further steps to be taken at GREEN PACK will focus on correct industrialisation and standardisation, and adjustment of operating costs.

CHALLENGES



GENERAL

- Need for alternative sources of raw materials.
- Introducing 4.0 tools and other innovation and quality improvement technologies.
- Legal requirements on the presence of substances of concern in food packaging.



ENVIRONMENTAL

- Reducing emissions and impact on livestock and mixed farms and aquaculture.
- Reducing food waste.
- Promoting more efficient use of plastics.
- Using environmental standards on products and services.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Environmental drive of the chain.
- Recyclability of plastic packaging.
- A more responsible food consumption model.
- Using surplus food.
- Green products in Green Public Procurement for schools and public institutions.



COMPETITIVE IMPROVEMENTS

- Innovative use of sector by-products as own raw material or for other sectors.
- Recovering organic waste for local upcycling.
- Removing single-use and non-recyclable plastic bags.
- Encouraging the sale of unsightly products.
- Improving labelling to meet new requirements including sell-by and best before dates.



AUTOMOTIVE



DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



RAW MATERIALS COSTS AND SUPPLY

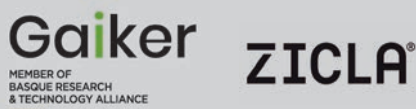


ProTIER

INTRODUCING CIRCULAR ECONOMY PROTOCOLS IN A TIER 1 AUTOMOTIVE COMPANY

AURIA IS A TIER 1 AUTOMOTIVE COMPONENTS COMPANY (direct supplier to car manufacturing companies). It manufactures floors (front and rear) and side panels for vehicles from several layers of different plastics, which are difficult to separate from each other and therefore to recycle. However, in the manufacturing process of both, large offcuts are discarded and due to the lack of adequate recycling processes end up in landfill. Under standard production conditions, discarded offcuts can amount to 3,000 tonnes per year. In ProTIER, AURIA relied on the GAIKER Technology Centre and the circular economy specialist company ZICLA.

COLLABORATORS





OBJECTIVES

- Exploit and optimise material resources in the production of flooring and acoustic and thermal insulation for the automotive industry.
- Recycle up to 1,500 tonnes per year of waste currently sent to landfill.
- Use recycled raw materials in new products, with at least 15% concentration; and reduce the corresponding consumption of virgin raw materials.
- Introduce secondary raw materials in other sectors.



RESULTS

- Optimisation of shredding and separation processes of plastic materials from AURIA soil trimmings.
- Procurement of approved recycled material for own production.
- Industrial implementation of a process capable of handling up to 1,800 tonnes of material per year.
- Manufacture and validation in production of new boards with 15% of the recycled material obtained.
- Reduction of 700 tonnes of virgin raw material per year.
- The new process achieved a reduction of 3,400 tonnes of CO₂ equivalent per year.



CONCLUSIONS

- ProTIER has implemented in AURIA an industrial process for the treatment and separation of plastics that form floor layers of the cars it manufactures; and has recovered the most interesting material from them to incorporate it again in its new products.
- This implementation was achieved thanks to the characterisation of the materials and optimisation of the production parameters in the pilot plant for study and treatment of plastics at GAIKER, and to the samples obtained on an industrial scale at the plant. In addition, there is a surplus of secondary raw materials which is undergoing approval processes on other markets.
- The process has been technically demonstrated and its industrial implementation has been achieved.

DRIVING FACTOR



BEST PRODUCTION
TECHNIQUES



BICAST

DEVELOPING ADVANCED COMPONENTS FOR ENGINE SLEEVES

ENGINE SLEEVES ARE USUALLY MADE OF GREY CAST IRON WITH A CHEMICAL COMPOSITION RICH IN CRITICAL ELEMENTS SUCH AS CHROMIUM, nickel and molybdenum. However, there are other technologies not yet implemented in the Basque Country, such as spheroidal casting by centrifugal technology, or high-silicon spheroidal bimetallic casting, which produce lighter components, lower machining costs, improved mechanical properties and greater durability. These features translate into a lower environmental impact by reducing fuel consumption and, therefore, emissions into the atmosphere. Thus, the introduction of new alloys in centrifugal technology to achieve new products poses a challenge for the Basque foundry industry, which needs to specialise in premium components with advanced properties within the European market.

CENTRICAST is a company specialised in the centrifugation of tubes and manufacture of engine parts and components. In BICAST, CENTRICAST worked in partnership with AZTERLAN, the Technological Centre specialised in metallurgy.

COLLABORATORS





OBJECTIVES

- Achieve the manufacture of new engine sleeves with improved properties that meet mechanical properties and durability requirements, by means of spheroidal and bimetallic casting.
- Extend the engine useful life.
- Improve the efficiency of the materials and metals used in manufacturing, as well as energy consumed.



RESULTS

- Obtained spheroidal cast iron tubes with high silicon content that meet the required mechanical properties and, especially, showing results of elongations greater than those established and required by the standard.
- Obtained bimetallic components by optimising the manufacturing parameters and adjusting the chemical composition. The manufactured components show good bonding between materials and none of the problems characteristic of these components, such as gaps, oxides and particles such as paint or slag from the process were observed.
- Reduced overall consumption of critical elements: 6% reduction of CO₂ equivalent emissions, and 3% reduction in abiotic resource depletion potential.



CONCLUSIONS

- The results of elongations greater than those established for spheroidal cast iron offer possibilities for different applications that have not been considered in BICAST.
- Adequate dissemination has not been possible due to the pandemic, and therefore there is a significant risk that the components developed will be of interest in the current market.
- An environmental assessment at different stages of the project should be conducted, since the process is not always beneficial in all environmental issues involved.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



ECOTAPE

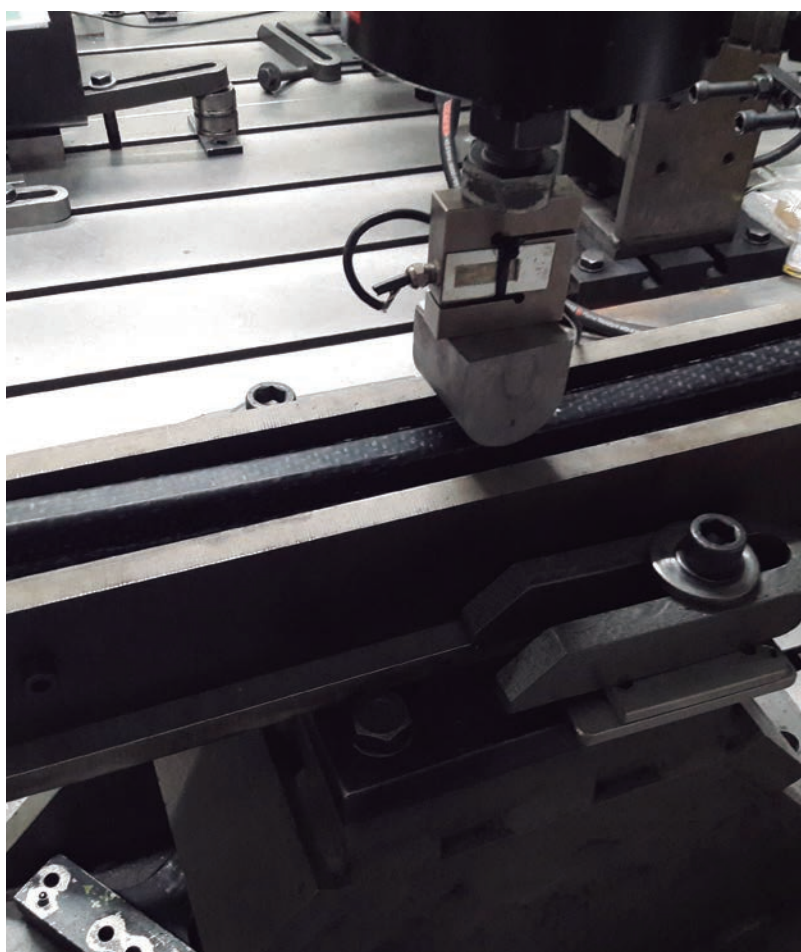
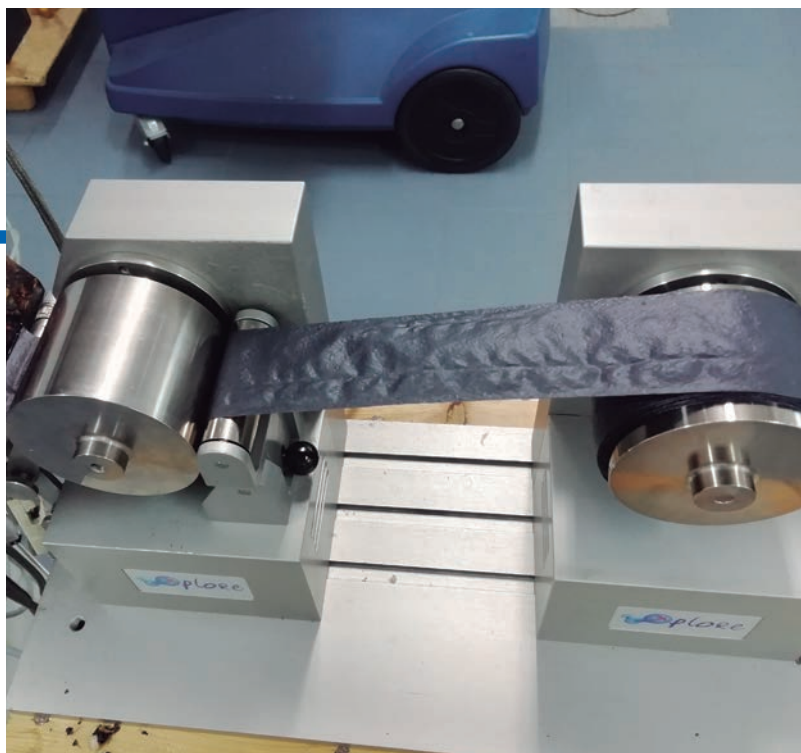
RECYCLED POLYPROPYLENE COMPONENTS FOR TRANSPORT VEHICLES

IN GENERAL, THE PRIORITY FOR THE NEW AUTOMOTIVE AND TRANSPORT COMPONENTS sector is to reduce the overall weight of the vehicle to reduce CO₂ emissions, improve power and range of electric vehicles, and also to comply with recycling regulations. Continuous Fibre Reinforced Thermoplastic (CFRT), are innovative plastic composites with high technical characteristics, low density, good weatherability and good recyclability. The fact that they are used to replace metal and/or technical plastics represents a major technology and market opportunity. It is currently used at a very early stage because manufacturing and processing techniques are expensive, in addition to a lack of product range. Obviously, the possibility of obtaining thermoplastic tape based on thermoplastic matrices from recycled sources does not exist at all.

CIE Automotive is a processing specialist and masters all available technologies available for the manufacture of automotive components and sub-assemblies. GAIKER Technology Centre and RECYCLAIR, the waste management company, also collaborated with ECOTAPE.

COLLABORATORS





OBJECTIVES

- Create a new generation of composites to be used in the manufacture of components for land transport vehicles with a structural function; and make the use of these composites more affordable through design, innovation and optimisation of their manufacturing processes.
- Introduce a range of more competitive parts in the transport sector for which there is currently no competition in our environment, maintaining the technical performance required for the current part, and with the possibility of diversifying to other sectors in a lean way.
- Re-introduce polypropylene (PP) plastic fractions that are currently used for energy recovery when mixed with other materials, into the economic cycle as secondary raw materials.
- Create a thermoplastic tape based on recycled PP: setting up the work procedure, selecting and classifying the source of PP to guarantee the homogeneity of the resulting product; and adapt the thermoplastic matrix specifications to the particular needs of ECOTAPE.



RESULTS

- Complete production cycle of a part used in the roof unit structure - from concept and creation of the ad-hoc composite sheet to manufacturing the demonstrator or prototype, including its design, transformation process, manufacturing the necessary tooling and product characterisation.
- Estimated potential savings of 2,700 tonnes of CO₂ equivalent per year.



CONCLUSIONS

- ECOTAPE's main technical limitation is availability of homogeneous and purified recycled PP fractions, as well as potential lack of interaction between a recycled plastic matrix and the reinforcement material itself.
- ECOTAPE must continue developing with several lines of action: optimisation of processing techniques to obtain a competitive tape; improving mechanical performance; reducing the thickness of the designed components; and further research into purifying the recycled PP stream to minimise the presence of foreign matter.
- Although the environmental impact has been positive, at the moment, the need for a technically improved tape to be more competitive prevents escalation to an industrial processing line for thermoplastic tapes based on recycled matrices.

DRIVING FACTOR



PLASTICS



RAW MATERIALS COSTS AND SUPPLY

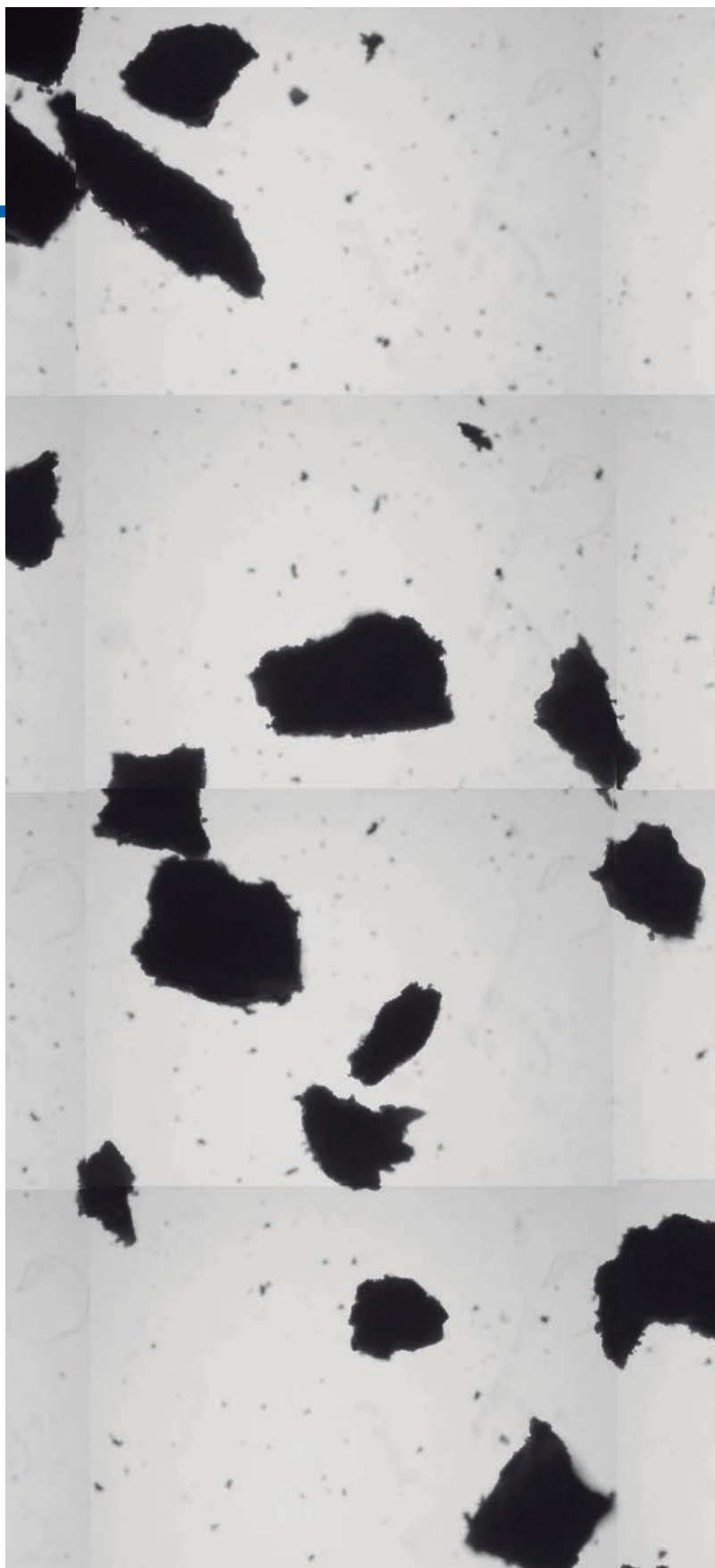


REGENERATE

DEVULCANISATION OF WASTE RUBBER TO BE RETURNED TO LIFE CYCLE

UNTIL NOW, THE BEST WAY TO COMPLY WITH WASTE HIERARCHY AND AVOID sending by-products of rubber manufacturing to landfill has been to grind them into particle sizes of less than 10 millimetres so that they can be reused to manufacture rubber products. Then, these finely ground granules are mixed with virgin rubber in a percentage permitted by the product quality. Today, new technologies making it possible to achieve something akin to a reversal vulcanisation of rubber, i.e., the reason for its traditional non-recyclability, have begun to emerge. These technologies, called "regeneration", basically consist of controlled breaking of sulphur (S) bonds without excessively affecting the necessary carbon (C) bonds. CIKAUTXO, developer of REGENERA, is a leading company in the innovation of rubber and plastic products.





OBJECTIVES

- Identify and assess available devulcanisation technologies by obtaining pilot samples of the waste rubber treatment result with these technologies.
- Obtain official approval of secondary raw materials obtained in order to introduce them in applications other than the automotive and domestic appliance sectors, such as, for example, playground floors or athletics tracks, etc., with subsequent reductions in environmental impact and economic savings.



RESULTS

- Identification of different devulcanisation technologies.
- Testing of the technologies identified, subjecting raw materials obtained to compatibility tests with CIKAUTXO specifications in its different product lines; discarding those technologies that are not suitable and carrying out approval processes with the most compatible technologies.
- An economic assessment of the viable alternatives and drawing conclusions to design an implementation plan over time.



CONCLUSIONS

- This technology is at an increasing TRL level and although it lacks the quality standards typical of mature sectors, and the supplier companies identified are also emerging and without structured supply, applications are gradually appearing.
- Economic costs related to transformation would only be profitable in a scenario of rising raw material prices, which is currently the case, and this will allow the project to be developed.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



EXTENDED PRODUCER RESPONSIBILITY (EPR)

ekidegroup
We are committed to the solution

VA4RM

MACHINE VISION FOR REMANUFACTURING OF AUTOMOTIVE PARTS

VA4RM IS AN AUTOMATED RECOVERY PROCESS OF AN AUTOMOTIVE COMPONENT according to its level of wear. The detection of these defects is complex due to multiple existing benchmarks, the area to be inspected, the nature of the component and the intra-class variation. Therefore, it is necessary to create complex smart algorithms that are capable to detect and measure defects quickly. The system has multiple environmental, technological and economic benefits which can be applied to different metal products and the automotive sector, that account from 14% to 17% of the manufacturing value in Europe, respectively.

The engineering firm EKIDE is leading VA4RM with the collaboration of VICOMTECH Technology Centre.

COLLABORATORS

vicomtech

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

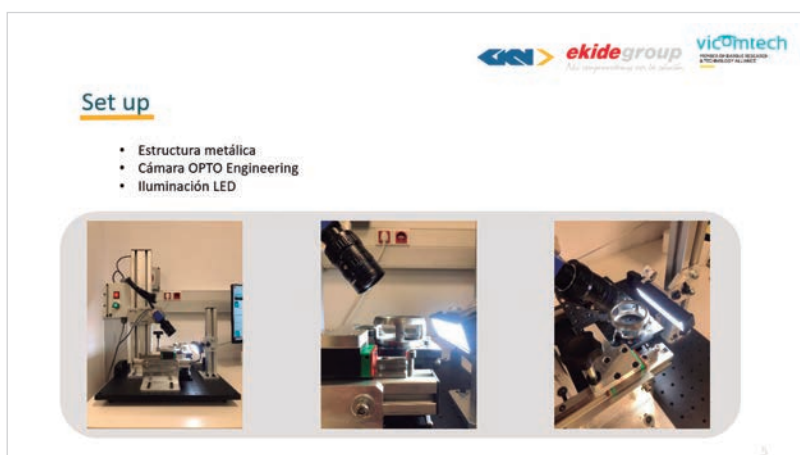
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Replace manual inspection with automated inspection based on AI allowing unified decision-making criteria, thereby increasing productivity in classification and diagnosis of parts and reducing errors derived from human factors in these processes.
- Improve the company's competitiveness and production by reducing material waste, driving the transformation of plants towards eco-efficiency.



RESULTS

- Development of detection system that allows maximum highlighting the defect in any product by means of oblique illumination. The developed algorithm is based on model assembly and combines a segmentation algorithm with an object detection algorithm.
- Full validation using a set of components not used in training, obtaining 100% correct classification results.



CONCLUSIONS

- The current validation data guarantee the technical feasibility of VA4RM to solve the problem posed.
- Regarding industrialisation, further steps should involve the creation of a more complete application with a graphical interface and a communication layer with the factory database.
- Training with more samples is necessary to obtain a model that is more robust to changes and to generate a more sophisticated decision layer that can be configured by the corporate client.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



RAW MATERIALS COSTS AND SUPPLY



REPTOOL

RECOVERY OF HOT FORGING TOOLS

HOT FORMING TOOLING WEAR OUT WITH USE AND GENERATE A LARGE VOLUME OF SCRAP, resulting in high economic and environmental costs for companies. Hardfacing by traditional welding techniques is not very effective on new generations of high-strength steels currently used by the industry for the manufacture of forming tools. However, fusion hardfacing or hard surfacing techniques based on powder and wire deposition using non-conventional technologies, such as electron beam and laser, are nowadays a real alternative to recover forming tools.

ESTAMCAL, a company of the Satuerca Group specialised in producing special parts basically for the automotive sector, has led REPTOOL, a project where TEKNIKER Technology Centre has also collaborated.

COLLABORATORS





OBJECTIVES

- Study the technical and economic feasibility of the recovery process of metal tools and tooling used in hot forging manufacturing processes of automotive parts, by means of laser hardfacing and hardfacing processes.
- Recover hot forming tools used by ESTAMCAL in its own production process, such as ejectors and inserts.



RESULTS

- The most suitable processing parameters were obtained for repairing or reinforcing inserts (either on the active side or the reverse side) and ejectors.
- Successful recovery of ejectors by hardfacing of hot work tool steels.
- Repair of inserts with a slightly inferior performance to that of a new insert. The abraded surface of the insert has been machined, and a laser hardfacing process has been applied to the reverse side.
- Impossibility to accurately determine the final behaviour of the repaired/reinforced tools, since the results obtained after testing these tools in a real-life manufacturing process have been very inconsistent.



CONCLUSIONS

- One of REPTOOL's next steps is optimising the insert reloading process to obtain a service life of recovered tools comparable to that of new tools.
- Preheating is also proposed as an alternative to reduce the possibility of micro-cracks, as well as a further distension treatment to minimise residual stress.
- A large number of inserts and ejectors need to be hardfaced in order to have more information and determine more accurately the degree of durability and improvement of the recovered tools. This is expected to contribute to complete economic and environmental feasibility studies.
- The tests must include punches, i.e., tools that are subject to heavy wear and tear and require material to be added to maintain part volume. The aim is to reduce costs by refurbishing these elements and extend their life by minimising added material in the machine.

DRIVING FACTOR



PLASTICS



RAW MATERIALS COSTS AND SUPPLY



C-RECYCLING USING CARBON FIBRE WASTE FROM THE AERONAUTICAL SECTOR IN AUTOMOTION

PREPREG OFFCUTS AND CARBON FIBRE COMPOSITES (CFC)

mainly end up in landfills at the end of their life cycle, both in the Basque Country and in Spain. However, there are recycling processes developed at commercial level based on different processes such as: catalytic wet conversion in batch processes; recycling by continuous pyrolysis; continuous pyrolysis of CFC; or mechanical recycling based on size reduction processes.

GAIKER Technology Centre leads C-RECYCLING, with the participation of the aeronautical industry ACITURRI and the automotive components manufacturing cooperative, MAIER.

COLLABORATORS





OBJECTIVES

- Promote the development of an industry which adds value to CFC recycling in the Basque Country.
- -Recover carbon fibre (CF) contained in the waste.
- Develop new end products in the automotive sector: lightweight components with high mechanical properties obtained by compression moulding or over-injection moulding processes, or parts with new aesthetics with a carbon finish through over-injection moulding.



RESULTS

- State-of-the-art study, including an analysis of CFC waste types and related recycling technologies, and Technology Watch reports.
- A CFC repair guide was drawn up.
- Preliminary design of a CF waste treatment plant in the Basque Country, with a complete technical-economic feasibility study of the plant and development of a demonstration case for CF and prepreg recycling by manufacturing 2 types of automotive demonstration prototypes.
- Verification and validation of rCF (recycled carbon fibre) manufacturing by pyrolysis of CF waste.
- Final demonstrators for automotive structural parts using rCF, and final demonstrators for technically demanding surface finishes.
- Proposal of treatment alternatives depending on the type of waste (uncured production rejects, cured production rejects and cured end-of-life CF waste and mixed with other materials).



CONCLUSIONS

- A major source of information and cross-reference of the documentation prepared was by liaising with leading companies in the CF value chain. This has also been useful for dissemination and outreach of the results to users or potential users of rCF, as well as facilitating advice to be given according to possible target product.
- Pyrolysis releases CFs of a quality suitable for inclusion in new products, but in order to be able to use the rCFs obtained, their dimensions and the way in which they are reincorporated into new materials or applications are important. The rCFs obtained are short fibres that have required further development to achieve continuous fibre formats (yarn or non-woven blankets) at a competitive market price. Applications have focused on structural and decorative parts in the automotive sector, but are also valid for sectors such as mini-wind turbine blade manufacturing.

DRIVING FACTOR



PLASTICS



RAW MATERIALS COSTS AND SUPPLY



C-RECYCLING II CARBON FIBRE WASTE IN HIGH VALUE-ADDED PRODUCTS

MOST OF THE SO-CALLED PREPREGS AND CARBON FIBRE PARTS end up mainly in landfills at the end of their life cycle, at a cost of €200 per tonne. This material, discarded by aeronautical companies, has a high residual value which can be used in sectors with lower safety requirements, where the use of carbon fibre differentiates a product from the rest due to its higher quality.

GAIKER Technology Centre is leading C-RECYCLING II, with the collaboration of the leading composites company POLIKEA, the aeronautical company ACITURRI, the music case manufacturer LUMASUITE, the industrial installation manufacturer FAGOR ARRASATE, and the specialists in innovation of machinery and industrial manufacturing processes, KONIKER.

COLLABORATORS



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Design and develop a process for industrialisation and marketing in the short-medium term of new high-value intermediate and end products based on recycled carbon composites.
- Boost the recycled carbon fibre industry in the Basque Country.
- Develop solutions that utilise both resin and carbon fibre and avoid the pyrolysis process, which only recovers carbon fibre.



RESULTS

- Definition of a pre-treatment methodology for offcuts and development of a technology to produce intermediate products that will serve as raw material to manufacture automotive, railway and other components (with formulations containing up to 90% recycled carbon fibre prepregs).
- Definition of compression process variables in a hydraulic press to obtain four end prototypes for the railway sector (sandwich panels), the automotive sector and violin cases.
- Reduced environmental impacts of the manufacture of all the demonstrator products of the C-RECYCLING II project thanks to the use of waste prepregs offcuts to replace carbon fibre or virgin glass fibre in composite formulations, as per LCA environmental assessment.



CONCLUSIONS

- The scarcity of end-use applications in this sector for recycled carbon-based prepregs has become apparent. In C-RECYCLING II, an open day for potential consumer SMEs, organised with HEGAN (Basque Aerospace Cluster), was held. However, a market penetration difficulty was observed.
- Although the cost of recycled carbon prepregs is 57% lower than that of commercial prepregs, the cost of a violin case made from recycled carbon is approximately €6 higher than those made from fibreglass; nevertheless, given the high commercial price of this type of product, the profit margin is still significant.
- C-RECYCLING II has launched initiatives in new projects with different trailblazing companies in the sectors involved and a patent has been made to protect the project results.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



VCM

TYRE CORD METAL RECOVERY INTO NEW PRODUCTS

THE MATERIAL CALLED **CORD METAL**, A **TYRE REINFORCEMENT WIRE**, is generated as steel and rubber waste in tyre factories, and ends up in landfill and/or energy incineration. INDUSTRIAS MUJIKA, a pioneering company in the recovery and validation of rubber by-products, proposes sustainable environmental solutions that minimise both waste destined for landfill and/or energy incineration, and consumption and impacts derived from virgin rubber and steel production that recycling these materials can replace.





OBJECTIVES

- Divert metal cord away from landfills and/or energy incineration.
- Define critical variables in the material separation process for metal cord.
- Analyse the optimal waste conditioning system for subsequent waste recovery and possible industrialisation.
- Expand the range of rubber by-products offered by INDUSTRIAS MUJICA, opening a new market.
- Develop own recycling technology.
- Offer a totally innovative service to the market.
- Export the product obtained to countries all over the world.



RESULTS

- Recovered clean rubber represents 30% of the total material and has excellent abrasion below 80 mm³.
- Improved competitive position on the market through product diversification.
- Customer validation of the technical feasibility of the new product.
- A clear target market is guaranteed for the innovation offered.



CONCLUSIONS

- The project developed has helped INDUSTRIAS MUJICA to investigate processes for recovery of non-industrialised materials on the target market.
- The process of cord separation and optimisation through the incorporation of tools and improvements and the implementation of a prototype process to be able to analyse and carry out all the tests has mobilised the organisation and has been a significant learning experience for any future project.
- The participation of corporate clients, including in joint trials, has allowed us to better understand their needs and define a business strategy that is more aligned with the market.

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



ECOBUS

NEW, SUSTAINABLE COACH MANUFACTURING TECHNOLOGIES

COACH MANUFACTURING INVOLVES CONSTANT PRODUCT DEVELOPMENT. The chief aim of IRIZAR, the sector leader, is to differentiate itself from its competitors, constantly investing in technological improvement, developing new and improved products, and improving customer care and service. IRIZAR proposes ECOBUS to position itself as a leading brand at the forefront of eco-design in its sector, with environmentally sustainable coaches which are endorsed by an Environmental Product Declaration (EPD).





OBJECTIVES

- Lighten materials to reduce consumption and GHG emissions in the use phase.
- Replace technology and materials with more environmentally-friendly ones: using composite and sandwich-panel materials for ceiling and floor construction solutions; replacing anti-corrosive paint with chromates; using new types of adhesive and sealing putty outdoors and indoors; implementing new technologies for side, rear and front panels; analysing and designing new luggage ducts; looking for alternative materials for fenders.
- A type III eco-label EPD.



RESULTS

- A prototype of a differentiated high-performance coach was designed and produced.
- 10% reduction of coach GHG emissions, which represents up to 139 tonnes of CO2 equivalent per unit.
- 40% weight reduction of ceiling and floor
- New, lighter side, rear and front panels with improved surface quality
- More sustainable and lower density adhesive putties were used.
- 30% reduction of weight in fenders
- Weight reduction in luggage ducts of 30 % without aeroplane covers and 50 % with aeroplane covers.
- Reduced manufacturing cost of the company's coaches by 8% thanks to improved production processes.
- An EPD by means of a type III environmental label.



CONCLUSIONS

- ECOBUS will enable penetration into new markets thanks to the product's environmental impact transparency endorsed by an EDP, which, although not yet mandatory in the sector, is expected to increase the company's sales by 12% in the coach sector.
- ECOBUS must be compliant with EC Regulation R66 coach rollover Type Approval and R80 on energy absorption requirements, in addition to load assumptions defined in the load logbook to maintain stiffness and strength of the current assembly. Likewise, with a view to the EPD, it is necessary to work towards an inventory of 99% of the weight of coaches, which is not always possible due to the lack of traceability of data obtained and absence of suppliers with environmental LCA approaches. Along these lines, IRIZAR continues to research into new manufacturing materials and eco-sustainable manufacturing processes.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



BEST PRODUCTION TECHNIQUES



TRIBAT

CRUSHING, INERTISING AND RECYCLING LITHIUM-ION BATTERIES

INNOVATION TREE (ITREE) IS A TECHNOLOGY-BASED COMPANY FOUNDED IN 2020 with the aim of developing and implementing advanced recycling processes to reduce waste and recover critical raw materials considered strategic by the EU. Lithium-ion batteries (LIB) are increasingly being used especially in electric cars (EV), which is emerging as the vehicle of the future. It is estimated that by 2030 there will be more than 40 million EVs on the road in Europe, but currently there is no established technology to recycle them. iTree is developing a hydro-mechanical technology to recover used metals and manufacture new LIBs. Currently, less than 5 companies worldwide can recycle these elements; and recovery and processing efficiencies are low.





OBJECTIVES

- Develop proprietary technology to demonstrate the recyclability of LIBs.
- Convert a troubling waste, due to hazardousness and toxicity, into a source of resources to obtain strategic materials and metals within the EU.
- Become one of the few companies worldwide that can recycle lithium-ion batteries in an efficient and environmentally safe manner.



RESULTS

- A process for safe opening and crushing of batteries was developed.
- Inactivation of batteries, so that they are inert to air or moisture.
- Separation of LIB main elements: plastics, metal and black mass.
- All these steps were integrated into a single prototype.



CONCLUSIONS

- Complex materials and products always pose usual complications in their recycling, but in the case of LIBs there are specific critical points: high initial charge, instability and reactivity to moisture and oxygen in the air, plus their capacity to catch fire even when discharged.
- TRIBAT addresses these issues in a controlled manner and minimises the risks of working with LIBs, while increasing the efficiency of separation and recovery of the main battery components (plastics, metallic and black mass).
- Separation of the main elements that remain dissolved in the aqueous phases needs further research work.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



FRAGPLAS

PLASTIC SEPARATION IN END-OF-LIFE VEHICLE WASTE

END-OF-LIFE VEHICLES (ELV) MANAGEMENT INVOLVES DECONTAMINATION STAGES OF HAZARDOUS SUBSTANCES

and components as well as material recovery. It is the first step in shredding and grinding the remaining decontaminated vehicle which is generally followed by several separation steps. This is a scheme oriented towards the recovery of metallic fractions where non-metallic fractions have come second. Thus, in 2012, only 12% of the 37,000 tonnes generated from these streams were recycled; and 34% went to energy recovery while the remaining 54% ended up in landfills. On the other hand, modern vehicles contain more and more plastics (up to 10-15% of their mass, depending on the model), and the proportion of these materials will be increasing in waste streams resulting from their end-of-life treatment.

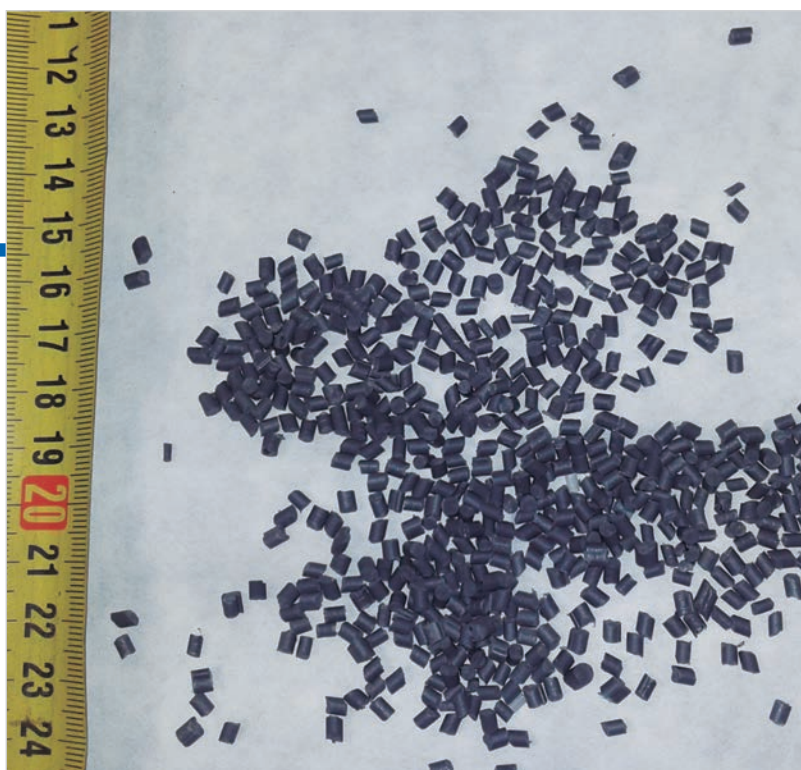
RECYCLAIR has led FRAGPLAS in collaboration with GAIKER Technology Centre for the project execution.

COLLABORATORS

Gaiker

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE





OBJECTIVES

- Validate a technological solution applicable on an industrial scale to obtain commercial quality polypropylene (PP) plastic concentrates from residual fractions generated in the treatment of ELVs shredder residue and other complex products.
- Assess automatic systems based on advanced sensors for continuous recognition and selection of PP mixed with other materials.
- Effectively identify and separate plastics from a complex mixture by polymer type, regardless of their colour, using a new optical sensor capable of recognising dark or black coloured plastics, a task that conventional automatic systems cannot perform.



RESULTS

- PP with purity above 95% was obtained along with a recovery yield of more than 90%.
- This purity was further refined by densimetric separation techniques, resulting in a recovered PP with experimental purity of 99% and it was found suitable for extrusion, pelletising and injection moulding.
- Semi-industrial testing in collaboration with equipment manufacturers, using batches of residual fraction from RECYCLAIR's treatment of shredder waste.



CONCLUSIONS

- The quality of recycled PP is directly dependent on the types of ELVs treated, which are manufactured at different times and with materials that vary over time. Regular inspection of streams is a limited measure when processing large volumes of bulk material.
- This issue and the wide supply of recycled plastics in the secondary raw materials market pose barriers to the economic viability of the new process. However, industrial scale tests by FRAGPLAS will continue to verify if the qualities and yields obtained are maintained.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



CAR KONPON INTEGRATING THE CIRCULAR ECONOMY IN MULTI-BRAND WORKSHOPS

THE SOCIAL, ECONOMIC AND MARKET SCENARIO IN THE CAR REPAIR SECTOR is affecting the competitiveness of multi-brand garages in the Basque Country, with a significant turnover loss and fading business fabric. On the other hand, there is a strong demand from the sector to hire increasingly specialised personnel prepared to address the latest market trends in terms of technological breakthrough, using new technologies and applying new concepts, with Vocational Training being the main source of trained personnel to perform tasks in repair workshops. The sector is immersed in a much-needed stage of transformation as a result of changes in consumer market preferences, the impact of the 4.0 revolution and protectionist strategies used by the brands towards their associated workshops.

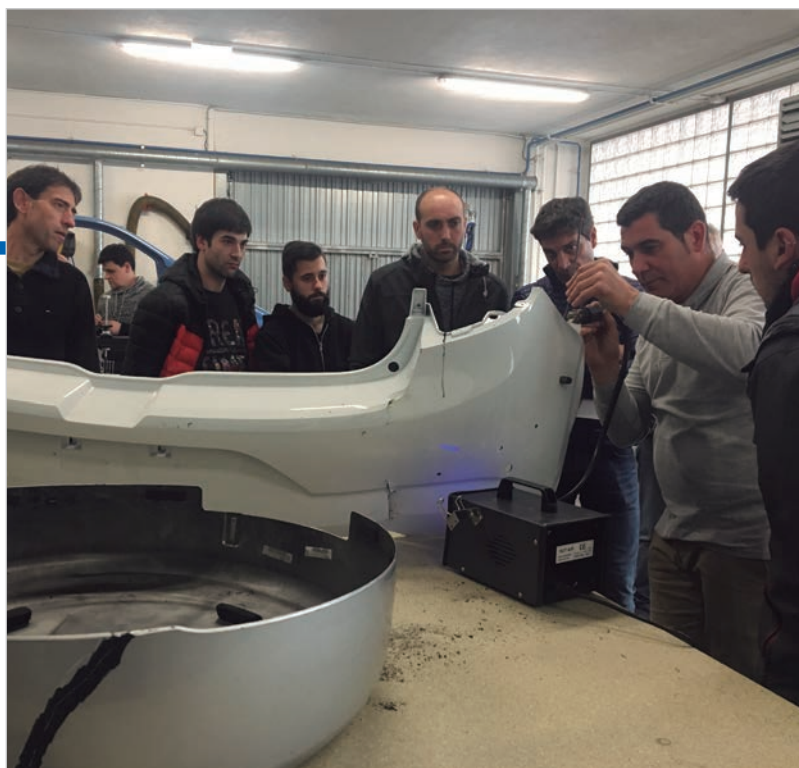
San Viator, a Vocational Training Centre (VET) located in Sopuerta (Bizkaia), has been led the CAR KONPON project in collaboration with the circular economy consultancy, ECONIA. TKNIKA, ZICLA, and vocational training centres such as DON BOSCO, MEKA, ARETXABALETA and IURRETA also participated in the project, as well as sector associations, BAT and AEGA.

COLLABORATORS



Tknika





OBJECTIVES

- Bring together the automotive service workshop sector, the vocational training sector and technological innovation to mobilise and prepare multi-brand workshop which have a trailblazing effect on the sector, through the design of a roadmap.
- Test and implement a set of techniques and technologies aligned with the principles of the circular economy.
- Offer standardised work protocols to the sector to act as an incentive and preparation for the rest of the garages and workshops and thus, improve the actual competitive edge of the multi-brand repair workshops in the Basque Country.



RESULTS

- CAR KONPON has successfully developed (including selection, research, development and piloting) a set of techniques based on complex advanced repairs and has mobilised a number of companies in the multi-brand workshop sector.
- A snapshot report of the multi-brand repair sector in the Basque Country was produced.
- Technical action plans for 5 strategic lines of advanced automotive repair have been piloted together with the workshops, which already have them.
- Technical documentation describing advanced repairs of the 5 lines for distribution to all multi-brand workshops in the Basque Country.
- Creation of a line of knowledge transfer between different players in the value chain.
- Implementation of the 5 lines which would cut emissions by approximately 1,000 tonnes of CO₂e.



CONCLUSIONS

- CAR KONPON will transfer the technical knowledge obtained by publishing a document containing the five advanced repairs and disseminating it to all automotive vocational training centres in the Basque Country, to multi-brand workshops and to associated companies.
- - Advanced repairs will be included in classroom activities and the portfolio of advanced repairs/remanufacturing in vocational training centres will also be extended according to the project methodology to become a long-lasting and sustained strategy.

CHALLENGES



GENERAL

- Focus on local manufacturing.
- Adapt to e-commerce and social media as a means of brand building.
- Reduce substances of concern in production.



ENVIRONMENTAL

- Demand bio-based products.
- Sustainability and/or information disclosure labelling.
- Circular management of unsold stocks.
- Unintentional release of plastics into the environment.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Environmental drive of the chain.
- Applying eco-design criteria to improve product circularity.
- Boost secondary and reuse markets.
- Set up collective extended producer responsibility schemes (EPR).



COMPETITIVE IMPROVEMENTS

- Environmental assessment of products.
- Digital product passports.
- Using secondary raw materials in production.
- Build repair networks.



CONSUMER GOODS



DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



RECITEST

HIGH-VALUE TUBE PACKAGING RECYCLING SOLUTIONS

THE USE OF RECYCLED MATERIALS IN THE PLASTIC PACKAGING SECTOR is something the sector is integrating as an unavoidable issue in the development of new projects, both as a legal obligation and as an immediate market demand. CTLpack, the leader in high-quality tube packaging solutions, is committed to implementing the principles of the new circular economy and contributing to develop more sustainable products. The possibility of reusing materials destined to become waste is an innovation and adds significant value in the field of sustainability in such a demanding sector.

In RECITEST, CTLpack has collaborated with AIMPLAS Technology Centre.

COLLABORATORS



AIMPLAS INSTITUTO TECNOLÓGICO DEL PLÁSTICO



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Recover swarf (industrial waste) directly from the machine, once appropriately treated and introduce them into ESTube manufacturing process or other applications, in a percentage to be determined.
- Research and implement a process including compaction, external grinding and external regeneration of the polymer by a process that allows the removal of inks and other decorative elements.



RESULTS

- Swarf produced in the plant can be regenerated and processed in the available means of production, even at high utilisation rates.
- The material is not suitable to be used in applications requiring food contact, since the removal of remaining inks and varnishes has not been possible, and this has added colouring to the regenerated chippings, making organoleptic properties not optimal and compromising its suitability for food contact.



CONCLUSIONS

- The resistance of packaging decoration, especially in the cosmetics sector, is characterised by its high-quality standards in terms of decorative richness (effects and colour density), bonding to various substrates, resistance to chemical attack such as solvents, water, etc. Sometimes, this makes decoration practically indestructible, which obviously makes it difficult to remove.
- The next steps will focus on assessing and optimising waste washing processes to remove decoration, which would open up a range of options to achieve the optimal objectives of this project. In parallel, realistic options facilitating the removal of decoration, or even avoiding it where it is not necessary, will be analysed.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



BEST PRODUCTION TECHNIQUES



CIRTIO2

NEW PROCESS FOR TITANIUM DIOXIDE RECOVERY FROM PAPER MILL WASTE SLUDGE

THE BASQUE COUNTRY GENERATES AROUND 2,000 TONNES OF PAPER SLUDGE with high titanium dioxide (TiO₂) content per year, out of the 110,000 tonnes generated globally. Although this sludge is hardly recovered, TiO₂ is a relatively high-value mineral that is used as a white pigment. A process to recover TiO₂ from waste, which is yet unknown, would save 80% of the energy consumed and CO₂ emissions per kg of TiO₂ compared to conventional processes for obtaining TiO₂ through mining and intensive chemical processing.





OBJECTIVES

- Technical and economical characterisation of a new process to obtain TiO_2 from TiO_2 -rich paper mill sludge.
- Obtain a fine powder containing more than 70% TiO_2 from paper sludge by means of an optimised TiO_2 purification process.
- Confirm that the cost of production is below conventional TiO_2 costs.
- Commercial validation of TiO_2 obtained by industries that consume it.



RESULTS

- Two final products were obtained in the form of a fine powder containing 70% and 80% TiO_2 respectively, from 20-30% TiO_2 contents in starting sludge.
- Energy consumption reduction from 100 to 14.72 MJ per kg of TiO_2 produced.
- Reduced CO_2 emissions from 8 to 1 kg per kg of TiO_2 produced.
- Optimised purification process using the Pulse Combustion Drying technology developed by Ekonek, which includes calcination, acid washing and drying.
- Very significant reduction in production costs compared to conventional process of obtaining TiO_2 from mining resources.
- Validation of filler applicability, as the products obtained have a whiteness of 94 compared to 100 for pure white pigment.



CONCLUSIONS

- The industrial process developed is feasible, has an attractive cost and lower environmental impact, plus, TiO_2 waste has applications in various industries. However, there are some purchasing barriers since this TiO_2 is not exactly the same as current commercially available virgin TiO_2 , and this it forces the market to reformulate some of its products (which is technically possible).
- The final project implementation requires new potential TiO_2 consumers who should be aware of the environmental impact savings derived from the TiO_2 produced in the project, as well as exploring further purification of the TiO_2 obtained with other industry players.

DRIVING FACTOR



PLASTICS



RECLAM

DEVELOPMENT OF INDUSTRIAL PACKAGING FILM BASED ON RECYCLED PLASTIC

DIVERSE WASTE PLASTIC STREAMS FOUND IN THE BASQUE COUNTRY are made up of high-quality materials which could have a second life if the necessary pre-treatment processes were properly conducted.

In the RECLAM project, GAIKER, a Technology Centre specialised in materials recycling has worked with PLASNOR, a company specialised in extrusion and thermoforming in the plastics sector, and LANTEGI BATUAK, an organisation for social inclusion and cohesion.

COLLABORATORS





OBJECTIVES

- Select plastic waste streams available at the Basque Country of potential interest for thermoforming film manufacturing.
- Design and implementation of the necessary pre-treatment operations in each case.
- Obtain pilot samples of industrial packaging film to study implementation feasibility.



RESULTS

- Selection and use of waste polyolefin streams from fishing nets, polypropylene (PP) from post-consumption caps, polypropylene from industrial waste, and mixed nets and caps.
- Optimisation of waste plastics pre-treatment and treatment techniques for the selected streams, including washing, shredding, laminating, extruding and pelletising, and calendering, depending on the case and need.
- Successful completion of thermoforming tests on a single mould.
- Potential savings of 50 tonnes per year of PP currently purchased as virgin raw material, and 80 tonnes per year of CO₂ equivalent.
- Estimated cost reduction of 25% in the final product.



CONCLUSIONS

- An attempt must be made to try to improve flowing properties with compatibilisers and additives.
- The use of industrial scraps from styrene plastics could, in theory, lead to better thermoforming film due to polystyrene intrinsic properties as opposed to polypropylene and other polyolefins.
- Using industrial waste materials is far more cost-effective than from post-consumer sources. The streams and availability of industrial waste material are better known and age less. This allows for a lower investment in recovery (from formulation) and greater guarantee to achieve the technical requirements demanded by a specific application.
- Industrialisation requires the creation of a mould probably by 3D printing, which will be subsequently used for thermoforming a rigid plastic part with a commercial films and finally casting polymer concrete inside the thermoformed part to obtain the final prototype mould.
- The material price impact on the end product price may vary slightly depending on the thickness required, and given that the cost of the material accounts for approximately 75% of the end product price, introducing recycled materials is a very attractive idea.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



GREEN PUBLIC PROCUREMENT



OVEUN

CHAIRS AND ARMCHAIRS FOR THE GERIATRIC AND SOCIAL CARE SECTOR

THE GERIATRIC CHAIR MARKET IS EVOLVING. THE PROFILE OF RESIDENTS WITH GREATER COGNITIVE IMPAIRMENT, demands a more adapted and resistant product; green public procurement requires a more competitive and demanding product in terms of regulations; and in addition, care homes also compete in a private market where image is vital. The absence of eco-designed products in this sector and of companies that base their commercial arguments on sustainability parameters offers an innovative opportunity for the development of eco-design and sustainable lines.

GERODAN, a company specialised in geriatric and social care equipment, leads OVEUN, with the collaboration of the eco-design and LCA consultancy IK INGENIERIA and the multidisciplinary design studio AIBA DISEÑO.

COLLABORATORS



IK / INGENIERIA





OBJECTIVES

- Design a collection of geriatric armchairs and chairs for geriatric and social care equipment, applying eco-design criteria
- Strategically position GERODAN on this market as a leading manufacturer of these products.



RESULTS

- The LCA result of current GERODAN's products showed an estimated lifetime of 8 years and that the raw materials (wood, varnish, foams and textiles) are responsible for 73% of the environmental impact obtained.
- The OVEUN prototype was designed and manufactured with 47% less environmental impact: it emits 36% less GHG emissions, reducing the impact of raw materials by 47% and the impact of end-of-life management by 52%, while optimising transport volume of the chair by 40% (since the chair can be disassembled) and increases its recyclability.
- The use of varnish and glue was reduced, as well as the weight of the wooden structure by replacing boards with pine wood, simplifying joints and eliminating iron fittings.
- 40% reduction in the storage volume of an armchair.
- Redesigned joints and part configuration make OVEUN easy to disassemble and unfold, with easily-separable, mostly recyclable and to a lesser extent, reusable components.
- The lifetime of the OVEUN prototype has been estimated at 15 years.



CONCLUSIONS

- GERODAN will launch a new OVEUN collection consisting of new chairs with new elements (without fastenings, optional wings, wheels and footrests, extendible to two or three-piece seats, etc...) as well as applicable accessories.
- Since the expected and estimated industrial cost of OVEUN is similar to that of the current replaceable product, it will be very positively welcomed on the market, given it provides much higher added-value, provided this assumption is met.
- The possibility of obtaining an eco-label is considered key to adequately communicate the advantages of the product and establish it on the market over time.

DRIVING FACTOR



ENVIRONMENTAL
POSITIONING
AND TRANSPARENCY



ALTZARI

FURNITURE VALUE CHAIN
ENVIRONMENTAL ASSESSMENT
AND MANAGEMENT

THE INDUSTRIAL RESPONSE TO ENVIRONMENTAL AND SOCIAL
ISSUES GAVE RISE TO CORPORATE SOCIAL RESPONSIBILITY (CSR)

actions as a voluntary exercise of transparency and commitment at a corporate level. Increasing demand from a demanding society and growing global competition have made it necessary to adopt a more proactive and committed attitude, since nowadays, ignoring sustainability parameters potentially means being excluded from the market. For this reason, automated tools that go beyond global corporate indicators but take into account environmental and social parameters and interact with non-corporate actors, are on the increase. Some examples include ECOVADIS, ACHILLES or BLUESIGN.

HABIC, the Habitat, Wood, Office and Contract Cluster Association of the Basque Country, have brought together the main companies in the sector and leads ALTZARI. In 2016, HABIC identified the need for businesses to demonstrate their social and environmental commitment to their companies, clients and stakeholders. The following firms have collaborated in ALTZARI: PLÁSTICOS ALAI, BURDINOLA, EUN SISTEMAS, MADERAS URKIA, ICAZA, ELKOR, IRURENA and the consultancies IK INGENIERIA and ZICLA.

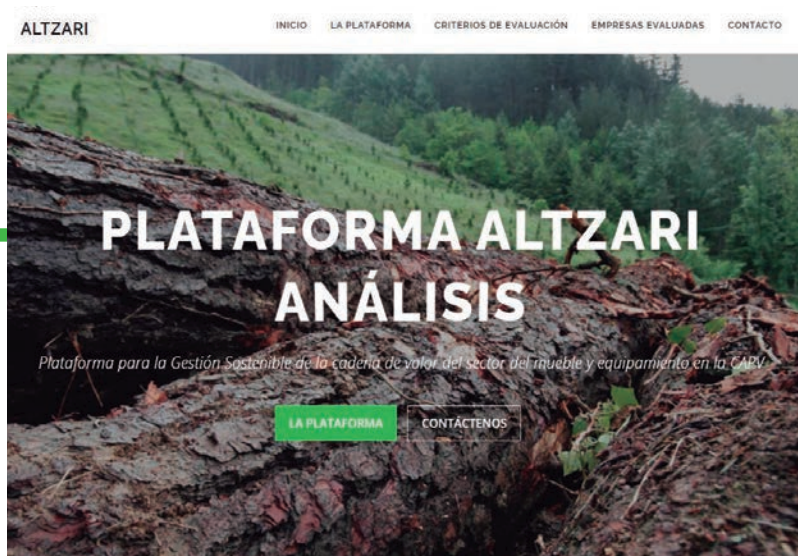
COLLABORATORS



IK /
INGENIERIA

ZICLA®





GESTIÓN DEL PRODUCTO

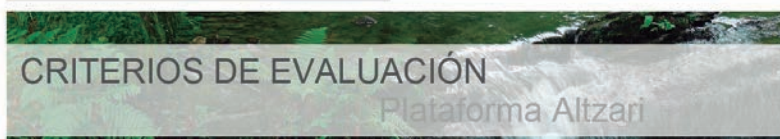
Se tiene en cuenta el tipo de materiales empleados en la fabricación del producto o los componentes, la presencia de sustancias tóxicas, la gestión del fin de vida del mismo gracias al ecodiseño o la presencia de materiales reciclados y la certificación ambiental del mismo con ecoetiquetas o similares.

- ▲ MATERIALES
- ▲ USO DEL PRODUCTO
- ▲ FIN DE VIDA
- ▲ ECODISEÑO Y CICLO DE VIDA

GESTIÓN DE PROVEEDORES Y DE LA CADENA DE VALOR

Se analiza la tracción que hace la empresa de sus proveedores y clientes, desde el punto de vista del establecimiento de requisitos ambientales o sociales.

- ▲ REQUISITOS SOCIALES
- ▲ REQUISITOS AMBIENTALES



OBJECTIVES

- Promote environmental performance and eco-innovation in the value chain of the Basque furniture and equipment sector through the practical implementation of a sustainability assessment model in a set of companies in the Basque industrial ecosystem.
- Enhance and channel green procurement, improving transparency towards actors and stakeholders, and environmental and CSR practices of companies.
- Integrate a life-cycle approach and improve environmental practices of companies along the value chain.



RESULTS

- Characterisation of the sector's value chain in the Basque Country.
- Development of a value chain assessment method, with demonstration experiences for the implementation of the developed eco-innovation trailblazing method.
- Creating and launching an environmental and social assessment method for the sector's value chain through the ALTZARI platform, which provides clear and transparent information on the environmental and social situation of a company and its product. The platform is useful for Procurement, CSR, EH&S and Sustainability departments of companies who wish to monitor the environmental and social performance of their supply chain; and for suppliers who need to address environmental and social assessment requests.



CONCLUSIONS

- The ALTZARI platform is the first one of its kind to be developed exclusively for the furniture sector. It is also a pioneering experience in value chain trailblazing within the Basque clusters themselves: the methodology developed in ALTZARI will obviously focus on the specifications of the furniture sector trailblazing chain, but the application of the concept to other sectors is also possible.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



WEARCYCLE FROM TEXTILE TO TEXTILE

THE BASQUE COUNTRY GENERATES A CONTINUOUS VOLUME OF WASTE COTTON IN THE REGION of 36 tonnes per year. This represents a source of resources for virgin yarn production, which can be a stable outlet. Thus, the use of post-consumer recycled (PCR) fibres can be a viable alternative to create high value-added fashion garments. In this context, WEARCYCLE aims to demonstrate as an ultimate goal, the competitive improvement of creating a circular economy market that involves the entire value chain of the textile industry.

TERNUA GROUP is an international company dedicated to design, develop and marketing of textiles, sports equipment and fashion under the Astore, Ternua, Lorpen, Loreak Mendian and Ternua workwear brands, with a strong commitment to sustainability.

TERNUA GROUP (Ternua and Loreak Mendian), is leading WEARCYCLE, with the participation of GUREAK, a leading European organisation for social and labour inclusion.

COLLABORATORS



GUREAK





OBJECTIVES

- Demonstrate the commercial viability of reusing PCR cotton waste, generating a circular economy cycle in the textile production sector based on eco-design and supra-recycling.
- Create a stable value chain that allows a shift from a linear model to a circular one in the textile industry.
- Design a capsule collection of eco-designed garments and/or accessories through upcycling and to be launched on the market in spring-summer 2022.
- Recycle 2 tonnes of PCR cotton from sheets from the Ikuztegia laundries (GUREAK Group) that currently end up in landfill.
- Achieve that 40% of the fibre materials used are from PCR cotton and that this does not increase prices by more than 5% over current manufacturing processes.
- Reduce GHG emissions by 228 tonnes per year within 3 years.



RESULTS

- Recycling of 2 tonnes of PCR cotton that has not ended up in landfill.
- 17 eco-designed garments: 11 models under the Loreak Mendian brand and 6 models for the Ternua brand.
- Development of a sustainable fibre, with 50% of materials from recycled cotton: 15% PCR cotton from bed sheets; and 35% post-industrial recycled cotton, mainly from remnants. The other 50% is organic cotton.
- The image of sustainable philosophy that Ternua has already established on the market has been extended to other brands in the Group. The collection has also been very well received by retailers, as it responds to the needs of today's consumers.



CONCLUSIONS

- The creation of sustainable, high value-added garments from post-consumer cotton is possible.
- Positive market response indicates there is a growing interest in consumers for sustainable fashion, which is beginning to be recognised as an effective way to minimise the impact of one of the most polluting industries on the planet.
- On a technical level, waste used has very deteriorated fibres, which makes it inefficient for recycling. However, alternative industrial uses for this material can be investigated to prevent it from ending up in landfill. The ultimate goal is to work with the community to solve problems in the immediate environment in a sustainable way, thus setting a good example and inspiring others.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



E5ECO

ADVANCED PACKAGING ECO-DESIGN USING PCR MATERIALS

THE ENVIRONMENTAL RELEVANCE OF PLASTICS HAS SIGNIFICANTLY INCREASED IN RECENT YEARS.

In May 2020, the European Commission launched a proposal to reduce the production and use of plastics, including a ban on single-use plastic products. The boost on plastics recycling has led to a number of initiatives in the industry, but they are slow and not yet widespread.

UROLA is a company specialised in designing solutions and manufacturing containers using blow moulding technologies. E5ECO was carried out in collaboration with the AIMPLAS Technology Centre and several suppliers of post-consumer recycled materials (PCR).

COLLABORATORS



AIMPLAS INSTITUTO TECNOLÓGICO DEL PLÁSTICO





OBJECTIVES

- Marketing new packaging to meet the necessary mechanical performance requirements, while reducing the use of virgin raw materials by 25%.
- Combine packaging eco-design strategies that facilitate weight reduction and the use of PCR material.



RESULTS

- 20-30% recycled material was incorporated alongside virgin material without compromising functionality.
- Net weight reduction of 12% over the original packaging design.
- Savings of 12% of virgin raw material with the potential to reach 40%, thanks to lighter packaging and the incorporation of PCR material.
- Increased production capacity.
- 11% reduction in energy consumption.
- Reduced unit cost by 10%.
- Reduction of all environmental impact indicators by 11%.
- Emission savings of 27.4 tonnes of CO₂e per year.
- At the distribution stage, eco-designed packaging would cut emissions by 4.21 tonnes of CO₂e per 100 km of road transport.



CONCLUSIONS

- The main difficulty faced by E5ECO relates to the lack of homogeneity in recycled material batches, not to mention the market's reluctance to bear the costs of the process.
- An important outcome of E5ECO is the launching of Urola Design, a new design method that has generated a new service which is now a reality on the market.
- Reducing packaging weight offers a more competitive product and increases the market share, as margins associated with plastic packaging are low and much of the cost of the packaging is based on raw materials.

DRIVING FACTOR



PLASTICS



WASTE DISPOSAL
REDUCTION



FLOTO

RECOVERY OF AGRICULTURAL
PLASTICS AND INDUSTRIAL
PACKAGING FILMS

FILM-TYPE WASTE PLASTIC STREAMS GENERATED IN THE PRIMARY SECTOR and industrial SMEs are generally relatively pure and easy-to-recycle PE fractions. However, they are not properly managed due to generation dispersion in small quantities from each source, and the lack of interest from plastic recycling companies installed in the Basque Country. The relatively small quantities of waste plastic generated in these cases by each individual organisation led to a lack of segregation at source, uncontrolled dumping or treatment, and landfill disposal. It is estimated that more than 20,000 tonnes of PE used in packaging end up in landfill or in energy recovery each year in the Basque Country. This is a material of interest to ZORROZA, the company leading FLOTO and specialised in treating waste plastic fractions, and LEUNAM, manufacturers of PE films for the industrial sector. GAIKER Technology Centre and the consultancy firm ZICLA, have also collaborated in FLOTO.

COLLABORATORS



Gaiker
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

ZICLA®

ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Quantify the technical, economic and environmental feasibility of recycling plastic film waste to be used in the agricultural and industrial sectors.
- Implement an industrial recycling process for these fractions based on proximity.
- Collect plastic waste generated on small farms and livestock farms, such as silage, greenhouse and tunnel plastics.
- Collect industrial packaging film waste generated in productive SMEs.
- Offer sectors the possibility of recovering the PE streams generated with a circular solution of possible consumption within the sector.



RESULTS

- Installation and industrial viability validation of a plastic washing process (installed in ZORROZA), with complete effectiveness in cleaning the described plastic streams.
- Installation and industrial feasibility validation of an automated industrial agglomeration equipment (installed at LEUNAM) for these streams.
- Industrial manufacture of recycled chips and industrial film bags in different final colours.
- Optimisation of fraction mixtures to avoid heterogeneity in moisture and fluidity index.
- Potential savings of 450 tonnes of plastic and 985 tonnes of CO₂e per year.



CONCLUSIONS

- The quality of the proposed recycling process would be greatly enhanced if it is based on better segregation at source, which avoids mixing due to storage and logistics.
- The recycled product faces scepticism in some industrial markets towards recycled film products due to their lower transparency and poorer aesthetic appearance, even though no technical problems have been found with recycled plastic.

CHALLENGES



GENERAL

- Low productivity.
- Shortage of qualified personnel.
- Improve data transparency.
- Develop higher value-added solutions.



ENVIRONMENTAL

- Improve energy efficiency of buildings.
- Harmonise environmental assessments of construction products.
- Reduce emissions and impact on extractive processes.
- Mandatory inclusion of secondary material in public works.
- Mandatory selective demolition of non-hazardous waste.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Environmental drive of the value chain.
- Industrialised construction.
- New, more sustainable materials.
- Guides of recycled and renewable building materials.
- Taxes on aggregate extraction.



COMPETITIVE IMPROVEMENTS

- Road pavement with more sustainable materials.
- Installation of low-carbon energy solutions in buildings.
- Research on local supply and demand and forging commercial relationships (symbiosis).
- Using Building Information Modelling (BIM) methodology as a construction management system.
- CE Marking of construction materials and secondary aggregates from CDW.
- Closing cycles of specific CDW streams: gypsum, milling, ceramics, altered soils.

CONSTRUCTION AND WORKS



DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



POLLUTION MINIMISATION



LURMASA

ON-SITE STABILISATION
OF CONTAMINATED SOILS
TO PRODUCE REUSABLE
MATERIALS

SINCE THE CONSTRUCTION OF LOGISTICS-PORT AND INDUSTRIAL INFRASTRUCTURES (DOCKS, SEAWALLS, DOCKYARDS, ETC.)

requires huge amounts of construction materials, industrial by-products, such as steel slag, are often used as filler materials, and this can cause soil contamination issues with heavy metals. Soil management work in these sites generates large quantities of excavated materials, which normally end up in landfill sites. The Port of Bilbao has used over 400,000 tonnes of iron and steel aggregate in infrastructures in a controlled manner since 2008, although new technologies are currently required to recover earth mixed with this aggregate.

AFESA is a leading company in waste management, soil treatment and demolition.

COLLABORATORS





OBJECTIVES

- Develop an innovative on-site treatment process to stabilise and solidify soils contaminated with heavy metals and filled with non-hazardous steel slag.
- Create a safe building material, similar to soil-cement or gravel-cement, which can be reused on the same site as the materials from which it was made.
- Obtain mineral binders and additives that reduce the permeability of the material, as well as leaching of heavy metals, providing the material with some self-sealing capacity.



RESULTS

- Identification and use of combinations of cement and mineral materials that improve performance (reducing crack formation and permeability, etc.) compared to that obtained exclusively using cement.
- Identification of other variables essential to improve equipment performance.
- Reduced cement consumption in the formulations used by partially replacing it with materials with a lower carbon footprint.



CONCLUSIONS

- Once selectively excavated, non-hazardous industrial materials that have been used as backfill, can be re-used as raw material for on-site manufacture of durable and recyclable soil-cement or gravel-cement pavement.
- This practice would avoid sending it to landfill and at the same time reduce the need to use quarried aggregates.
- LURMASA has implemented a technically and economically feasible solution, but requires regulatory evolution in the Basque Country.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



HUFRO

USING ASPHALT MILLINGS IN NEW ROAD SURFACE COURSES

THE MAIN ROAD REHABILITATION CONSISTS OF REMOVING, usually by milling, bituminous mixes from surface courses and replacing them with new mixes so that road surfaces remain comfortable and safe. Around 50,000 tonnes of asphalt mix waste are generated annually in the Basque Country, which can be used to manufacture new mixes by integrating old aggregate with the new mineral skeleton and old bitumen with new bitumen. On the other hand, aggregate and bitumen make up approximately 75% of the cost of a bituminous mix; and bitumen is by far the most expensive bituminous mix material. Other significant environmental and economic savings include a reduction in energy consumption, as well as transport, landfill and manufacturing costs. However, in the Basque Country, no technical development has taken place since according to regulations, recycled materials cannot be used in wearing courses, which are the most frequently replaced. At present, milling aggregate can only be used in base and binder courses.

ASFALTADOS OLARRA, a specialist company in the sector, led HUFRO, with the collaboration of the civil infrastructure engineering company CIESM-INTEVÍA and the PORT OF BILBAO.

COLLABORATORS





OBJECTIVES

- Verify through physical road tests, the possibility of using milled materials at rates of approximately 20% of the total mass of the hot asphalt mix in wearing courses.
- Produce a wearing course test section on a road inside the Port of Bilbao to be subject to moderate traffic of heavily loaded lorries (approx. 80 per day).
- Characterise mixtures in the laboratory and at the manufacturing plant.
- Observe the behaviour of tested sections by monitoring its characteristics in the medium term (two years).
- ASFALTADOS OLARRA expects to recover up to 15,000 tonnes per year of road millings currently destined to landfill.



RESULTS

- Application of mixtures of iron and steel type coarse aggregate with ophitic-type coarse aggregate.
- Use of a milling rate of 20% in a bituminous mix type AC16 Surf for wearing courses without decreasing the quality of the material.
- Similar characteristics of the new material in relation to those already existing with virgin materials (quarry aggregates).
- No anomalies in the sections executed after 12 months of commissioning.
- 7% reduction in unit cost of production and 5% increase in market share.
- Reduction of material sent to landfill by 15,000 tonnes per year by ASFALTADOS OLARRA, S.A.



CONCLUSIONS

- There are sufficient guidelines in place for handling and integration of millings into hot asphalt mixes to allow widespread implementation of the technique for wearing courses in T2 to T4 traffic.
- The key issues to take into account are: achieving a homogeneous milled material; obtaining the correct dosage to meet the specifications; and mixing the material at the required temperature, without overheating or underheating.
- A working guide should be drawn up, including specific guidelines for material handling in the laboratory and quality control of this application.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



NESERCO

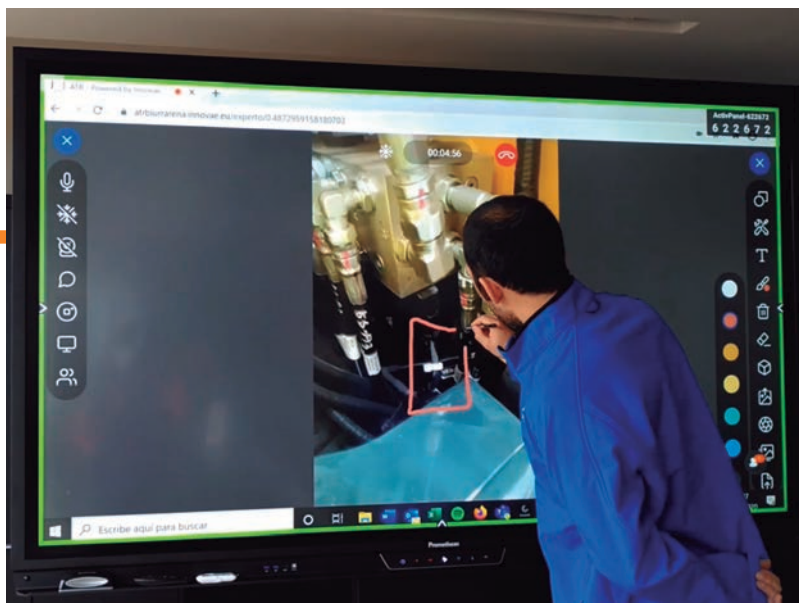
CONSTRUCTION MACHINERY SERVICISATION

BIURRARENA IS A COMPANY SPECIALISED IN THE SALE OF CONSTRUCTION MACHINERY, providing warranty service and maintenance services. Renting or leasing machinery for a period of time represents a smaller percentage of the turnover, but the market is increasingly demanding this type of service. Moreover, most of the machines on the market are idle for long periods of time while the owner does not need them, and leasing can increase their utilisation rate.

When pricing leasing equipment, the equipment maintenance costs are usually taken into account and the price is standardised regardless of the intended application. Since the behaviour of each machine is unknown in each operating context, this is the only way to fix the price of leasing without impacting on the distributor, while on the other hand, it prevents the definition of preventive maintenance strategies for the machines, as the needs and/or spare parts required in each piece of equipment after each use are unknown. For NESERCO, BIURRARENA collaborated with IKERLAN Technology Centre.

COLLABORATORS





OBJECTIVES

- Develop a new business model focused on the servitisation of construction machinery, impacting both the use phase and the end of life of the equipment.
- Apply Industry 4.0 to the new business model and relationships between suppliers and customers.
- Strengthen the company's business and gain competitiveness.



RESULTS

- Completion of "Life Maps" for critical systems and components for the different types of machines in each operational context. These theoretical maps facilitate a comprehensive assessment of equipment conditions, identifying potential issues linked to early degradation.
- Design of a Machinery Management Model that facilitates the monitoring and study of behaviour, and subsequent decision-making aimed at optimising maintenance strategies and/or upgrading equipment. This facilitates the deployment of servitisation strategies for part of the fleet, incorporating different servitisation scenarios and designing performance indicators to optimise the performance of fleet (leasing, renting, second-sale strategies, etc.).
- Developed a tool/app aimed at improving and strengthening diagnostic and repair processes (fault trees, remote technical assistance, etc.).
- Estimated savings of annual CO₂ equivalent emission of 1,200 tonnes.



CONCLUSIONS

- The company technicians' knowledge has been the most reliable and major source of data in structuring and completing the data map, which is the result of integrating data from different origins.
- The After-Sales Management Model provides more value in maintenance contracts, dynamically customising strategies to the actual condition of the equipment.
- The Fleet Management Model focuses on maximising performance throughout equipment useful life and deploying strategies at the level of changes in operational contexts, proposals to incorporate new equipment within a leasing contract, as well as upgrading proposals for a second sale.
- The weight of new sale of high-value equipment is even higher than leasing or other types of contracts linked to availability indicators, etc. NESERCO has identified new opportunities and designed a new management model to complement the sale of equipment.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



WASTE DISPOSAL REDUCTION



BRIK

PREPARING ALTERNATIVE FUELS FOR THE CEMENT INDUSTRY

THE AVAILABILITY IN LARGE VOLUMES OF REFUSE DERIVED FUEL (RDF) with high calorific value, relatively uniform composition and morphology, offers a competitive advantage for cement companies. On the other hand, the current management scheme for end-of-life vehicles (ELVs) leads to the generation of the so-called light fraction waste, which, after being treated to recover metals, yields a material rich in plastics and elastomers with high calorific value. However, it is a very bulky fraction of waste material, with a relatively low bulk density, which makes direct recovery as RDF difficult, since it is very difficult to feed and easily washed away by suction and gas treatment systems in place at potential recovery facilities. At present, disposal at authorised landfill sites is common.

DEYDESA 2000, part of the Otua Group, is specialised in recycling fractions from ELVs shredding, recycling small and complex metals, sorting steelworks rejects and separating clean metal. For the BRIK project implementation, the company worked with LEMONA, a cement manufacturer, and INATEC, Otua Group's R&D Unit.

COLLABORATORS





OBJECTIVES

- Recovering energy contained in the non-metallic and light fraction of car shredder waste for cement production.
- Reduce the volume of light fraction by pelletisation and adapt particle size to free it from dust.
- Reduce the unit cost of transporting the light fraction under study and facilitate its storage.



RESULTS

- Tests at the supplier company with an initial material sample indicated that the material was suitable for pelleting, but this was not the case in pilot trials conducted at DEYDESA 2000.
- Different humidity, crushing and compression tests were carried out, but in the end pelletisation could not be maintained on a continuous basis over time or was not homogeneous (sometimes very compact pellets were obtained, while at other times, powder or partially melted materials were produced).
- The erratic behaviour of the process does not seem to be associated with humidity and compression ratio variations.



CONCLUSIONS

- The pelletisation process proposed by BRIK is unstable and fails to allow the production of pellets in a constant way over time.
- With a view to recovering light reject from light fraction, DEYDESA 2000 and the Otua Group are planning, together with several European companies and technology centres, to participate in the Horizon 2020 programme to find energy efficient solutions using this material as fuel.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



WASTE DISPOSAL REDUCTION



CLOROX

DECREASING CHLORINE IN END-OF-LIFE VEHICLE WASTE

THE WASTE FROM DECONTAMINATION OPERATIONS OF END-OF-LIFE VEHICLES (ELV)

at Authorised Treatment Centres (ATC) are compacted and fragmented to recover any secondary raw materials contained, obtaining three fractions: ferrous metals (destined for smelters); shredder light fraction, or Fluff (light materials such as foams, textiles, wood, dirt and varying amounts of metals in non-mass format); and shredder heavy fraction (which is sent to extraction plants of contained non-ferrous metals, resulting in a waste stream rich in mixed plastics). Both light fraction and non-metallic heavy fraction are mainly managed in landfills.

The ELV legislation sets recycling and recovery targets for the materials contained in ELVs, and compliance involves recovery of polymeric materials present in light and heavy fractions. After comprehensive extraction of the metals they both contain, high calorific value fractions which can be potentially useful for the manufacture RDFs are obtained. Furthermore, the use of RDFs in cement plants in the Basque Country is subject to limits on several pollutants, which means that heavy fraction is almost entirely sent to landfill since its chlorine content is above the limit established (1%).

DEYDESA 2000 is part of the Otua Group, specialised in recycling fractions from ELVs shredding, recycling small and complex metals, sorting steelworks rejects and separating clean metal. For CLOROX implementation, the company worked with LEMONA, a cement manufacturer, and INATEC, Otua Group's R&D Unit.

COLLABORATORS





OBJECTIVES

- Implement a system to reduce chlorine content to introduce RDFs into cement factories in the Basque Country.
- Ensure profitability of the cooperation between DEYDESA and LEMONA.
- Meet the requirements of ELV legislation. This involves combining different advanced conditioning and separation technologies to remove PVC derivatives.



RESULTS

- A treatment scheme based mainly on X-ray separation was implemented.
- The RDF obtained has a chlorine content of 0.62%.
- A recovery of 70% of the plastic fraction derived from heavy fraction treatment as RDF material in the cement industry.
- Trial run on a large industrial scale with the manufacturing 19,885 tonnes of clinker using 173.27 tonnes of RDF material treated according to the developed process.



CONCLUSIONS

- The use of RDF as an alternative fuel is technically feasible and does not pose adverse effects on the product quality and the production process at the cement plant. Flue gas and particulate emissions have remained unaltered and are compliant with the applicable legislation.
- CLOROX is an environmentally and economically viable project to produce RDF compared to disposal alternatives at current market costs.

DRIVING FACTOR



REDUCTION OF GREENHOUSE GASES (GHGS)



GREEN PUBLIC PROCUREMENT



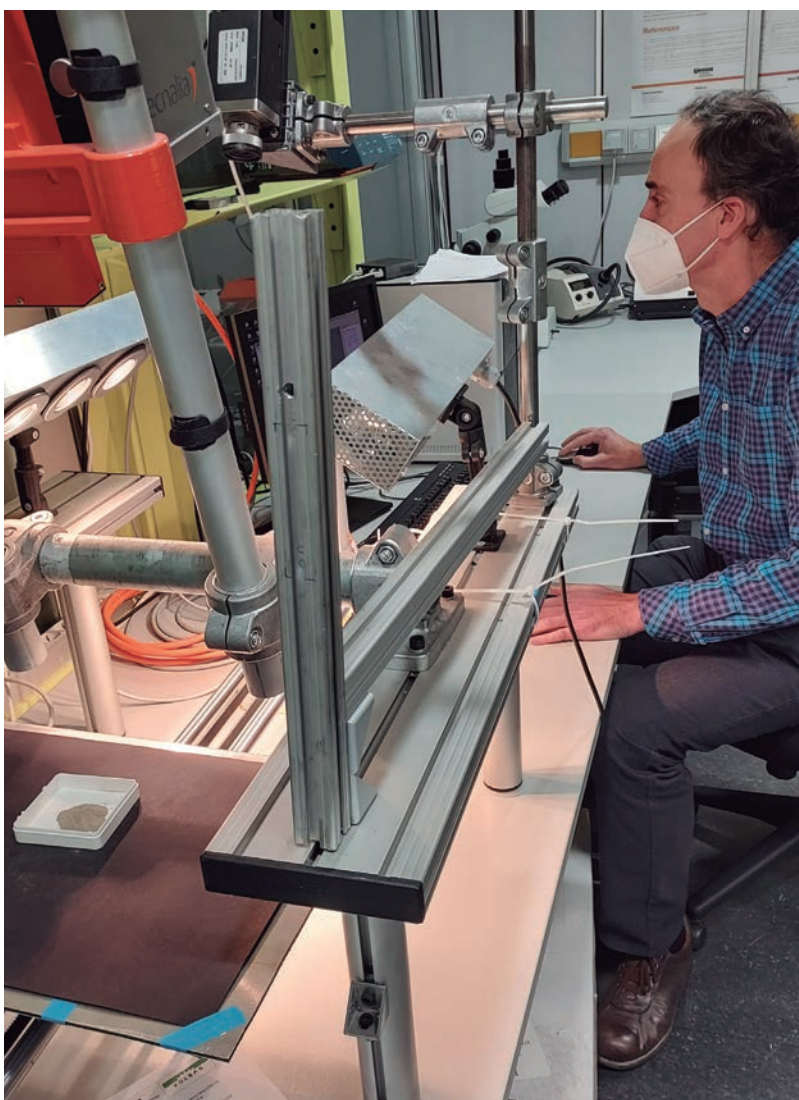
NEUCLICEM CO₂ CAPTURE IN ALKALINE WASTE GENERATION

THE BASQUE COUNTRY PRODUCES 0.5% OF EUROPEAN GREENHOUSE GASES and is aligned with reducing these emissions by 40% (KLIMA 2050). Furthermore, 50% of the 1.2 million tonnes of Construction and Demolition Waste (CDW) and a large part of the 96,000 tonnes of white slag produced each year in the Basque Country, are not recycled. The cement sector is committed to produce new products based on alternative raw materials that minimise the environmental footprint associated with its processes. Among others, new active additions to cement based on recovered waste and with lower CO₂ footprint have been introduced to help achieve climate neutrality goals by 2050.

SOCIEDAD FINANCIERA Y MINERA (FYM) is one of the leading companies in the production of cement and innovative products for construction and has led NEUCLICEM, with the collaboration of the TECNALIA Technology Centre and the CDW management company, VOLBAS.

COLLABORATORS





OBJECTIVES

- Designing a new CCUS (Carbon Capture Use and Storage) process based on the accelerated carbonation mineralisation of concrete CDW waste fines and white steel slag, and using spectral monitoring tools.
- Establish carbonation protocols aimed at future sequestration of as much CO₂ (15-40%) as possible of a cement plant flue gas and to improve the technical performance (>20%) of alkaline waste.
- Validate the use of new mineralised materials in the production of hydraulic road binders (HRB) with lower CO₂ footprint (≤40%) and higher circularity (≥30%).



RESULTS

- High content compounds with CO₂ capture potential were obtained: CDW fines from concrete (49% CaO) and white steel slag (45% CaO, 9.4% MgO).
- The fraction of greatest interest was identified in 11.3% of CDW fines from concrete and 26% of white slag (<125µm)
- Approximately 4.5% of CO₂ captured per hour under initial basic standard conditions. 10% new CaCO₃ was generated.
- Identification by X-Ray Diffraction (XRD) and FTIR spectroscopy, of signals related to the carbonates generated, as well as in hyperspectral imaging (HSI) and Raman equipment.



CONCLUSIONS

- The amount of material of suitable fineness for capture (<125µm) can be significantly increased (from 75% to 90%) by additional grinding of 0/4mm fines.
- There is great carbonation potential in fine fractions of concrete CDW and white steel slag, having confirmed an effective irreversible CO₂ (100% pure) capture in the initial phase of the project, which could be maximised.
- XRD showed an excellent potential for carbonation process monitoring and control, but it will be necessary to delve into the results obtained from HSI and Raman equipment.

DRIVING FACTOR



POLLUTION MINIMISATION



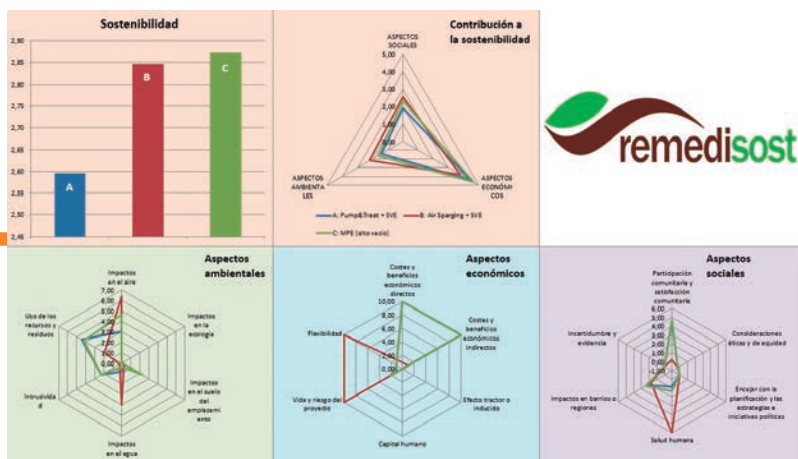
REMEDISOST SUSTAINABLE PLANS FOR CONTAMINATED SOIL REMEDICATION

SELECTING THE APPROPRIATE ENVIRONMENTAL RECOVERY TECHNOLOGY FOR CONTAMINATED soil is a key aspect for soil remediation. Law 4/2015 on the prevention and remediation of contaminated soil sets forth the control and assessment requirements for soil quality to be implemented to guarantee soil protection and use, and the measures for its recovery. Article 1 establishes the need for a detailed soil quality investigation in soils posing an unacceptable risk, and demands recovery alternatives are studied, including technical, environmental, economic or other relevant issues for reuse of contaminated soil. No methodologies of this type are currently available in the Basque Country to meet this demand.

GAIKER Technology Centre is leading REMEDISOST, with the participation of the NEIKER Technology Centre, the leading waste management, soil treatment and demolition company AFESA, and BC3 (the Basque Centre for Climate Change).

COLLABORATORS





OBJECTIVES

- Develop a rigorous and reliable methodology to assess the sustainability of different contaminated soil remediation plans that technically allow a soil to be recovered from an initial situation of contamination to a final situation in accordance with its intended use.
- Control and prevent the transfer of impacts between life cycle stages and reduce impact generated taking into account the environmental, social and economic effect produced during the entire life of the remediation process, using a methodology that takes the entire Life Cycle into account.
- Conduct an analysis of soil-supported services provided by other ecosystems, and impact of the proposed remediation plans on them, and include these results in the impact assessment.
- Define an algorithm to calculate the sustainability index, develop a software tool to apply the methodology, and validate it through implementation in three case studies.



RESULTS

- The REMEDISOST methodology was defined and a tool facilitating its application was developed as a pioneer in the Basque Country. It enables comparing the sustainability of different remediation plans and choosing the most appropriate in each case through evaluation of a set of environmental, economic and social impacts.
- The methodological approach and the methodology usefulness, usability and fields of application have been compared and analysed with the stakeholders.
- Raising awareness regarding the relevance of sustainability in the remediation of contaminated soils; disseminating practical and theoretical aspects of the methodology.



CONCLUSIONS

- REMEDISOST has opened new lines of work for participating companies, such as the methodology validation in more practical cases which will allow the analysis model to be refined.
- An IT tool that facilitates the application of the methodology to its potential user organisations has been developed, incorporating functionalities such as multi-component analysis and geographic information systems, which is also innovative.
- REMEDISOST makes it possible to include the remediation of contaminated soils into the design and development of land-use plans.

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



WASTE DISPOSAL
REDUCTION



VALCIM

USING INORGANIC
WASTE STREAMS IN
CIVIL ENGINEERING
WATERPROOFING LAYERS

**DIFFERENT CIRCULAR ECONOMY STRATEGIES AND PLANS
ENCOURAGE THE SEARCH**

for alternatives to dumping such abundant by-products as white and black steelworks slag and swarf from municipal solid waste (MSW) recovery, construction and demolition waste (CDW) and foundry sands and fines. In view of this scenario, HORMOR, a company dedicated to produce prefabricated concrete elements and sale of steel aggregates for public works, building, urbanisation and paving, proposes the development of products for low-cost waterproof layers for civil works, optimising and characterising different products (gravel, gravel-cement and concrete), and using different contents of slag (black and white), filler, CDW fines and cement.





OBJECTIVES

- Design, research and development of new VALCIM products by combining over 95% of strategic mineral streams.
- Analyse the mechanical and permeability properties of the different products and demonstrate their use in a real-life scenario, monitoring behaviour and leaching.
- Gain deeper knowledge of the cementing effect of recovered minerals (fine fractions of CDW, MSW slag and steel slag) to bind the remaining inert skeleton.
- Demonstrate technical and environmental feasibility of new products in a real-life scenario.



RESULTS

- Laboratory development of 3 products intended for waterproofing and structural application: gravel, gravel-cement and concrete.
- Gravel: optimisation of bearing capacity (CBR) and permeability by means of different mixes using 30% white slag mix and up to 10% filler. The CBR reaches a value of 219, compared to 120 in previous tests; and waterproofing reaches a $K=7.10^{-8}$ m/s after 4 days compared to $K=4.17.10^{-7}$ m/s in previous results.
- Gravel-cement: obtaining mixtures with 15% white slag mix, 72% AS4/12, 14% AS11/22 and cement at 2, 3 and 4%.
- Concrete: dosed with 6% cement by weight, 22% white slag mix and 72% steel aggregates. A compressive strength of 19 MPa at 7 days is achieved by minimising the cement content.
- Environmental viability assessment of products developed in VALCIM by means of LCA comparing to similar products using virgin raw materials.



CONCLUSIONS

- The added value of the waste streams studied has been demonstrated by the excellent technical results achieved in gravel areas (in terms of bearing capacity and waterproofing) and concrete (mechanical strength).
- However, concrete marketing requires a durability analysis.
- Application for permits and design of road sections to implement optimised gravel and gravel-cement.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



GREEN PUBLIC PROCUREMENT



KOOPMAT TERMIC USING RECYCLED TEXTILES FOR THERMAL INSULATION

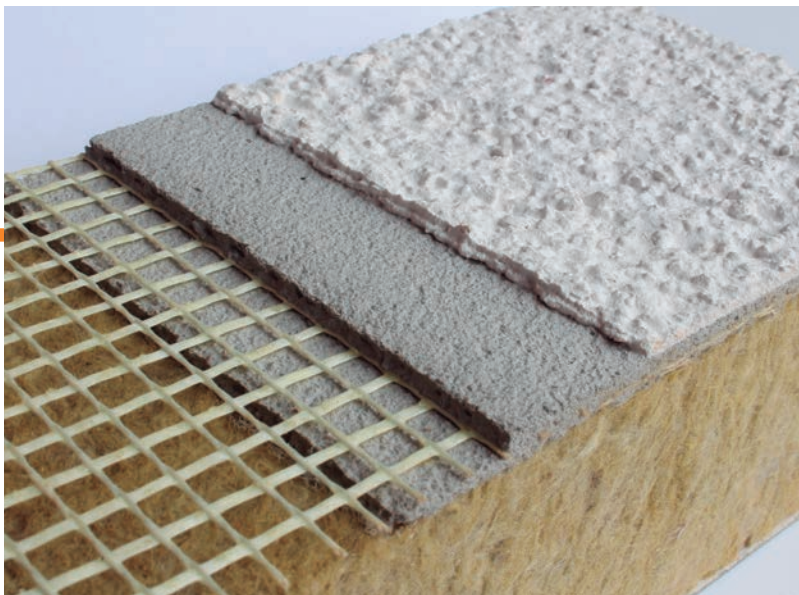
THE NON-REUSABLE FRACTION OF THE TEXTILE WASTE

COLLECTED BY KOOPERA contains natural fibres such as cotton, wool and blends of cotton with man-made fibres, which can be used in thermal insulation. However, currently there are no facilities collecting post-consumer textiles for reuse and production of a by-product for this application. Given its high environmental footprint, the construction sector is continuously looking for environmentally sustainable building material solutions.

KOOPERA, a leading insertion company in treatment and reuse of post-consumer textiles, is leading KOOPMAT TERMIC, with the collaboration of the energy rehabilitation specialist RENER and TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Produce and validate thermal insulation panels to be used in outdoor construction elements or party walls, manufactured from post-consumer recycled textile material that is currently not reusable.
- Reduce the carbon footprint of post-consumer textile waste management.
- Generate new jobs for people in situations of vulnerability or social exclusion.
- Reduce the environmental impact of potential work-sites using the insulation material obtained.
- Setting up a partnership between organisations from two sectors such as textiles (KOOPERA) and construction (RENER).



RESULTS

- The technical specifications of the material and the end product have been defined.
- Development and implementation of the complete process, which includes: selection and classification of post-consumer textile material; raw material adaptation; textile flock manufacturing and treatment: insulating material manufacturing, validation, characterisation and on-site installation.
- Obtaining a textile panel with an acoustic and thermal performance that is very good and even better than other textile insulation products available on the market.
- The fire rating obtained is also superior to other insulations of this type, although it is below other mineral wool insulations with very high fire reaction performance.



CONCLUSIONS

- The contribution of the value chain from positive work with external suppliers such as Triturats La Canya, RMT and Logrotex, has been fundamental in achieving the objectives set.
- KOOPMAT TERMIC has successfully demonstrated that some textile waste donated by the public can be recycled into thermal and acoustic insulation panels.
- The process steps are technically feasible, but the panel composition and technical performance need to be optimised. This will require determining the final manufacturing process, defining the companies to rely on, as well as working from a LCA and product approval perspective.

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



RAW MATERIALS COSTS
AND SUPPLY



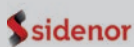
NUCAAS

CEMENT PRODUCED FROM
LOCAL INDUSTRIAL
BY-PRODUCTS

THE ENVIRONMENTAL IMPACT OF PORTLAND CEMENT INTENSIVE USE IN THE CONSTRUCTION SECTOR demands new mineral supplements with hydraulic and pozzolanic potential. Over 1 million tonnes of Construction and Demolition Waste (CDW) are generated in the Basque Country alone (20% by weight of the total waste generated). This is a strategic waste stream for the Basque Country as it contains mineral resources with a high potential for use in binary cement formulation.

NUCAAS is a project led by CEMENTOS LEMONA, a cement manufacturer which has involved the entire value chain: white slag supply companies such as the steel manufacturer SIDENOR ACEROS ESPECIALES; construction waste management companies such as HIERROS Y METALES GUTRAM; and construction material application companies such as EXCAVACIONES Y OBRAS DE DIEGO S.L.

COLLABORATORS





OBJECTIVES

- Obtain available waste that meet the appropriate requirements to serve as raw materials for Portland cement.
- Achieve concrete formulated with new cements offering adequate performance for use.
- Obtain cost-competitive waste compared to that available on the market and considering the processes to be carried out.
- Reduce the environmental impact of new cements in a complete positive way compared to conventional cement.
- Integrate the value chain made up of producers and waste management companies, cement manufacturers and users of cement in construction products, applying the principles of circular economy.



RESULTS

- CDW collection and conditioning in a recycling plant to be introduced into cement.
- Manufacture of two binary cements under real conditions using cement plant resources including: recycled concrete whereby hydrated cement component is able to promote the formation of new CSH gel by seed effect; and recycled ceramic as a brick whose richness in amorphous silica gives it a pozzolanic capacity which is useful for cement setting.
- Use of new binary cements by end users for incorporation into concrete formulations. Both binary cements achieve the same mechanical performance as their conventional cement counterparts.
- Practical on-site application of concrete with one of the new binary cements, with similar performance to that of concrete with commercial cement.
- Potential savings of 2,300 tonnes of CO₂ equivalent per year.



CONCLUSIONS

- NUCAAS opens a new potential market for CDW as an addition to cement provided that cement standards permit the addition of conditioned CDW as up to 10% to cement, and that cement manufacturers can pass on the price increase resulting from the use of recycled concrete CDW, whose processing and transport costs for use in cement manufacture make it more expensive than current non-renewable natural raw materials.
- This opens the door to new business opportunities for both waste management companies and cement companies. Waste management companies can expand their waste recovery market, while in turn reducing the waste volume going to landfill. Cement companies can find alternative raw materials to natural raw materials.
- The scope of application of these results is currently being analysed in order to introduce the CDW market in the Basque Country, as a supplier of a solid product capable of satisfying local demand while maintaining the necessary quality standards.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



DIGIDEMO

BUILDING DEMOLITION MATERIAL DIGITALISATION

THE DEMOLITION PHASE IS A KEY STAGE IN MAXIMISING CIRCULARITY OF MATERIALS AND PRODUCTS.

In the Basque Country, 73% of Construction and Demolition Waste (CDW) is effectively recycled and all directives and regulations are aimed at improving this percentage. In order to achieve a high degree of CDW recovery, reuse and recycling, demolition must be based on objective and accurate data on different aspects of the building to be selectively demolished and its surroundings. This context provides an opportunity to implement digital tools and methodologies that streamline and offer technical rigour to the pre-demolition study or audit.

LEZAMA DEMOLICIONES, a company specialising in industrial demolition and CDW management and recycling, has led DIGIDEMO, and TECNALIA Technology Centre has also participated in the project execution.

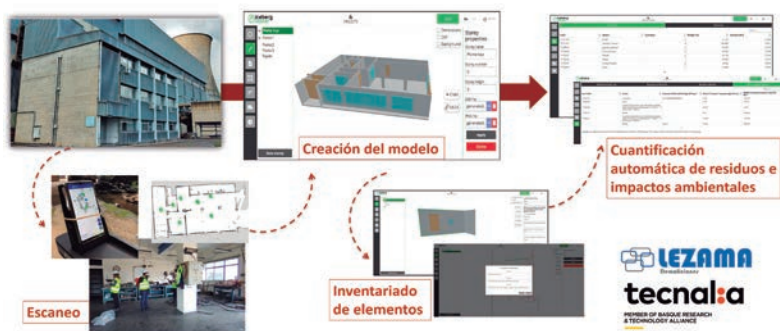
COLLABORATORS





HERRAMIENTA DIGITAL PARA LA CUANTIFICACIÓN PRECISA DE LOS MATERIALES PROCEDENTES DE DEMOLICIÓN

Permite una gestión mejorada de los residuos durante la demolición y una estimación de los impactos ambientales



OBJECTIVES

- Development, adaptation and real-life demonstration of a digital tool (BIM-SD) for accurate quantification of end-of-life materials in buildings.
- A 3D model with semantic information for each demolition project, which allows viewing components and helps the decision-making process.
- Optimal planning of demolition work.
- Accurate quantification and improved management of resulting CDW.
- Estimation of associated environmental impacts.



RESULTS

- Implementation of expert knowledge, databases based on company equipment, environmental impacts and economic costs derived from demolition tasks, transport and final management of CDW.
- Demonstration of the BIM-SD tool on a real-life demolition project. The results are useful for drawing conclusions and validating their commercial exploitation in future market projects.
- Over a 3-year horizon, DIGIDEMO will enable the company to improve contract acquisition (+3-4 additional works) and turnover (+€2M) per year, as well as substantially improving its margin per work.



CONCLUSIONS

- The digitalisation of buildings to be demolished is feasible in terms of time and costs when the right tools are available. Thus, modelling of a complete building (3 floors, 2,400 m³) was validated in two working days, including surface scanning, element generation and material inventory.
- The digitalisation of the demolition provides a CDW forecast, with a deviation below 20% in mass, as well as an estimate of the environmental impacts and economic costs without significant increase in timescales for the preliminary study and works.
- The results will be applied in future demolitions in the Basque Country, achieving 90% recovery of material resources, with greater waste traceability and lower economic costs.

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



CITY SEDUCE

ECOSYSTEM-BASED URBAN
ASSESSMENT AND PLANNING
OF EUROPEAN MUNICIPALITIES

**INTERNATIONALLY THERE ARE DIFFERENT METHODOLOGIES
SUPPORTING STRATEGIC MANAGEMENT OF URBAN
SUSTAINABILITY.**

However, none of the existing technological proposals is currently marketed as a mixed, integrated package that sets up a system for sustainability positioning and assessment on the one hand, and defines an individualised roadmap to guide municipal management, on the other.

The CITY SEDUCE project was born from strategic positioning due to the new EU policies and priorities of the European research and innovation programme, Horizon 2020. The assessment tool to be developed aims to be a pioneering example of a comprehensive model to support assessment and decision-making in European municipalities.

CITY SEDUCE is led by NAIDER, a social and business project whose founding objective is to collaborate in building smart economies, co-create innovative and inclusive cities, and co-lead processes towards environmental sustainability.





OBJECTIVES

- Develop a strategic management tool to assess the state of sustainability of European cities.
- Position European cities in a standardised diagnostic system.
- Show further steps to be taken to move towards an optimal state of environmental sustainability, defining a progressive model of strategic maturity.
- Support institutions in assessment and positioning of municipalities through comprehensive strategic management models.



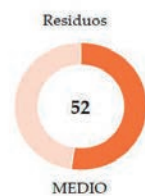
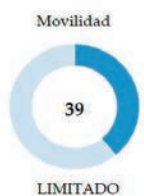
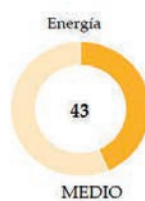
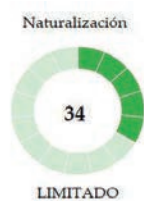
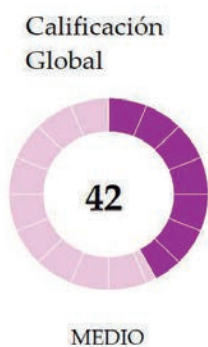
RESULTS

- A tool was developed to assess the maturity status of environmental sustainability in each municipality in a semi-automatic way, and to verify the impact of the measures implemented on the development of sustainability.
- Categorisation of the state of sustainability in a municipality through the POSITIONING stage included in the tool.
- Action plan and research based on the results that can be achieved in the municipality through the PROJECTION stage included in the tool.



CONCLUSIONS

- The implementation of CITY SEDUCE has identified new opportunities for improvement and product development. Thus, by incorporating new elements of analysis, the tool could be completed by integrating economic, social or urban realms to provide a more complete picture of the municipalities. It could also be adapted to the 2030 Agenda and the Urban Agenda with the aim of aligning Basque Country municipalities with Sustainable Development Goals.
- Nowadays, digitalisation opportunities allow technological solutions that facilitate the use of the tool with web applications or mobile apps.



DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



NATURBIDEAK

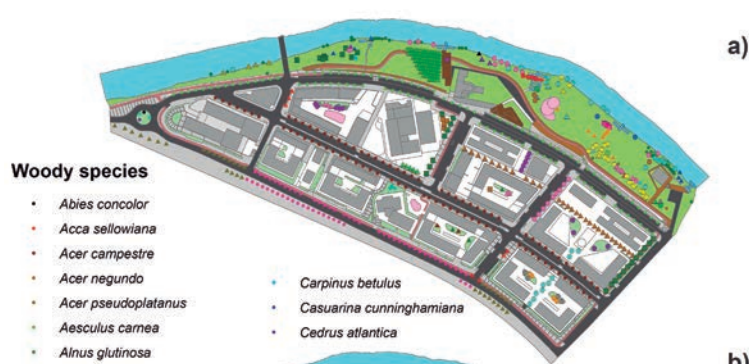
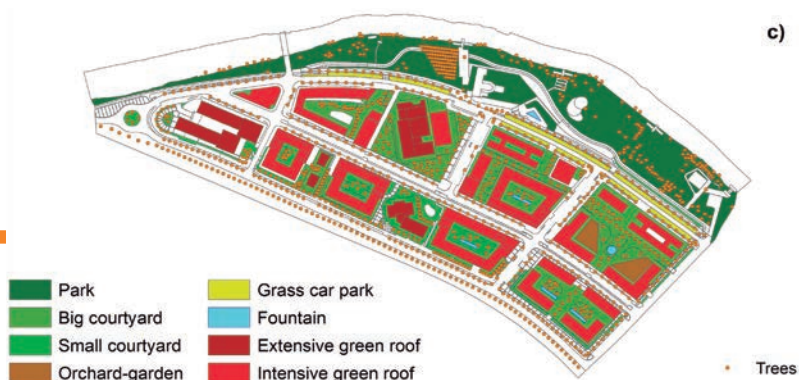
NATURAL URBAN ENVIRONMENT REGENERATION SOLUTIONS IN DONOSTIA

COPENHAGEN, ROTTERDAM, PARIS, LONDON AND VITORIA-GASTEIZ are among many other cities which have opted for greening and nature-based solutions to adapt to climate change. Nature-based Solutions are inspired by nature, provide environmental, social and economic benefits, and strengthen the use of ecosystem services in combination with existing infrastructures in urban or peri-urban settings. Nevertheless, the benefits of Nature-based Solutions applications are rarely quantified and only qualitatively indicated.

NEIKER Technology Centre is leading NATURBIDEAK, with the collaboration of TECNALIA Technology Centre and DONOSTIA-SAN SEBASTIÁN TOWN COUNCIL.

COLLABORATORS





c)

a)

b)

c)



OBJECTIVES

- Establish a common methodology that achieves quantification of the benefits of Nature-based Solutions (NBS) on four environmental variables (biodiversity, carbon sequestration, improved thermal comfort and run-off management), integrated in a practical case for the first time, while responding to the individual challenges of each variable.



RESULTS

- Method validated in the "L.M.06 - TXOMIN ENEA" area of Donostia-San Sebastián.
- A meso-scale analysis including an assessment of the benefits of the River Park planned in Txomin Enea as a NBS in itself, as well as its possible contribution to the urbanised part.
- A micro-scale analysis conducted with proposals for small-scale NBS and their effectiveness has been quantified.
- No major modifications were possible in construction projects under way in the area as they were at a very advanced stage of definition, but actions that could be implemented on site in terms of NBS were agreed with city council technicians, such as: increasing ground cover and vegetation, or installing permeable pavements.



CONCLUSIONS

- The meso-scale analysis results of Txomin Enea are positive thanks to the River Park Nature-based Solution, as it promotes the presence of a rich and diverse bird community close to the residential area, as well as rich and abundant macrofauna. Regarding the thermal variable, the cooling capacity of the river park over an urbanised area was demonstrated. However, the current project for Txomin Enea land development in isolation presents a negative diagnosis.
- This working method helps decision making by the Administration and generates knowledge which can be applied by companies that design and market Nature-based Solutions. The results are aligned with the studies being carried out in various European projects and EU-funded NBS research lines.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



ALOCLIN

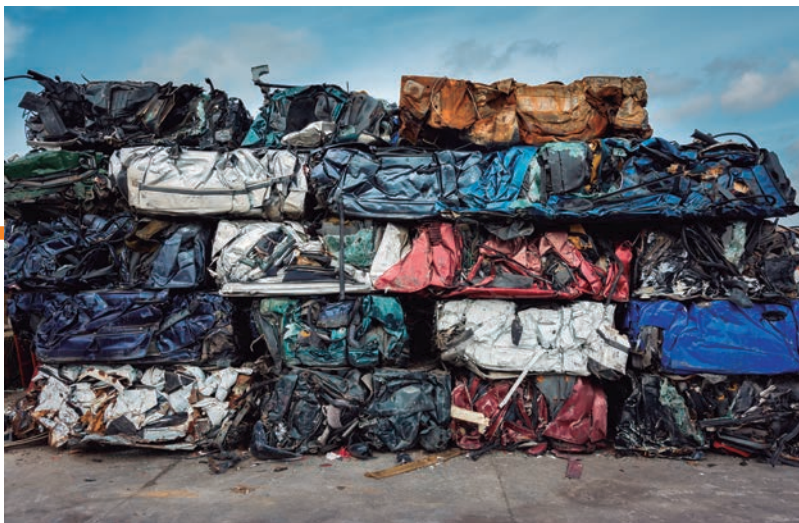
SALT SLAG TREATMENT BY-PRODUCTS FOR CLINKER PRODUCTION

SECONDARY ALUMINIUM REFINING REQUIRES THE USE OF SODIUM AND POTASSIUM CHLORIDE MIXTURES as fluxes to prevent oxidation, increase yield and boost thermal efficiency; but in doing so, it generates so-called aluminium salt slag which is a hazardous waste. The recovery of salt slags aims at separating the aluminium metal and salt from the contaminants so that all components can be reused. RESAL, a company of the Otua Group, carries out the necessary grinding and separation treatments, and the hydrometallurgical treatment of the non-metallic fraction (NMF) of the salt slag, and is able to fully close the aluminium recycling and reuse cycle. For ALOCLIN, the cement company SOCIEDAD FINANCIERA Y MINERAL and INATEC, the Otua Group's R&D Unit, have collaborated in the project.

The main source of input waste for the Otua Group's secondary aluminium refinery is ELVs, which are subject to reuse, recycling and recovery targets that are difficult to achieve with the treatment technologies currently in operation.

COLLABORATORS





OBJECTIVES

- Adapt a by-product, NMF from the hydrometallurgical treatment of salt slag, to be used in a highly demanded application, i.e., clinker production, as a replacement for the metal oxides normally used, based on the similar composition of bauxite used in the cement industry and NMF from salt slag.
- Increase the percentage of material recovery in the treatment of ELVs.



RESULTS

- Definition of specifications to be met by the material destined for the cement production company.
- Characterisation of NMF resulting from the hydrometallurgical treatment of salt slags (free moisture, hydration, chlorides, aluminium, reactive species, and chemical composition).
- The NMF refurbishment encountered technical problems which did not allow the required specifications to be met.



CONCLUSIONS

- ALOCLIN has studied the use of aluminium salt slag NMF in the production of clinker and has demonstrated, according to the characterisations, that it is possible to obtain raw material with the appropriate characteristics for clinker production from salt slag NMF.
- RESAL is still interested in recovering the NMF resulting from the management of salt slag, under the specifications set by the cement production industry, and continues to work at process level to obtain the operability that will allow it to meet the needs of ALOCLIN in the future.

DRIVING FACTOR



POLLUTION MINIMISATION



ARIS

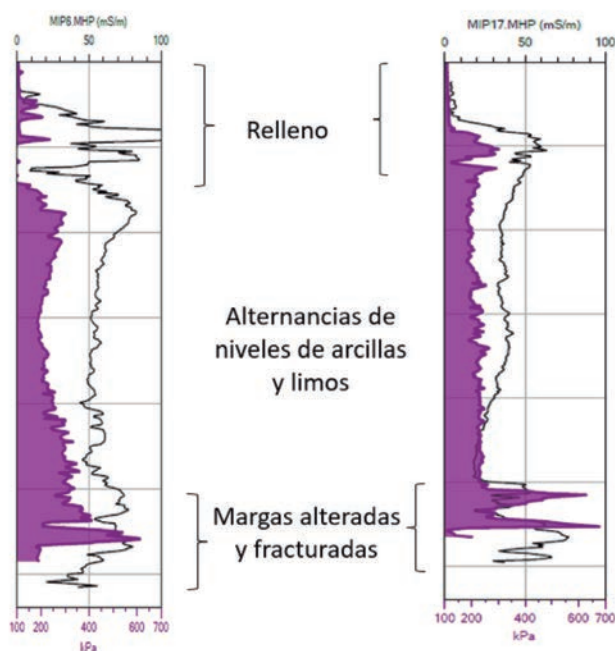
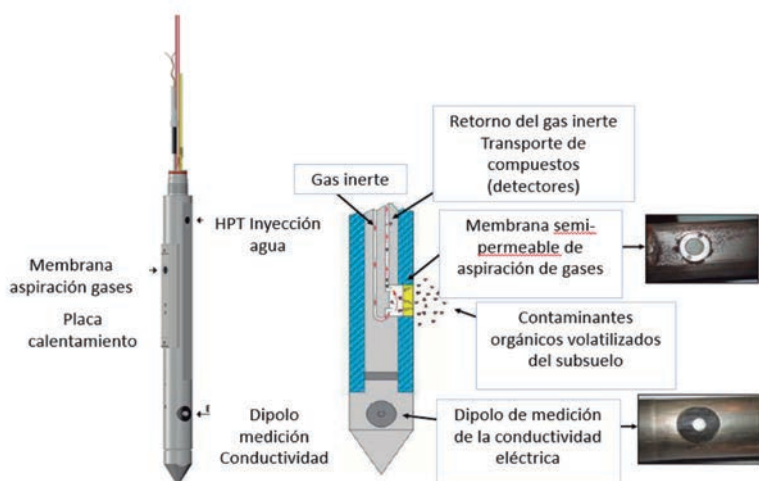
HIGH RESOLUTION TECHNOLOGIES FOR CONTAMINATED SOILS MANAGEMENT

DENSE INDUSTRIAL FABRIC AND INTENSE HISTORICAL ACTIVITY HAVE HAD AN IMPACT ON SOIL IN THE BASQUE COUNTRY, whose Circular Economy strategy seeks to reduce waste generation and minimise the management of contaminated land in landfill sites. Legislation prioritises soil quality monitoring and forces organisations responsible for land contamination and/or remediation to investigate and remediate soil. Conventional methods require boreholes to be drilled for soil and groundwater sampling, and samples are then analysed in the laboratory. The MIPHPT (Membrane Interface Probe & Hydraulic Profiling Tool) technique consists of directly obtaining information about the subsurface by introducing an instrumented probe. As the probe advances, the physical parameters of the subsoil (conductivity and permeability) are measured and recorded, and volatilisation organic pollutants (volatile and semi-volatile) contained in the soil is triggered. Pollutants are later analysed on the surface by means of portable detectors. This technology provides ongoing results and a much larger volume of data than conventional techniques.

TALANTIA, focuses its activity on protecting and improving the quality of the environment through the implementation of new technologies, especially in the management of contaminated soil and groundwater. TEKNIMAP is a company specialising in the fields of environmental consultancy, inspection and monitoring.

COLLABORATORS





OBJECTIVES

- Evaluate the MIPHPT technology in the Basque Country, contrasting the results obtained with respect to conventional technologies, and validating its field of application and prospects.
- Detect and assess soil and groundwater contamination in situ, to complement conventional investigation methods.
- Optimise conventional borehole locations.
- Reduce laboratory analyses.



RESULTS

- The technique is both operational and fast, as the equipment bores holes at a higher speed than traditional soil analysis equipment, handling a greater volume of data in a much shorter time.
- The lower limit of detection (LLOD) of the field method is not a problem, as no laboratory positives have been recorded in the field.
- Differentiation of lithologies by means of electrical conductivity and injection pressure gauges allows a high vertical resolution of the different sections in terms of permeability and clay content, and both parameters are essential to define the migration of contaminants.
- The technology does not directly address the regulatory need to certify compliance with reference concentrations in relation to uses, which has limited the emerging demand for these services in the EU.



CONCLUSIONS

- The implementation of MIP HPT Direct Push tools in the Basque Country would have a wide application potential given that industrial areas are located in favourable areas for its use. A plant in the Basque Country can cover a large part of the Iberian Peninsula and southern France.
- The increased volume of data offered by the technology reduces the uncertainty inherent in the heterogeneity of the subsurface, and, in the remediation phase, accurately delineates affected areas in 3D and facilitates highly efficient in-situ treatments. This minimises and even avoids excavation and landfill management of soils that can be reclaimed, thus supporting the Circular Economy Strategy.
- The subsequent phases are oriented towards the use of MIPHPT technology in in-situ remediation, by applying oxidising and/or reducing compounds and monitoring effectiveness. Market research and the contribution of the administration will also be explored in depth. It would be interesting to transfer the technology to an operating company and to market, and to raise awareness of the method among potential policy makers, developing a plan to communicate the results.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



POLLUTION MINIMISATION



ARIS II SMART REMEDIATION OF CONTAMINATED SOILS

1.3% OF LAND IN THE BASQUE COUNTRY is occupied by potentially contaminated soils; and more than 350 of soils analysed have contaminated water and cannot be remediated by excavation. In terms of reuse, only 20% of potentially contaminated soils have been returned to the market, which means that the remaining 80% end up in landfill. In-situ remediation has been confirmed as the most efficient and sustainable method. ARIS II proposes introducing innovative technologies to the Basque Country to increase the capacities of companies in the environmental sector and provide exportable value to other territories.

TALANTIA, the company developing ARIS II, focuses its activity on protecting and improving the quality of the environment through implementing new technologies, especially in contaminated soil and groundwater management. TEKNIMAP has also collaborated in this project.

COLLABORATORS





OBJECTIVES

- Design and perform two pilot decontamination trials using in situ chemical oxidation (ISCO) and in situ chemical reduction (ISCR) techniques on groundwater and soil based on the results of the MIPHPT (Membrane Interface Probe Hydraulic Profiling Tool) campaign available in the ARIS I Project.
- Monitor the effectiveness of remediation work, applying the MIPHPT technology again.



RESULTS

- This project is based on a field campaign that is currently under way, and therefore data on the method efficiency are not yet available.
- One of the major challenges identified was the final selection of subcontractors available with the means to implement the envisaged technology (reagent injection by "direct push") at affordable costs.
- Selection of injection reagents/suppliers.
- As a provisional assessment we can conclude that trials are proceeding more slowly than expected, but within the expected margins for a first-time experience.



CONCLUSIONS

- No final conclusions can yet be drawn from the trials, but interest has already been identified at national level in incorporating these technologies. In fact, the project has prompted investment in equipment from one of the project's key subcontractors.
- A strong dependence on international companies for the supply of reagents under patent has been identified, although this is the norm in the industry. The selection of reagents is one of the keys to the project.

DRIVING FACTOR



ENVIRONMENTAL
POSITIONING AND
TRANSPARENCY



GREEN PUBLIC
PROCUREMENT



HP GREEN

**RAINWATER DRAINAGE SYSTEM
USING RECYCLED PET**

PET (POLYETHYLENE TEREPHTHALATE) IS THE MOST WIDELY RECYCLED PLASTIC IN THE WORLD. Recycling infrastructures are well established, from collection and sorting to further processing and end use. PET can be recycled multiple times, although only a first level of recycling is allowed for food use. Beyond this level, it is used for a wide variety of end products such as fibre, textile fibre filler, webbing, and bottles and containers for non-food uses, including detergents and phytosanitary products. There are many applications for recycled PET in the construction sector, but mass production to develop a manufacturing industry has been limited. ULMA, specialists in construction drainage systems, seeks to change this situation.





OBJECTIVES

- Incorporate resins made from recycled PET (by glycolysis) in the manufacture of polymer concrete material, to be used in drainage and sewerage applications.
- Achieve an industrial mass-produced product which can be exported all over the world.
- Reduce landfilling of low-value PET streams.
- Meet the sustainability criteria set by the future building trend.



RESULTS

- Recycled PET resin obtained on a laboratory and industrial scale, was integrated with the rest of the polymer concrete material components.
- New product development: rainwater drainage channels with minimal environmental impact.
- Concrete with exceptional mechanical resistance (up to 4 times more resistant to compression than traditional concrete) was obtained, allowing the production of light elements with reduced dimensions.
- Use of 400 tonnes of PET waste streams per year, diverting them from landfill disposal, and saving 345 tonnes of CO₂e.
- 2% contribution to the company's turnover.



CONCLUSIONS

- One of the major factors contributing to HP GREEN success has been the detailed study of the industrial adaptation of the product and process, given that scalability is always a critical factor to take into account when starting from a laboratory level development.
- The success of the new variety of PET resin-based polymer concrete material is a major step forward for the company and will also lead to exploring new avenues for incorporating recycled materials into its products in the future.

DRIVING FACTOR



POLLUTION MINIMISATION



BIOREM

BIOREMEDIATION OF SEWAGE SLUDGE-POLLUTED SOIL

INDUSTRIAL ACTIVITY, HIGH POPULATION DENSITY AND LACK OF AVAILABLE AND VIABLE LAND, have contributed to the proliferation of landfills in urban, peri-urban and natural areas in the Basque Country. Landfills are sources of soil pollution and affect water. The shortage of natural or agricultural land makes it necessary to look for new strategies to recover contaminated land for other uses that support social and economic regeneration of the environment. The physical and/or chemical soil treatment technologies available are very costly and have a high impact on soil ecosystem (incineration, vitrification, washing, nano-remediation). In contrast, biological technologies are less costly, but often require long lead times to produce the desired effects. Biological technologies include bioremediation (bacteria), vermiremediation and phytoremediation.

The UNIVERSITY OF THE BASQUE COUNTRY (UPV-EHU), through its Department of Zoology and Animal Cell Biology, leads BIOREM, a project in which NEIKER has also participated.

COLLABORATORS





OBJECTIVES

- Apply a combination of bioremediation techniques to improve the health of soils amended with sewage sludge from sewage treatment plants.
- Integrate the proposed bioremediation technologies to seek synergies and mitigate the inherent limitations of each.
- Increase the performance of polluted soil remediation processes and improve soil health.



RESULTS

- Soil health significantly improved in the plots due to the treatments applied. The most effective treatment included those incorporating all three remediation techniques simultaneously: plants (lucerne), earthworms and micro-organisms.
- Remediated landfill soils do not exert acute or chronic toxic effects on *Eisenia fetidae* worms or their reproductive capacity.
- Dieldrin has been the pollutant with the highest removal rates with degradations between 50% and 78%.
- Removal rates around 20-25% for heavy metals (Cd, Cr, Pb and Ni) and Benzo(a)pyrene.
- Reduction of Cr (on 21 out of 24 subplots), Ni (on all subplots), Pb (on 23 out of 24 subplots) and dieldrin (on 17 out of 24 subplots) to values below those stipulated by current legislation. However, in the case of Cd and Benzo(a)pyrene, reductions still exceed the VIE-B limits for other uses.



CONCLUSIONS

- The conclusions reached at the moment can only be extrapolated to soils with similar characteristics to those studied: with deposition of sewage sludge, high organic matter content, high stage of ground-water table, and not very high diffuse pollution.
- The most effective treatments are those that incorporate all three remediation techniques simultaneously (bioremediation, phytoremediation and vermiremediation).
- The next phase of BIOREM will apply the optimal methodological approach defined in the small-scale project on a large scale, with one-year cultivation of selected plants with the best combination of remediation strategies.

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



ECOBRIDGE PROJECT ECODESIGN OF REUSABLE MODULAR BRIDGE

THE ECOBRIDGE PROJECT CAME OUT IN THE CONTEXT OF THE CONSTRUCTION OF THE BILBAO SOUTH METROPOLITAN BYPASS.

This is a radically different structural concept compared to traditional bridge design which aim to find monolithic elements, with a service life of up to 100 years, but rarely considering maintenance. In these traditional scenarios, demolition of elements and full life-cycle management are not taken into account and the issue is simply passed on to future generations. ECOBRIDGE presents a modular ecobridge which improves the end-of-life of bridges. As opposed to the usual demolition operations, modularisation allows the bridge to be cleanly dismantled and reused on another site, without waste generation.

VIUDA DE SAINZ is a construction company dedicated to providing services related to construction, operation and maintenance of all types of public and private works.





OBJECTIVES

- Extend the end-of-life of conventional bridges and usual demolition work through the eco-design of a new modular and reusable bridge.
- Verify Ecobridge structural performance and evolution over time.
- Quantify the environmental advantage of Ecobridge through a comparative LCA.



RESULTS

- The Ecobridge developed saves 3% in CO₂e emissions compared to the traditional solution, with a single use.
- As Ecobridge is reused, the improvement in CO₂e emissions increases dramatically: from 3% to 49% with just one reuse; to 64% with three uses; and up to 71% with four equivalent uses compared to building an additional traditional bridge.
- Reusing the ecobridge avoids the demolition of 300 tonnes of materials and cuts CO₂e emissions by 1,200 tonnes.



CONCLUSIONS

- ECOBRIDGE has validated the developed eco-bridge complies with structural performance over time, and this was materialised in the limit states imposed by the reference standards in the sector.
- By using the bridge in a location other than the original one, CO₂e consumption per square meter of deck is reduced by about 50% compared to traditional equivalent solutions.

CHALLENGES



GENERAL

- Managing profitability of utilities.
- Managing electricity generation mix in the medium term.
- Digitalisation of the network and its integration with Europe.
- Developing predictive maintenance systems and self-optimisation systems.



ENVIRONMENTAL

- CO₂ and other GHG emissions.
- Recovery of critical raw materials contained in waste.
- Minimising waste generation.
- Improvement of waste collection and treatment processes (92% of the impact is in the use phase).

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Product eco-design and energy labelling
- Re-manufacturing electrical and electronic equipment
- Waste recycling.
- Servitisation associated with electrical systems
- Regulation and control with simulation.



COMPETITIVE IMPROVEMENTS

- Eco-designing energy-related products
- Energy labelling.
- Treatment of waste electrical and electronic equipment.
- Recovery of non-ferrous metals contained in waste batteries.
- New renewable energy storage technologies: molten metals.
- Lithium-ion based energy storage system.
- Conversion of renewable energy into chemicals using electrolysis processes.
- Manufacturing manganese dioxide and iron as secondary raw materials.



ELECTRICAL AND ELECTRONIC EQUIPMENT



DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



HPP

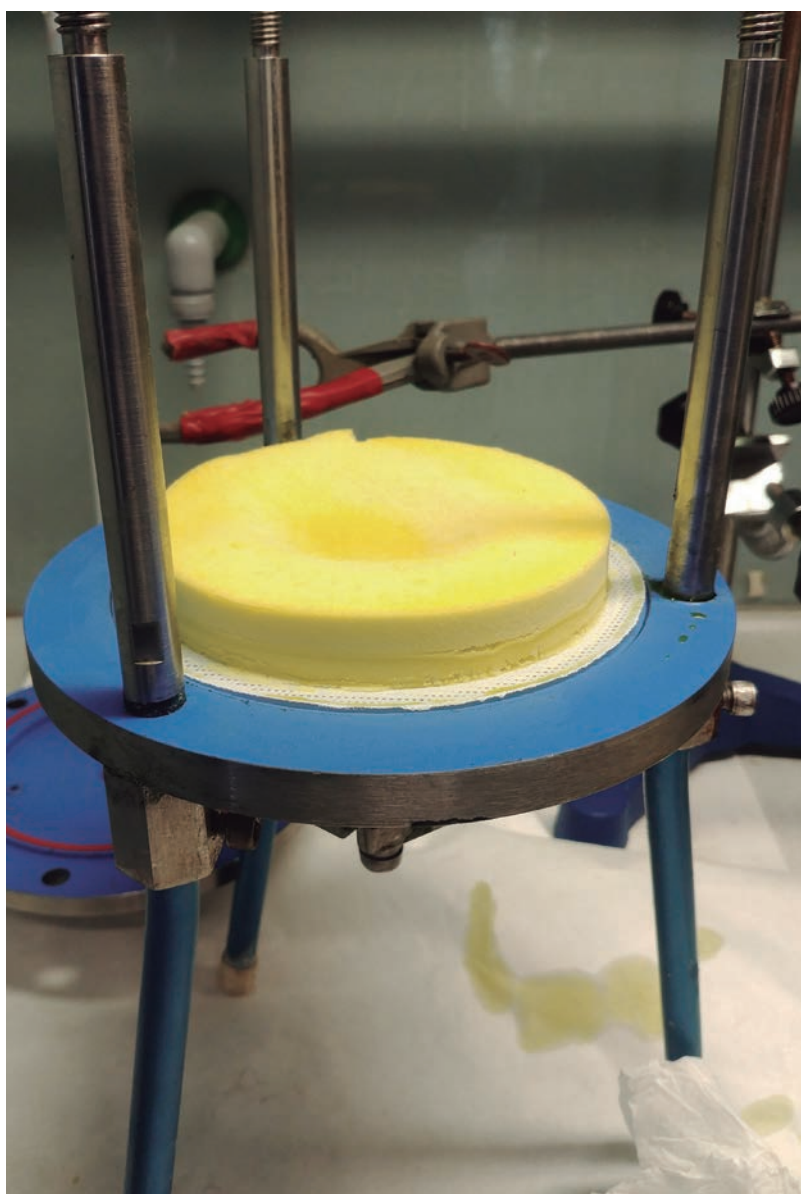
HIGH PURITY SECONDARY ALUMINIUM OXIDE FOR LED AND ELECTRONIC COMPONENT MANUFACTURING

HIGH PURITY ALUMINA (HPA) IS A HIGHLY DEMANDED PRODUCT OF HIGH ECONOMIC VALUE AND CRITICAL TO MANUFACTURE SYNTHETIC SAPPHIRE, which is widely used in the manufacture of electrical and electronic components. Typical HPA production is linked to very expensive raw materials with high energy costs and subject to environmental policies. Secondary aluminium oxide is a source of alumina with impurities and a potential alternative raw material to produce HPA. Since quality requirements are very demanding, the chief technological challenge is to maximise aluminium oxide purity.

BEFESA, a leading European company in hazardous waste recycling services for the aluminium industry, has worked in different lines to recover secondary aluminium oxide as an alternative raw material to bauxite.

COLLABORATORS





OBJECTIVES

- Obtain an alternative material of the so-called 4N grade with the appropriate characteristics and properties of high purity alumina, and valid for the manufacture of LEDs and electronic components.
- Reduce the amount of primary aluminium processed and the extraction of bauxite ore to 10,000 tonnes per year at European level.
- Use a non energy-intensive secondary source material without extraction of natural resources or import of materials.
- Reduce the cost of obtaining the product by 7%.
- Diversify into new applications and higher value-added sectors with competitive solutions.



RESULTS

- A high purity alumina was obtained from secondary aluminium oxide, but did not reach grade 4N, with a tolerance limit below 100 ppm.
- The chemical intermediate obtained, aluminium chloride grade at 18% Al_2O_3 , can be used as a potential alternative to the coagulant market in the paper and/or water treatment industries, and thus, become a new product of recycled origin.



CONCLUSIONS

- HPP involved a very high technical risk due to the high purity (99.99%) required by a 4N-grade HPA. The high degree of purity achieved (82.0%) is not sufficient to demonstrate the project viability. Although this a very ambitious challenge, the line of research is expected to continue, optimising parameters and facilitating selective recovery by means of a new R&D and Innovation project with a public-private partnership in collaboration with the Bilbao School of Engineering (UPV/EHU).
- The results obtained have given rise to a new market for secondary aluminium oxide as a raw material to produce aluminium chloride (chemical intermediate obtained after chemical treatments), used as a coagulant in the paper and water treatment industries. The technical, economic and environmental feasibility of this potential new product will be analysed in the short term.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



ECOBIOSENSOR

ECO-DESIGN OF BIOSENSORS FOR FOOD SAFETY DIAGNOSIS

SIMPLE, COST-EFFICIENT AND PORTABLE DIAGNOSTIC DEVICES BASED ON DISPOSABLE OR SINGLE-USE SYSTEMS are increasingly applied in the food industry as well as in the clinical and veterinary sector. These devices are replacing more tedious and costly traditional methods. The application of materials with a reduced environmental footprint and miniaturisation of analytical devices are promising strategies to reduce the environmental impact caused by the massive use of these devices. BIOLAN, a leading company in analytical technology applied to the food and health sectors, has identified an opportunity to develop a new generation of more sustainable biosensors that contribute to the dematerialisation and increased recyclability of BIOLAN products. TEKNIKER and GRUNVER have also participated in ECOBIOSENSOR: in the development of the measuring equipment, and the life cycle analysis of the current and new solution, respectively.





OBJECTIVES

- Eco-design of measuring equipment: miniaturisation of the potentiostat as the measuring equipment through the application of electronic components based on "System on a Chip" (SoC).
- Eco-design of test strips or biotests: reduce plastic material and apply conductive inks based on aqueous solutions.
- Validate eco-designs: to confirm the environmental performance of both the measuring equipment and test strips or biotests with respect to previous solutions from a life-cycle approach.



RESULTS

- Miniaturisation of measuring equipment.
- Miniaturisation and simplification of biotest strips.
- Reduced full-life environmental footprint of new products compared to previous products by 21.8%, reaching 76.5% in the manufacturing phase, 59.7% in distribution and 55.7% in end-of-life.



CONCLUSIONS

- BIOLAN has achieved a portable biosensor eco-design, which will allow launching diagnostic solutions for the food industry to the market with lower environmental impact.
- The lessons learned from ECOBIOSENSOR encourage further work on the eco-design of other devices and analysis elements.
- The use stage is the most significant stage in the life cycle for improving the results of this project.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



ECOPILA

Zn-AIR BATTERIES WITH REDUCED ENVIRONMENTAL IMPACT

ZN-AIR BATTERIES PROVIDE ONE OF THE HIGHEST ENERGY DENSITIES ON THE MARKET, while using active materials such as zinc (Zn) or manganese oxide, which are inert in the environment. Thus, reducing plastic in battery cells would result in an easily recyclable product with minimal environmental impact. On the other hand, batteries are subject to Extended Producer Responsibility (EPR), whereby the producer pays a fee when batteries are released to the market, for future collection and recycling. These collection processes are carried out by collective EPR Schemes, which are faced with: the geographical dispersion of batteries; a mix of batteries with different chemistries resulting in a low percentage of batteries being collected (barely 30% are collected and properly treated); and poor recycling of these batteries.

CEGASA focuses its activity on energy storage and is the world's leading manufacturer of industrial alkaline Zn-air batteries, which have the highest energy density on the market. In ECOPILA, CEGASA worked with BOSTLAN as a partner company, which has a Zn waste management division.

COLLABORATORS





Estimación de reciclabilidad Pila EZ8



■ sin salida ■ salida posible ■ salida factible



OBJECTIVES

- Establish a new and complete circular economy route for Zn-Air batteries manufactured by CEGASA.
- Replace the polystyrene (PS) casing of batteries, due to recycling difficulties.
- Remove lead (Pb) content present in battery solder.
- Improve the efficiency of the collection systems and recovery of materials through the BOSTLAN recycling process, implementing a new line of business for the recycling of Zn-air batteries of European origin, in the Basque Country.



RESULTS

- Technically feasible replacement of PS envelope with cellulosic material together with a seal made of polylactic acid (PLA), a biocompostable material.
- Technically feasible process of welding with laser technology.
- Recovery of over 90% of the materials/components of post-consumer Zn-air batteries, improving by more than 40 points the minimum recycling rate required by the European Commission for this type of batteries. Zn recovery was similar to commercial types, and the process studied for the recovery of cathode materials also obtained good results and can be used again even at a higher level (manufacture of electrolytic manganese dioxide).
- Reduction of 2,770 tonnes of CO₂ equivalent per year.



CONCLUSIONS

- Market research is needed to assess acceptance of a product with the same functionality as the current product but at a higher price. Depending on the results obtained, the necessary investments in equipment and adaptation of the production line will be decided.
- The recycling process proposed for ECOPILA - which also includes all types of Zn-air batteries - is technically and economically feasible, and therefore, Spanish and European collective ERP schemes are currently being approached to model the collection of spent batteries and to establish a pan-European network for the recycling of this type of batteries.
- BOSTLAN has taken the first steps to make the necessary investment in an innovative process for the recycling of Zn-air batteries in Europe.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



PLASTICS



RECYMUFLA

RUBBER-FREE HIGHLY RECYCLABLE WASHING MACHINE DOOR SEALS

DOOR SEALS (OR MUFFLERS) FOR LOADING CLOTHES IN DOMESTIC WASHING MACHINES ARE MADE OF EPDM RUBBER (ethylene propylene diene monomer (M-class) rubber), a non-recyclable rubber as its vulcanisation process is irreversible. The washing machine seal is a mature product that has not been innovated in the market for a long time. RECYMUFLA proposes to increase the recyclability of the washing machine gasket thanks to the development of thermoplastic elastomer (TPE) gaskets.

This project responds to the need to incorporate a sustainability variable into CIKAUTXO's household appliances. There is no company in the world currently manufacturing washing machine door seals that offers this type of innovation. Therefore, if successful, this project would reach a global scope that would allow CIKAUTXO, a company specialising in the development and production of rubber and plastic components for various applications, to achieve a leading position and a competitive advantage.





OBJECTIVES

- Develop a new range of rubber-free, highly recyclable washing machine seals that comply with watertightness, flexibility, resistance to vibration and abrasive wearing requirements.
- Reduce energy consumption and noise by 15% and 20%, respectively, during the working cycle of washing machines.
- Optimise the current extrusion process for the new recyclable TPE material.
- Reduce the manufacturing process lead time by 12%, cutting down energy consumption and CO₂ emissions in the factory.
- Launch the new range of sustainable seals to the market by 2022.



RESULTS

- Improved abrasion resistance of the TPE-based material, in addition to the technical requirements set for the product.
- Set up injection moulding process conditions of washing machine seals with the new TPE-based material.
- New geometry design of the washer seal for the new material.



CONCLUSIONS

- The development and characterisation of the material requires close collaboration with the R&D unit (CIKATEK) due to the necessary transfer of material and technology knowledge (extrusion and injection) to CIKAUTXO team, specialised in the injection process of the EPDM rubber material.
- The development of RECYMUFLA resulted in further knowledge of extrusion compounding during the preparation of multiple TPE-based formulations with different thermoplastics, elastomers (SEBS) and process additives and functionalisation.

DRIVING FACTOR



ENVIRONMENTAL
POSITIONING
AND TRANSPARENCY



PGS

SUSTAINABILITY OF SUPPLY CHAINS IN THE ENERGY SECTOR

VALUE CHAIN MANAGEMENT AS A STRATEGY TOWARDS

Sustainable Development has gained importance globally in recent years. In the Basque Country, the environmental performance of the representative Basque industrial fabric was measured using the Bank of Environmental Indicators, but only from a corporate perspective, to enable each company to know its position in relation to the competitors. On the other hand, the EnergiBasque Strategy has identified the importance of improving sustainability management as a differentiating added-value factor, for a large number of companies in the energy sector. Although this affects large corporations first, much of the impact is felt on their value chains, and therefore more integrated work is increasingly needed to make significant improvements.

Participants of the PGS, led by the Basque ENERGY CLUSTER, included the renewable energy leader SIEMENS GAMESA, the lift and ramp manufacturer ORONA, companies from the energy sector, and the consultancy IK INGENIERÍA.

COLLABORATORS





OBJECTIVES

- Define and develop a systematic approach for trail-blazing companies to manage sustainability from a value chain perspective.
- Support companies in the value chain to take on board sustainability management concepts to improve their competitiveness and generate new business opportunities.



RESULTS

- PGS analysis document, which includes a sustainability management system for industrial value chains.
- PGS procedure to characterise the value chains of companies in the energy sector and generate Management Plans.
- Good Practice Report applicable to the industrial field, as an example for companies wishing to improve deficiencies in their value chain.
- Validation of the Procedure in SIEMENS GAMESA and ORONA, by means of a diagnosis of the value chain that includes analysing the current situation, and a report of Programmed Actions to improve the results of the sustainability diagnosis.
- Implementation of the Life Cycle Analysis (LCA) in SIEMENS GAMESA, as an environmental management procedure of wind turbines.
- Upgrading the Eco-design management system in ORONA and ORONA Suite software for a more efficiently transfer of the life cycle information of supplier companies to environmental profiles.



CONCLUSIONS

- During the performance of the diagnosis, it became evident that the questionnaire is sufficiently broad to address the sustainability assessment of any company. However, it may be too general for very large or large companies (with established sustainability parameters), as opposed to small companies with little or no experience in such diagnostics.
- Large companies manage global sustainability excellently at the corporate level but have not delved into the potential improvement linked to the life cycle of their products and services. Hence, Management Plans and the resulting Programmed Actions focus on enhancing the collection of data on the life cycles of their products throughout the value chain.
- PGS started the NEOSUB project under the Basque Government's HAZITEK programme, and as a result electrical substations have been designed and developed based on eco-design criteria, in collaboration with operators, engineering firms and manufacturers of capital goods.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



IRAGAZIZ IRABAZI

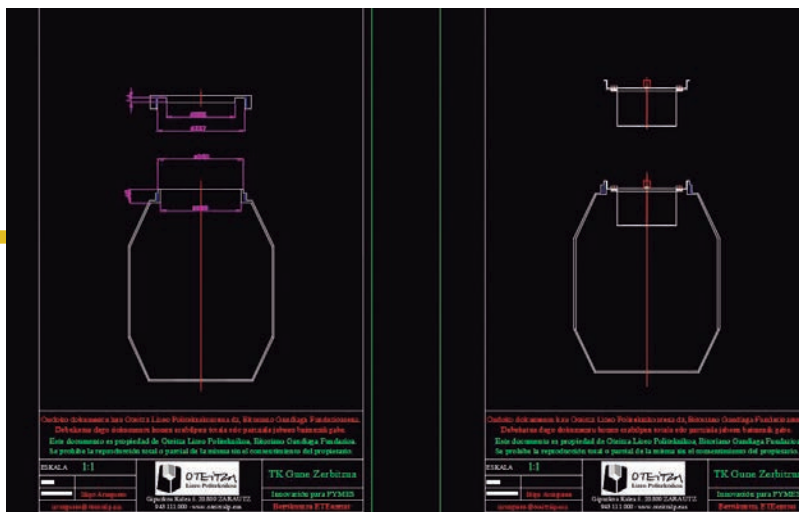
ATTACHABLE FILTER FOR WASTE VEGETABLE OIL COLLECTION DRUMS

CATERING AND HOTEL ESTABLISHMENTS GENERATING COOKED VEGETABLE OIL with a percentage of solid impurities and humidity of less than 15% must make it available to an approved management body. In practice, this percentage is often more than double, which means food waste has to be transported to and filtered in a facility at the operator’s plant. EKOLIO has also identified the need to improve the quality of the oil collected, a critical factor to obtain benefits in the recycled oil value chain. Furthermore, the company has a customer loyalty policy and operates on a market highly influenced by economic cycles, through environmental innovation and anticipating the environmental legislation that affects the sector and the company itself.

EKOLIO, a company dedicated to managing waste oil from the hotel and catering industry in Gipuzkoa, leads IRAGAZIZ IRABAZI, with the collaboration of OTEITZA LIZEO POLITEKNIKOA and the eco-design and LCA consultancy, IK INGENIERIA.

COLLABORATORS





OBJECTIVES

- Improve the quality of used oil collected in the Basque Country by filtering oil at source to reduce organic waste present by 50%.
- Develop an eco-designed filter that can be attached to collection drums located at the collection point.
- Involve professionals from the hospitality sector, given the variety of drums and the large number of waste collection points.



RESULTS

- The LCA revealed that 95% of the environmental impact is due to stainless steel extraction, a material that is nevertheless a fundamental requirement set by health standards.
- Design of a filter consisting of two filtering systems with stainless steel mesh, adaptable to different types of drums.
- Manufacture of a filter prototype with a unique filtration system that is adaptable to the drums and the mesh developed.
- This unique filter saves 1.92 kg of steel per filter, reducing raw material consumption by 68%, manufacturing energy consumption by 50% and the environmental impact associated with transporting the filter by 73%. In addition, carbon footprint has been reduced by 57% and the overall environmental impact by 65% through the entire life cycle.
- Landfill waste reduction amounted to 2 tonnes per year.



CONCLUSIONS

- EKOLIO has manufactured a prototype filter that is practical, durable, recyclable, replaceable, hygienic, easy-to-clean, easy to attach and adapt, ergonomic and safe-to-use for catering professionals, hoteliers and authorised waste managers, all thanks to eco-design methodology.
- The participation of hospitality sector end-users has been significant and crucial in the filter selection among the various options designed and analysed.
- For industrialisation and commercialisation purposes, the types of drums will be reduced and replaced with the three types of drums covered by the eco-designed filter. A corporate environmental communication strategy will be implemented at congresses, trade fairs, newspapers and specialised journals in collaboration with the Gipuzkoa Recycling Cluster and Ihobe.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



REDUCTION OF GREENHOUSE GASES (GHGS)



CO2PACK

INDUSTRIAL CO₂ REFRIGERATION EQUIPMENT

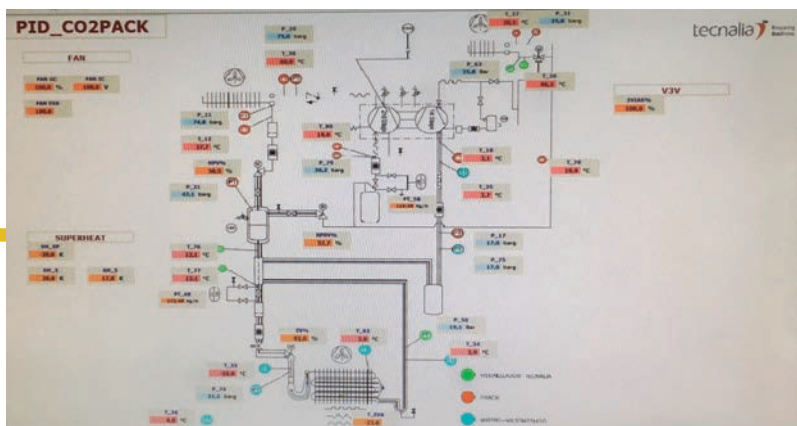
GASES COMMONLY USED AS REFRIGERANTS IN REFRIGERATION EQUIPMENT HAVE A HIGH GLOBAL WARMING POTENTIAL (GWP).

This means that, if released into the atmosphere, these gases contribute significantly to the greenhouse effect. This is one of the main drivers of global warming. In this context, in 2014, the European Commission approved the Regulation (EU) No 517/2014 on fluorinated greenhouse gases, which imposes a gradual ban on refrigerant gases with high GWP, especially in those sectors using high refrigerant charges and with significant leakage rates, as in the case of the industrial refrigeration sector.

KIDE is a company dedicated to manufacture, marketing and installation of commercial and industrial cold rooms. In CO2PACK, TECNALIA has contributed to the design, characterisation and validation of the functional prototype, IK Ingeniería has carried out the LCA, and ISEA has participated in management and coordination.

COLLABORATORS





OBJECTIVES

- Develop a low-temperature (-20°C) industrial refrigeration unit using CO_2 as refrigerant with a GWP of 1 versus the current refrigerant (GWP of 4,000).
- Redesign the thermodynamic cycle.
- Work at high pressures.
- Maintain cooling capacity and energy efficiency.



RESULTS

- Manufacture of a CO_2 refrigerator prototype, validated on the test bench.
- Reduced environmental impact of climate change by 8.08% compared to the current machine.
- Reduction by 4,300 tonnes of CO_2 equivalent emissions per year.
- Cost overrun contained, within the expected range.
- Development of industrialisation and optimisation guidelines for the prototype.
- Obtaining and using LCA as a guide to improve environmental impact.



CONCLUSIONS

- The refrigeration technology developed far exceeds the requirements of the European F-Gas regulation, providing a pathway for the development of a whole range of new refrigeration machines, reducing climate change impact and maintaining energy efficiency.
- The first models will be launched to the market in early 2022.
- The transfer of knowledge from TECNALIA's research area to industrial materialisation has been fundamental to the success of the project.
- Public funding has increased the intensity of collaboration, improving outcomes and decreasing time to market.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



Mondragon
Unibertsitatea

Goi Eskola Politeknikoa
Faculty of Engineering

REMACOMPIND

REMANUFACTURING INDUSTRIAL PRODUCTS AND COMPONENTS

REMANUFACTURING IS A CIRCULAR ECONOMY STRATEGY BASED ON EXTENDING THE LIFE OF PRODUCTS

and/or components at the end of their useful life. The industrial process involved consists of restoring a used product or component to a level of performance, quality and warranty equal or superior to that of a new product. In order to know if a product is suitable for Remanufacturing, it is necessary to study its typology, applicable Remanufacturing technologies and business model. Remanufacturing implies a resource-efficient manufacturing industry and its industrial development is strategic in AM development in the Basque Country, as well as representing a great opportunity for Basque industrial companies.

The ESCUELA POLITÉCNICA SUPERIOR de MONDRAGON UNIBERTSITATEA (EPS-MU) is leading REMACOMPIND, in which CEGASA, the manufacturer of industrial batteries, Lithium-Ion batteries and energy storage solutions, and the UNIVERSITY OF BAYREUTH have participated.

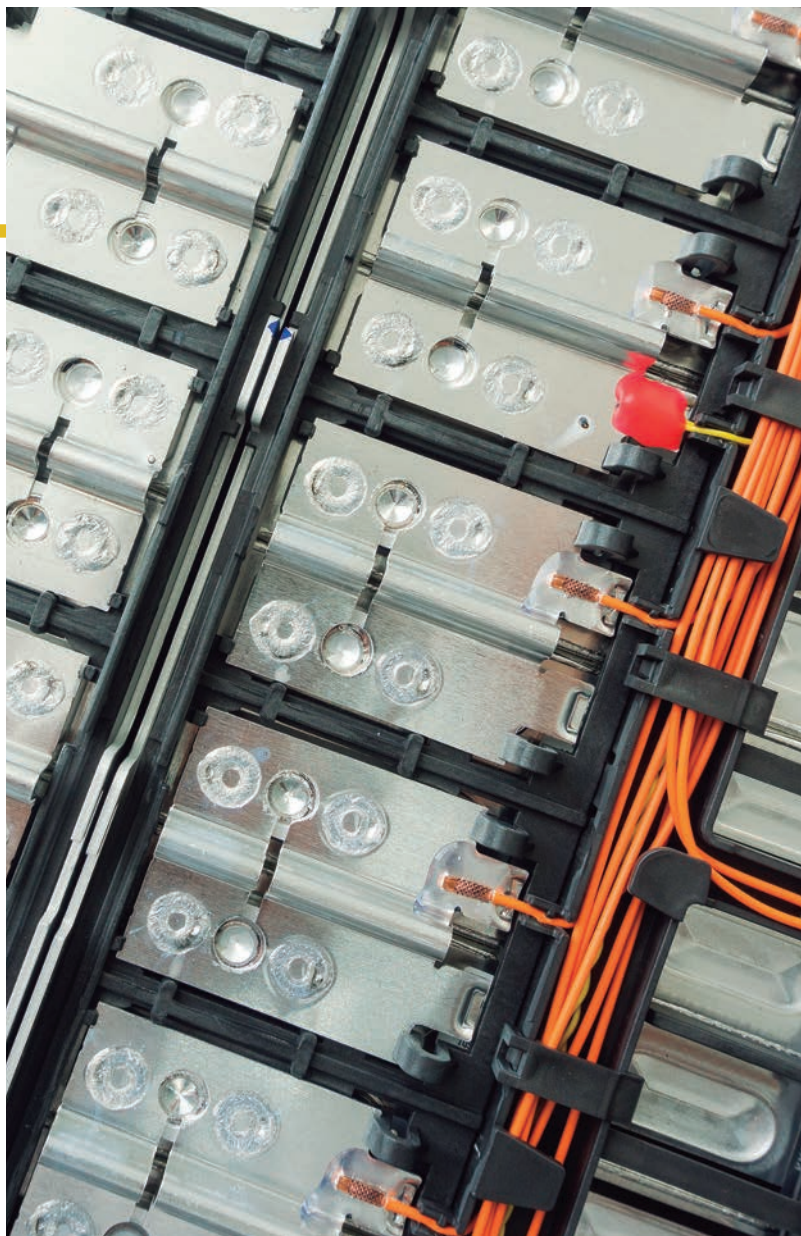
COLLABORATORS



UNIVERSITÄT
BAYREUTH

CEGASA





OBJECTIVES

- Identify and define Remanufacturing possibilities and R&D and Innovation in the Basque Country including: market niches for the Remanufacturing of industrial components, products and equipment in a planned, fast and economic way, and in compliance with the regulations in force in the major industrial sectors.
- Define the potential Remanufacturing market in the Basque Country, the criteria related to process organisation and the best Remanufacturing practices at international level.
- Develop a practical guide of Remanufacturing technologies.
- Define the issues to be taken into account for the efficient management of logistical and productive operations of a Remanufacturing system.
- Draw up a roadmap on R&D & Innovation needs for Remanufacturing in the Basque Country.
- Apply the analysis developed in the foregoing points to CEGASA.



RESULTS

- 197 companies with Remanufacturing potential were identified and classified into three groups: 42 high potential companies that remanufacture; 33 high potential companies that do not remanufacture; and 122 medium potential companies with no remanufacturing companies.
- Product datasheets for 40 companies were drawn up including their Remanufacturing potential, market penetration and technologies necessary for market penetration.
- Publication (by IHOBE) of guidelines for the implementation of the efficient logistics-production chain of the Remanufacturing system, and of a guide containing operational protocols to select the technologies applicable to the remanufacturing process.
- Cost savings of 3% and market share increase of 3% in its application to lithium battery remanufacturing cases at CEGASA.



CONCLUSIONS

- The Basque Country has a high Remanufacturing potential to be exploited.
- Remanufacturing is not often seen as a strategic activity by companies despite the profitability it brings to OEMs.
- Remanufacturing pilot projects need to be launched in industrial sectors to disseminate their potential. The REMANEX project has been undertaken to promote Remanufacturing in Basque industrial companies, and a guide for excellent Remanufacturing in the Basque Country has been developed and applied.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



POLLUTION MINIMISATION



ECONOISENSE

ECO-DESIGN OF A HIGH-PERFORMANCE SONOGRAPH

PRODUCTS IMPROVING PEOPLE'S QUALITY OF LIFE BY RAISING AWARENESS OF NOISE ISSUES must be environmentally friendly and their design in line with European targets for Waste Electrical and Electronic Equipment (WEEE) recovery and recycling. Noisense is a high-performance device created and marketed by NOISMART, a technology-based company specialising in noise control. This sonograph indicates when there is more noise than there should be, making noise "visible". It can also be used to detect noise pollution levels, creating data collection networks (IoT) and analysing data (Big Data).

To develop ECONOISENSE, NOISMART has worked with the GAIKER Technology Centre, BIZINTEK engineering and the MUKA DESIGN LAB design studio.

COLLABORATORS





OBJECTIVES

- Eco-design, manufacture, validate and certify a new sonograph of the Noisense family for indoor and outdoor environmental noise measurement.
- Create noise data collection networks (outdoors) with which to understand noise pollution at a site.
- Monitor noise and raise awareness of noise pollution in different environments.
- Anticipate demand for products with lower environmental impact and facilitate the dissemination of the environmental benefits of new devices through green marketing.



RESULTS

- Removal of unnecessary materials, optimisation of the number of components, and unification of housing and packaging materials.
- Optimisation production and assembly processes, reducing size and weight of both the device and packaging; and easy disassembly of housing and components.
- Manufacture of the Noisense Advanced prototype with a redesign that takes full advantage of the electronic components used in Noisense Basic. One prototype has been made with an electret microphone and another with a digital microphone, with the result that the latter is more sensitive to noise variations, reaching a reduced value of 55 dBA.
- The new device is suitable for outdoor use as long as housing designs are specified.
- Self-certification of the prototype to be completed in the future with CE marking in independent laboratories.



CONCLUSIONS

- ECONOISENSE has allowed an estimate of the production costs of the eco-designed devices and contributed to a decision to start a manufacturing process with production of a pre-series of 50 units.
- The brand name of the eco-designed equipment produced through this project will be ECONOISENSE.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



RECAISCE RECYCLING THERMAL INSULATING REFRACTORY MATERIALS

THE MANUFACTURING PROCESS OF THERMAL INSULATION

REFRACTORY MATERIALS GENERATES waste from manufacturing rejects and dust from machining operations containing silica fibres and biosoluble fibres, which can be recycled to manufacture new parts. Introducing recycled raw materials necessarily changes the manufacturing parameters of vacuum formed parts, but it is not known how.

NUTEC PROCAL, a high-technological manufacturer of high temperature fibre vacuum formed parts, has worked with the CEIT technology centre to develop RECAISCE.

COLLABORATORS





OBJECTIVES

- Eliminate up to 270 tonnes of materials currently ending in landfill.
- Create recycling lines for two types of materials: on the one hand, fibre (from slip preparation operations, milling process, and machining operations of the formed parts); and out-of-tolerance parts on the other.
- Classify fibres by composition, size, or forming properties.
- Analyse thermal-mechanical properties of the materials generated.
- Study the compatibility between additives and fillers used in out-of-tolerance vacuum-formed parts.



RESULTS

- A dust separation system is implemented according to the different fibres which make up dust.
- The powder produced satisfactory results in its contribution to the recycled parts.
- Definition of new formulations based on the granulometric analysis of material from out-of-tolerance parts.



CONCLUSIONS

- RECAIS CER does not affect the waste value chain since it disposes of waste produced in the plant.
- Implementation requires suitable partners for grinding, screening and sorting fibre products.
- RECAIS CER provides a method to analyse the reuse of waste from high-temperature fibre-based products, such as those generated by companies repairing furnaces or installing thermal insulation material.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



RETA ECO

NEW SPORTS BETTING TERMINAL

EKASA DIVERSIFICACIÓN IS PART OF THE RETABET GROUP of companies which the only company in the sector in Spain that integrates all the processes related to betting operations, including the design and manufacture of its own betting terminals. This gives the company a unique added value in the sector, where there is no initiative or activity published with an environmental approach to the design of betting terminals.

EKASA DIVERSIFICACION leads the RETA ECO project, in which several companies have participated: ADN DESIGN for eco-design and development of terminals; iEXCE for production and assembly; AVACON with electrical development; and G6 POLIURETANOS TECNICOS for the supply of plastic parts.

COLLABORATORS





OBJECTIVES

- Analyse, assess and implement the environmental and commercial benefits derived from a new eco-designed betting terminal following the guidelines of the UNE EN ISO 14044:2006 and 14006 standards: 2011.



RESULTS

- The LCA of the current terminal has identified the production phases of parts and components and the use phase as the most relevant in terms of environmental impact. In the first phase, the electronic elements stand out with a contribution of over 90% to the impacts of this phase; in the second phase, energy consumption accounts for 49% of the total impacts, and this is the greatest contributor to the product's environmental footprint.
- A prototype developed and built was manufactured with an impact reduction compared to the RETA INICIAL terminal between 0.4% and 3.4% depending on the impact category.
- Reduction of 5.43 kg (3.4% of the total) of the total weight of the terminal.
- Savings of 7 tonnes of raw materials per year and a 10% reduction in unit cost.



CONCLUSIONS

- The estimated life cycle of 10 years for the terminals has not yet been reached, so full knowledge of the system is being enriched by the analysis of the first generation of terminals installed and in use.
- The measures adopted do not increase the production cost of the terminal, and therefore, their implementation can be easily integrated into new product proposals. For example, they have been prominently incorporated in the most recently developed terminal, the RETA ECO 5 EVO.
- RETA ECO represents an important differentiation factor for the company, as none of its competitors have launched a similar improvement initiative. The RETA ECO terminal has therefore reinforced the company's leading position in the sector and its environmental commitment.
- The company is currently developing protocols to improve end-of-life management of older terminals that are nearing the end of their expected life cycle.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



STRAMER

RECOVERING STRATEGIC METALS FROM LITHIUM-ION BATTERIES

THE PROPER MANAGEMENT OF LITHIUM-ION BATTERIES WILL BECOME AN ABSOLUTE NECESSITY IN THE SHORT TERM.

Large companies in the sector are working on the creation of new recycling plants and battery treatment plants are being converted, complementing traditional batteries recycling with new lithium-ion lines. Forecasts indicate a general increase in the use of these batteries, both in electric appliances and electric mobility. In fact, there is a need for recycling plants throughout the country including this new line of treatment.

The waste management of lithium-ion batteries faces the challenge of introducing batteries into the recycling process, through Waste from Electrical and Electronic Equipment (WEEE) and battery management systems, as well as developing a valid method for the different types of batteries, especially LCO (LiCoO₂) and NMC (LiNiMnCoO₂). The most commonly used processes are mechanical, pyrometallurgical (discarded because the Li ends up in the slag), and hydrometallurgical, which are often combined.

REYDESA RECYCLING, a company of the Otua Group dedicated to the recovery of metals, leads STRAMER, where INATEC, the Otua Group's R&D Unit, have also collaborated.

COLLABORATORS





OBJECTIVES

- Conduct a new production activity for the management of Li-ion batteries, for which analysing the stages that make up the process for recovering metals such as Li, Co and Ni is proposed.
- Minimise the environmental impact of treatment.
- Complete a study of industrial alternatives to current recovery.



RESULTS

- In-depth technical knowledge has been obtained on energy storage systems from WEEE at the level of components present, quantities, separation methods and recycling possibilities.
- A methodology for discharging and dismantling of Li-ion batteries, was developed, and a robust method for the recovery of the fractions of interest they contain: Cu, graphite, Al, stainless steel, polymers, and target metals: Li, Co and Ni.
- Drafting of a technology watch report on the industrial processes currently carried out by leading companies in the sector.



CONCLUSIONS

- The analysis of various scenarios for the development of a new line of business has led to networking with companies to capture batteries.
- A continuation of STRAMER has been proposed to conduct a demonstration project of the developed process and implement improvements for its industrialisation.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS

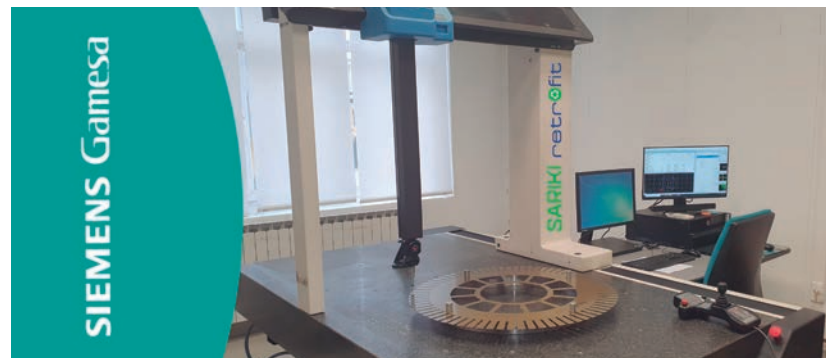


RETROFIT

RETROFITTING OF COORDINATE MEASURING MACHINES

THE TECHNOLOGICAL UPGRADING OF INDUSTRIAL EQUIPMENT, and in particular Coordinate Measuring Machines (CMM), is a necessity to embrace Industry 4.0 and improve companies' competitiveness. Adapting the capabilities of CMMs to the latest digital technologies, such as laser scanning, means having state-of-the-art equipment, without the need to invest in manufacturing the most massive components of these machines.

SARIKI, a provider of metrology inspection solutions and measurement services, including training and production line integration services, has developed the capability to analyse and retrofit any manufacturer's equipment to meet the latest inspection needs, at a fraction of the cost of purchasing new equipment.





OBJECTIVES

- Develop a methodology for the analysis of any CMM in order to upgrade it to meet new inspection needs.
- Ensure the reliability of retrofitted equipment.
- Develop the capability to upgrade components, control, software and capture system (probing or 3D scanning) for any CMM.



RESULTS

- Creation of an analysis procedure for any CMM, regardless of the manufacturing company, which establishes the possibilities for upgrading components to meet the latest industry needs.
- Two technological demonstrators of more than 25 years old machines were upgraded to meet the latest software and digitising systems and mapped to guarantee their original precision. One of them was upgraded to 5-axis and with the option of 3D laser scanning.



CONCLUSIONS

- There are multiple possibilities for upgrading components to improve old metrology equipment, depending on the retrofitting target use, the costs of which can be a fraction of the cost of purchasing new equipment.
- It is possible to retrofit old analogue equipment (more than 25 years old) to original specifications with the latest digital technologies and most up-to-date processing software, facilitating managing inspection and interfacing tasks with other plant systems.
- RETROFIT has achieved a solution for retrofitting of CMMs available on the market.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



CIRCULAR BUSINESS MODELS



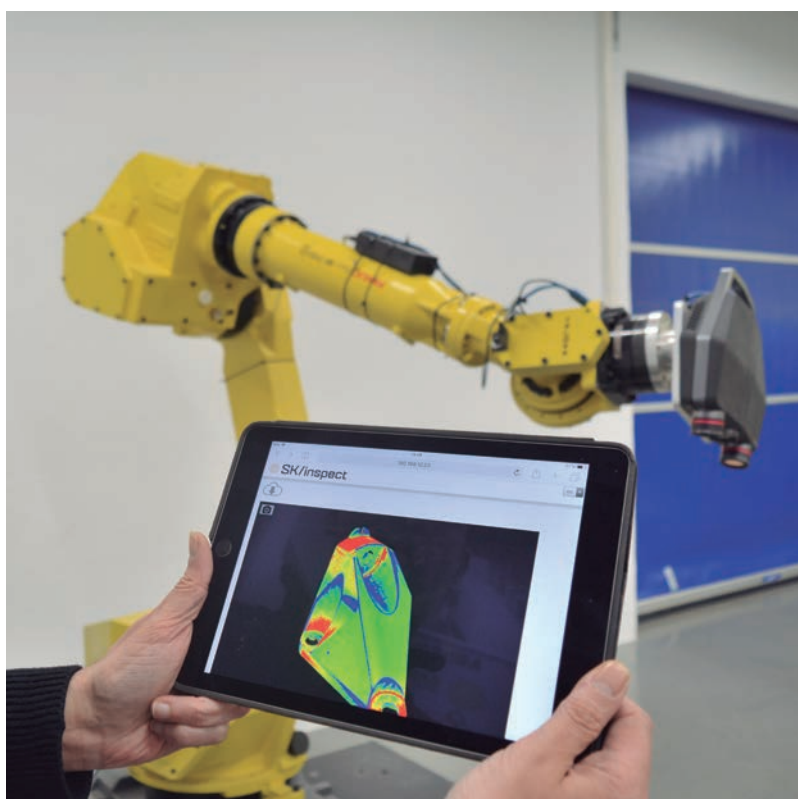
SERVITIZA 4.0

DEVELOPING HIGHER VALUE-ADDED SERVICES FOCUSED ON INDUSTRY 4.0

SERVITISATION IS A NEW BUSINESS DEVELOPMENT CONCEPT, WHICH IS EMERGING IN BUSINESS implementation with great potential. SERVITIZA 4.0 has analysed the possibilities of two business models: the commercialisation of metrology equipment under the pay-per-use model; and the services associated with data originating in the continuous monitoring of metrology equipment and oriented towards maintaining a sustainable and optimised production process.

SARIKI, is a provider of metrology inspection solutions, including training and production line integration services, as well as measurement services.





OBJECTIVES

- Analyse the development of a pay-as-you-go business model to increase the lifetime of metrology equipment
- Build a roadmap to offer services based on metrology data and digitalisation as a fundamental part of the manufacturing processes to guarantee the quality of the production output.



RESULTS

- A starting point was created to develop a model of remote predictive maintenance of measuring equipment by means of a computer visualisation system of monitored data and a storage database.
- The business model based on pay-per-use of metering machines is technically feasible, but needs the market to evolve in order to be implemented.
- The business model based on the use of metrology data must overcome technical barriers such as the standardisation of implementation processes, but its economic viability is remarkable.



CONCLUSIONS

- Metrology data provides guarantees, robustness, accuracy, security and reliability which are essential for servitisation and digitisation of metrology.
- Communications cybersecurity and the plug-and-play model in the installation of metrology components offer the opportunity to exploit data in an expert way in any production process.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



RAW MATERIALS COSTS AND SUPPLY



FABRIMANREC

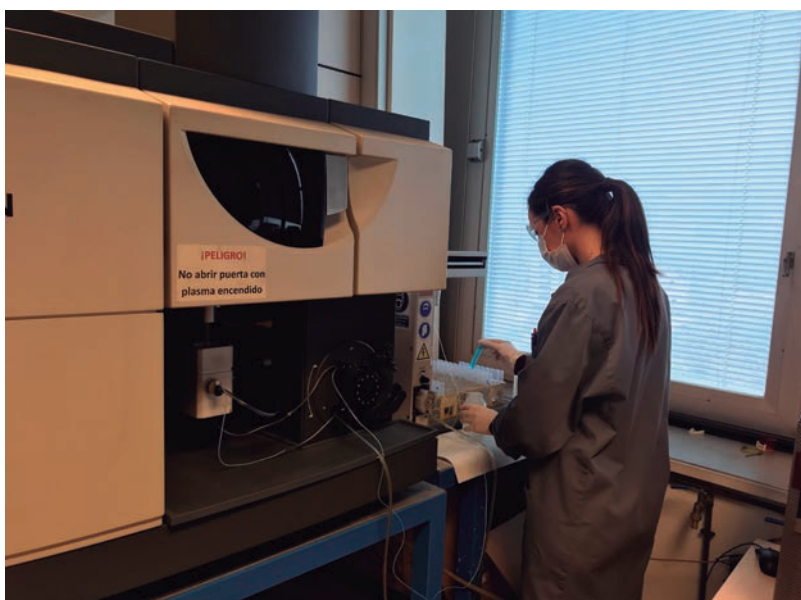
NdFeB BONDED MAGNETS MANUFACTURED FROM RECYCLED SINTERED MAGNETS

MARKET RESEARCH INDICATES THAT THE DEMAND FOR NDFEB BONDED MAGNETS will grow at a significant rate over the next 5 years. Rare earths needed to make these magnets are produced almost exclusively in China, which controls 99% of the world's production of heavy rare earths, mainly dysprosium (Dy) and terbium (Tb); and 87% of light rare earths, mainly neodymium (Nd) and praseodymium (Pr). In addition, China applies restrictions on their exports according to its political and economic interests. The EU has therefore declared rare earths to be "critical raw materials" (CRMs).

The Basque Country imports significant amounts of sintered NdFeB magnets, which are mainly used to manufacture electric motors and generators. There is no record of magnets being removed and recycled at the end of their useful life. This recycling could contribute to reducing the external dependence of the Basque Country on CRMs. STADLER is dedicated to the design and manufacture of metal parts using powder metal pressing technology, and has relied on the CEIT Technology Centre for the creation of FABRIMANREC.

COLLABORATORS





OBJECTIVES

- Study the options for collecting sintered NdFeB magnets at the end of their useful life in the Basque Country.
- Classify sintered NdFeB magnets available for recycling on the basis of their chemical composition, estimating the annual mass available for each group, and identifying the sectors of origin (electronic scrap, electric motors, generators, etc.).
- Develop a methodology to reduce collected magnets to powder (atomisation or HDDR process) and study the properties of powder obtained (chemical composition, microstructure, granulometry, morphology, fluidity, density, etc.).
- Develop a methodology to produce bound magnets from recovered powder.
- Characterise the magnets manufactured, comparing their characteristics according to the origin of the raw material.



RESULTS

- Atomised powder was obtained from recycled materials with which isotropic bonded magnets can be produced.
- Powdered material was obtained by hydrogenation of recycled magnets and via HDDR process on different types of magnets of different compositions.
- Significant improvement of the magnetic properties of hydrogenated materials by completely eliminating hydrogen.
- Prototypes of magnets bonded with recycled material tested in an industrial environment on commercial equipment.
- Reduced environmental impact by over 64%, with more than 600 tonnes saved in CO₂e emissions.



CONCLUSIONS

- The study of the magnetic properties of the samples obtained shows that the properties of the recycled materials are still inferior to the commercial ones. Thus, the demonstrators manufactured by STADLER and tested at COPRECI have provided good results for commercial materials.
- It is worth noting that a focus group formed by 7 local players (component manufacturers, electric motors and recyclers) received training thanks to public-private collaboration. Their work revealed a key issue: the need for an automated system to separate magnets from the rest of the ferrous scrap (casing, electric steel, etc.) and has given rise to consortia for new projects in the field.

DRIVING FACTOR



PLASTICS



POLLUTION MINIMISATION



BRomoX

SEPARATING PLASTICS WITH BROMINATED FLAME RETARDANTS FROM WEEE

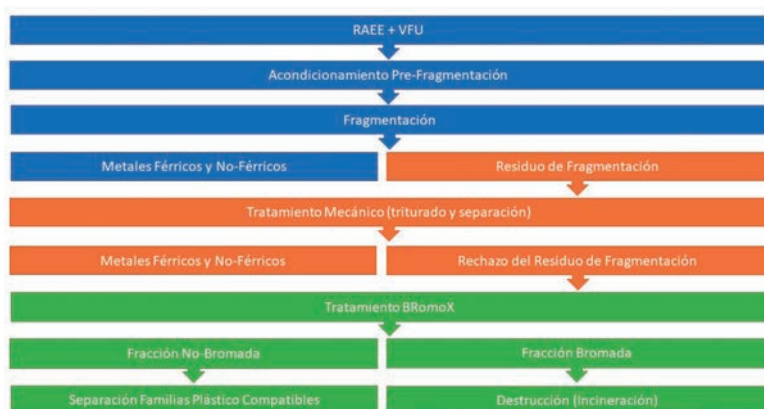
THE DIRECTIVE 2012/19/EU AND ROYAL DECREE 110/2015 ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

focus on the identification and separation of plastics containing Brominated Flame Retardant (BFR) materials, which are part of printed circuit boards, plastic housings or connectors and cables. The European regulation on Persistent Organic Pollutants (POPs) requires the separation of plastics containing BFRs, and in particular, polybrominated diphenyl ethers (PBDEs) for recycling of WEEE materials and components. Materials with PBDEs content higher than 500 ppm (> 0.1% of Br) are defined as hazardous (Directive 2011/65/EU or RoHS 2) and this figure set to go downwards, since this Directive is under review (COM(2021) 656, Oct. 2021) and proposes a further reduction of PBDEs to 200 ppm. In order to meet these and future constraints, plastic recycling demands new technologies, as it will be very difficult to achieve this distinction with the usual treatments. Technology based on X-ray sensors is increasingly used for this purpose, as it guarantees the best results by sorting materials by their atomic density.

ZABOR RECYCLING is a company of the OTUA GROUP specialising in recycling of electrical and electronic cables and components with copper and aluminium content. In BRomoX, it has worked with INATEC FOUNDATION and GAIKER Technology Centre.

COLLABORATORS





OBJECTIVES

- Implement a system for the identification and separation of brominated plastics that will serve as part of the end-of-life decontamination process for WEEE.
- Recover up to 97% of plastic fractions with BFR content, separating them from the fractions that do not have it in order to recycle them within the polymer market.
- Set up the first facility to reduce BFR content in plastics from WEEE in the Basque Country.



RESULTS

- In-depth study of the plastic fractions from WEEE, sampling and characterising sufficient quantities of polymeric waste, reference and real samples, to be used with the proposed technology, with created and real-life waste streams.
- Feasibility of XRS (X-Ray Sorter) technology to define a treatment line capable of achieving a polymeric fraction from WEEE with bromine content below 0.1%, making the waste non-hazardous.
- Correct calibration of XRS technology for the identification of bromine compounds in plastic matrices.
- Saving of 8,400 tonnes of CO₂e per year thanks to the recovery of materials involved in the process.
- Implementation of a brominated polymer separation process for decontamination of WEEE waste using XRS technology. The work carried out at BRomoX has granted ZABOR Recycling an authorisation to treat plastic fractions containing BFRs (an Authorisation approved by the Basque Government in 2020).
- Increased company's market share by 5%.



CONCLUSIONS

- BRomoX will now focus on the design of a viable treatment scheme to meet the new targets demanded by current and forthcoming legislation on BFR content in recycled plastics from WEEE and End-of-Life Vehicles (ELVs), where research is in progress to find the best techniques to separate brominated fractions from plastics. The BRomoX treatment will be part of an overall treatment which will go further than the current state-of-the-art knowledge on recycling plastic rejects from WEEE and ELVs shredder waste to prevent these materials from ending up in landfill.
- The final aim of the new initiatives will be to close the recovered material cycle: sorting the material into families of compatible plastics to demonstrate their use as raw material for the manufacture of new parts for new EEE and other types of parts applicable to other consumer sectors.

CHALLENGES



GENERAL

- Embracing the multi-site model.
- Connecting machines, remote management and incorporating Artificial Intelligence.
- Specialised human resources (dual apprenticeships, machine assemblers, etc.).
- Move from selling machines to selling solutions.



ENVIRONMENTAL

- Environmental impact and energy consumption (83% of the impact/costs occur during the use phase).
- Quantity of raw materials used (in the construction of machinery and derived products).
- Reduced use of oils and lubricants.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Ecodesign of machinery.
- Re-manufacturing and retrofitting.
- Servitisation linked to monitoring systems, IoT and pay-as-you-go, pay-per use or pay-by-result models.
- Recyclability of machines.
- Technical improvements in processes and machine tool.
- Cleaner technologies.
- Environmental drive of the chain.



COMPETITIVE IMPROVEMENTS

- Reduced weight of parts.
- Mass reduction.
- New milling machine models.
- Reduced energy consumption per machine.
- Reduced compressed air consumption.
- Reduced lubrication oil.
- Cutting fluid disposal.
- Auto-shut-down for machinery.
- Regeneration regulators.
- Optimised pneumatic and hydraulic drives.
- Energy-efficient engines.

MACHINERY



DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



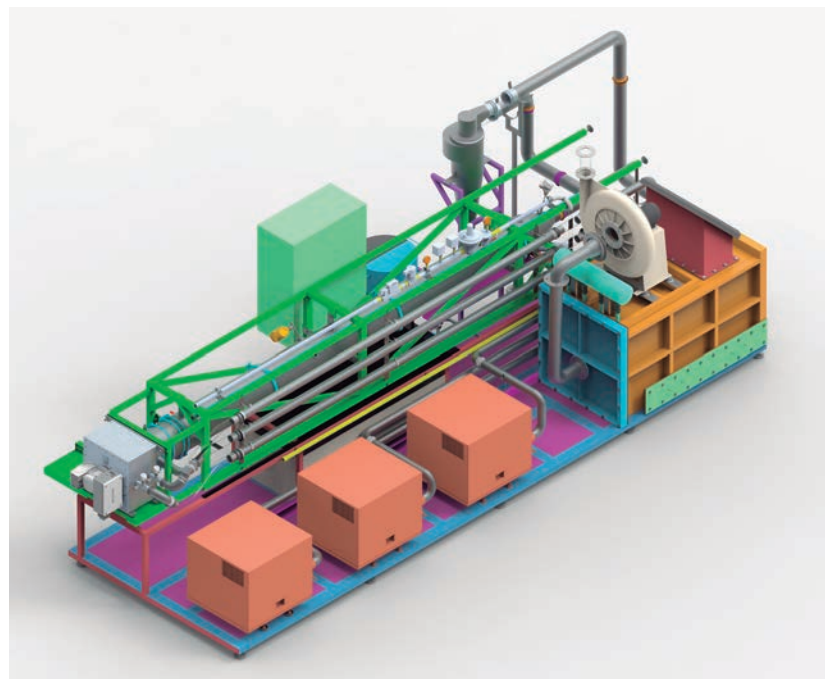
WASTE DISPOSAL REDUCTION

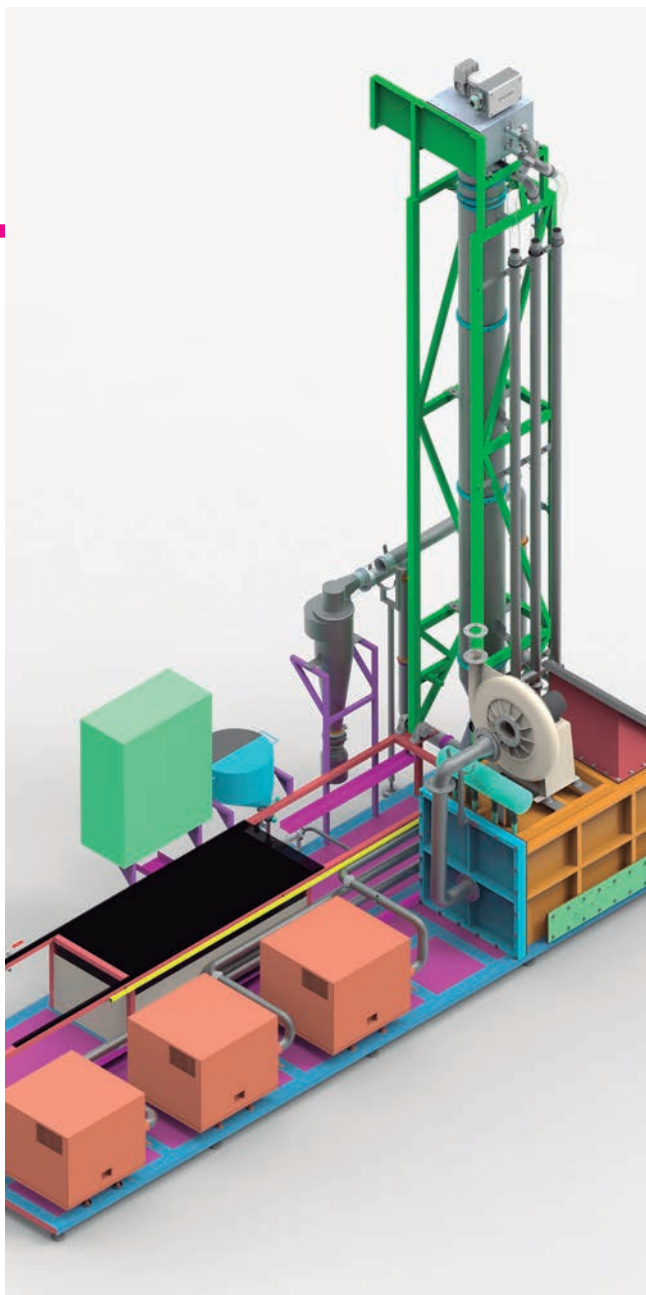


SERVIPCD

PORTABLE DRYER FOR INDUSTRIAL MATERIAL RECOVERY

EKONEK HAS DEVELOPED A NEW DRYING TECHNOLOGY THAT ALLOWS TO TRANSFORM LIQUID OR PASTY PRODUCTS into powder instantly, which means converting many waste/by-products into new valuable products. However, when this powdered product is new to the market, on-site pre-commercial manufacturing of the product is necessary to test the market. For this purpose, EKONEK is producing a small, portable version of its drying technology, so that it can be moved to industries for a certain period of time.





OBJECTIVES

- Design and build a small and portable 20 kW Pulse Combustion Drying technology dryer, the world's first reference of its kind.
- Offer a tool to industry for pre-commercial production of useful materials for circular economy applications.
- Demonstrate the operation of the unit in 2 industrial locations.



RESULTS

- Computational fluid dynamics simulations (CFD) to subsequently carry out the mechanical design.
- Expressions of interest from companies to test the equipment with their products, and interest in acquiring this type of small equipment from some technology centres.



CONCLUSIONS

- Downscaling (making a significantly smaller device than has been done so far) of the technology involved in SERVPCD is a novel but also complex approach.
- This type of small equipment is in demand, both for rental and for purchase by technology centres for their own development of new powder products.
- The need for key components subject to the supply crisis can lead to delays.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT

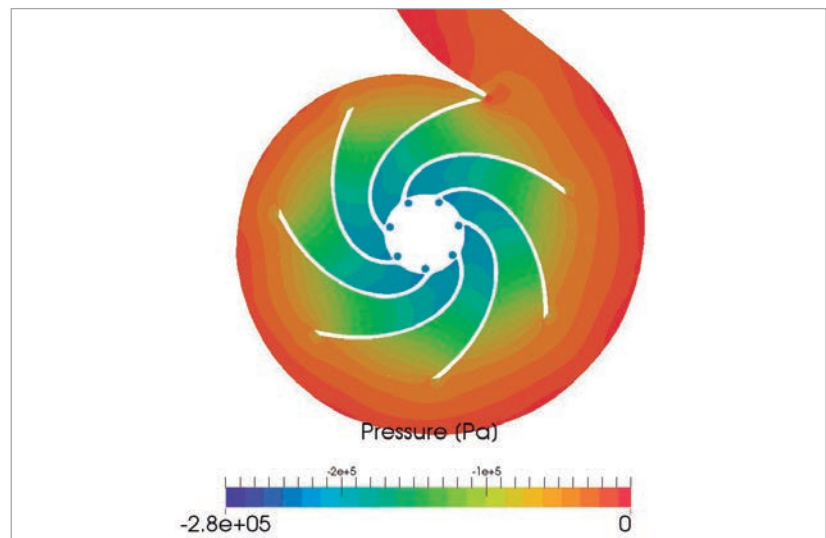


ECOPUMP

ECO-DESIGN OF A NEW CENTRIFUGAL PUMP

IT IS ESTIMATED THAT APPROXIMATELY 11% (300 TWH) OF THE ANNUAL ELECTRICITY CONSUMPTION in the EU-27 is linked to centrifugal pumps, a major environmental impact that according to preliminary Life Cycle Assessments (LCA) happens mainly in the use phase, where energy efficiency is a key parameter.

EMICA is a company dedicated to the manufacture and marketing of centrifugal pumps, which has its own patents and in-house maintenance and service workshops.





OBJECTIVES

- Improve a successful centrifugal pump model selected from the EMICA catalogue, to develop a simplified and industrialisable method and apply the improvements to the rest of the EMICA catalogue.
- Validate a CFD (computational fluid dynamics) model and implement an improvement system to be replicated in several models.
- Improve performance in the selected pump at optimum point - a 5% improvement would reduce the annual CO₂ equivalent emissions per pump unit tested to 37 tonnes, and would cut current emissions by 10% at same hours of use per year.



RESULTS

- The physical prototype manufactured was tested on a test bench to verify the CFD model, which showed that the parts with the greatest impact on the equipment hydraulic performance were the impeller, the drive body and the suction cover.
- Failure to improve pump performance through various interactions with a series of redesigns, which failed to achieve substantial improvement.
- Modification of elements as recommended by a new pump design software, which did not substantially improve performance at the optimum point.



CONCLUSIONS

- ECOPUMP showed that the performance of the pump analysed, and probably of many pumps in the EMICA catalogue, reached asymptote in terms of basic design improvement, probably derived from the company's extended background and matured hydraulic knowledge.
- It seems necessary to readjust the lines of work towards an improved wider system - the motor-pump system - and to optimise its actual consumption, as this system is made up of two elements with different points of optimum efficiency the motor and the pump.
- The operational needs of the client company may vary from one day to the next, and in many cases the work points of the actual system may need to be shifted from those that are theoretically designed.
- In order to analyse motor-pump systems from a real consumption improvement perspective of the assembly at the actual points (fixed or variable) of operation of the client company, competitive driving and control systems must be developed.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



EMBER

CENTRIFUGAL PUMPS REMANUFACTURING

INDUSTRIAL REMANUFACTURING PROCESSES ALLOW THE RECOVERY OF A LARGE PART OF A PRODUCT value in the form of materials, energy and knowledge stored in the product during its design and manufacturing process. EMICA, an expert manufacturer of centrifugal pumps, is aware that remanufacturing has advantages for the customer, who obtains a product at the cutting edge of technology at an affordable price and in many cases, of higher quality than new ones, and with a smaller environmental footprint; besides, the manufacturer reduces manufacturing costs, achieves improved productivity and higher quality products, develops new lines of business and anticipates environmental legislation.





OBJECTIVES

- Testing the feasibility of setting up a remanufacturing unit to use centrifugal pumps that have reached the end of their useful life and whose components can be reused for the generation of a new product.
- Reduce the amount of material used in manufacturing.
- Provide higher added value by incorporating Industry 4.0 features into centrifugal pumps.



RESULTS

- Savings of 70% in raw materials (mainly high-quality cast iron) and 203 kg of CO₂ equivalent from re-manufacturing each centrifugal pump.
- - Definition of a remanufacturing procedure (including disassembly, cleaning and assembly) including setting up and unifying criteria to diagnose the condition of centrifugal pumps with potential.
- - Development of sensors to improve preventative maintenance of remanufactured pumps.



CONCLUSIONS

- The remanufacturing process consists of restoring a worn out (failed, end-of-life, obsolete or scrap) product or component to a level of performance and quality equal or superior to that of a new product; offering an equal or superior warranty. The EMBER project implementation has shown that remanufacturing is feasible and economically interesting for EMICA.
- Distribution and maintenance channels are important for the implementation of remanufacturing processes. Thus, scaling up the volume of units is complicated for EMICA since it is a manufacturing company and not an equipment maintenance provider, which makes it difficult to identify potential equipment to be remanufactured and initially limits the market to client companies that request equipment diagnostics to assess further steps.
- Likewise, EMICA operates on an international market with a distribution network that can slow down the implementation of remanufacturing requirements on equipment, especially in developing countries.
- Having a remanufacturing process distinguishes EMICA from multi-brand repair shops, as it provides the equipment with a differential value compared to a standard repair, and highlights the robustness and reliability of the company's equipment. Profitability of remanufacturing has been demonstrated, with activity scalability yet to be implemented.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



EPAdis

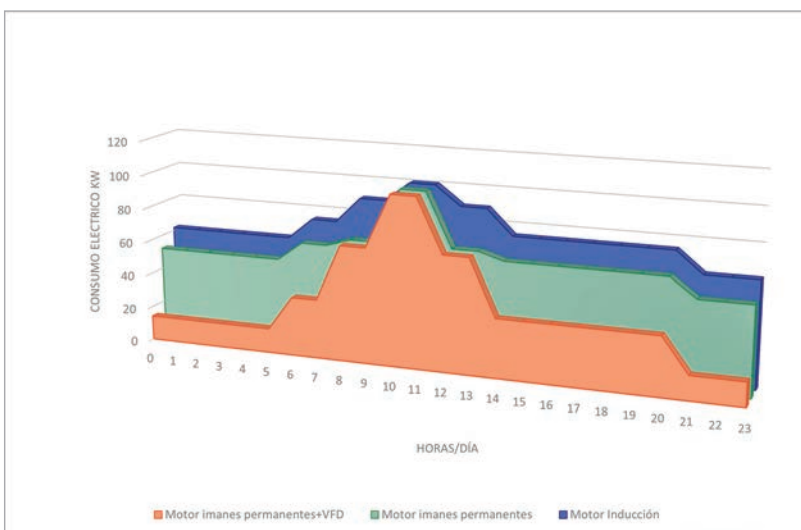
ECO-DESIGN OF CENTRIFUGAL PUMPS FOR OPTIMISED USE

APPLYING THE RECOMMENDATIONS OF THE EXTENDED PRODUCT APPROACH (EPA)

for centrifugal pumps, EPAdis seeks to optimise the efficiency of the pump, motor and drive assembly. The aim is to demonstrate the scope for improvement in the performance of motor-pump assemblies, including alternative frequency variators and motors to the squirrel cage induction motors normally used. This would lead to increased added value of the product, while the end-user company would achieve a consumption reduction and therefore, cost improvement and reduced emissions. Moreover, this improvement brings forward the application criteria of the Commission Regulation (EU) 2019/1781 effective from 1st July 2023, with the obligation to include IE4 motors in the 75-200 kW working range.

EMICA is a company dedicated to the manufacture and marketing of centrifugal pumps, which has its own patents and in-house maintenance and service workshops.





OBJECTIVES

- Reduce environmental impact and cut energy costs under the EPA concept.
- Demonstrate substantial performance improvement of “EPA-designed” assembly versus current pump+engine units in operation.
- Encourage investment to include frequency converters in new and existing pump units.



RESULTS

- Proven compatibility of permanent magnet motors with pump-motor units.
- The results vary greatly depending on operating conditions. In the most favourable case, with a load profile defined according to Blauer Engel and a 110 kW motor, energy consumption was reduced by up to 50 %.
- Environmental impact reduction by 48% in single score and 51% in tonnes of CO₂e.



CONCLUSIONS

- The use of pump-motor units with permanent magnet motors and frequency inverters is recommended for centrifugal pump units.
- The proposed permanent magnet motors provide increased efficiency to IE4 levels, reducing the housing size and weight, without considerably increasing pump-motor unit costs.
- The joint selection of pump, motor and frequency inverter according to the EPA concept helps to avoid the general tendency to oversize motors.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



ELEKTROZULAKETA MACHINE TOOL PUNCH HOLDER ECO-DESIGN

THROUGH THEIR SECTOR ORGANISATIONS, COMPANIES IN THE MACHINE TOOL INDUSTRY have collectively embraced environmental improvement initiatives at pan-European level, based on extensive research and a Life Cycle Analysis (LCA) viewpoint. FAGOR ARRASATE, a leading manufacturer of cutting and forming lines, is aware of the environmental cost derived by the production installations they design, which is high in the use phase (production at client's premises) and proportionally negligible in the construction phase. On the other hand, its own nature as a cooperative drives its social responsibility and environmental awareness philosophy, as well as a conviction to improve its relationship with the social environment.

ELEKTROZULAKETA is an example of this philosophy which will be applied to the Punch Holder of an open-sided mini-press (6-10t), where the hydraulic drive has been replaced with a servo-electric drive. To achieve this, FAGOR ARRASATE has worked with the Mechanics Department of the MONDRAGON UNIBERTSITATEA Goi Eskola Politeknikoa.

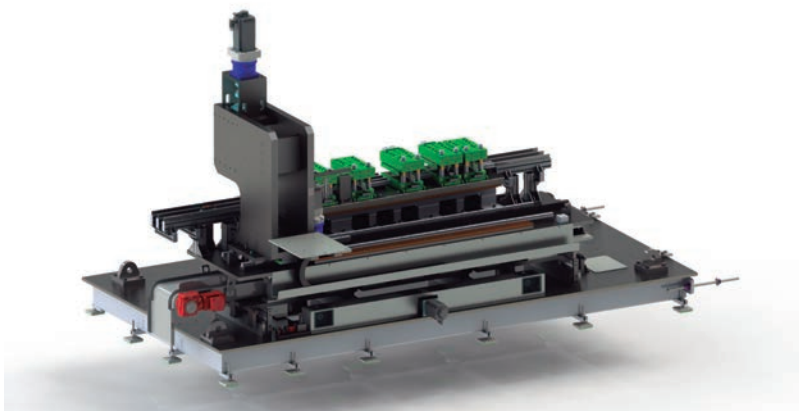
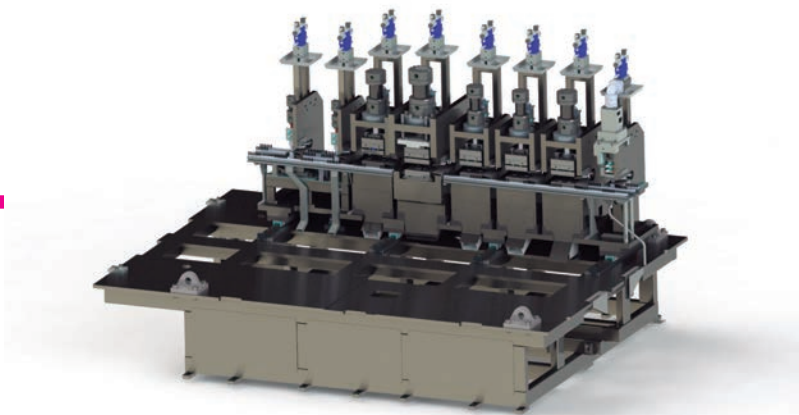
COLLABORATORS



Mondragon
Unibertsitatea

Goi Eskola
Politeknikoa





OBJECTIVES

- Redesigning the Punch Holder product using an electric drive instead of a hydraulic drive to achieve similar technical performance (cadence, force, etc.) and efficiency improvements.
- Eliminate the use of hydraulic oils in the use phase.
- Reduce electricity consumption by more than 30% in the use phase.
- Reduce faulty products due to burrs by 30% in the use phase.
- Reduce the environmental footprint in the manufacturing phase.
- Achieve greater durability of the industrial line manufactured, including reuse.



RESULTS

- 37% increased energy efficiency due to the new servo-driven Punch Holder.
- Reduction of defects by controlling cutting speed, improving quality, without negatively impacting cycle time.
- 34% reduction of CO₂ equivalent emissions, achieving savings of 4,100 tonnes per year.
- 2% reduction in unit manufacturing cost.
- 5% contribution to the company's overall turnover.



CONCLUSIONS

- The units may be difficult to run as the load to be applied increases, although this is not a critical limitation in punching stations.
- The incorporation of servo drives as opposed to hydraulic components implies higher training requirements for machine and maintenance personnel.
- FAGOR ARRASATE, in contact with its preferred corporate client, has designed and implemented a line equipped with electrical drives according to ELEKTROZULAKETA. Subsequently, given the advantages of the new design, all bids submitted for installations in developed countries included this option. Moreover, corporate clients' responses have been overwhelming, and currently, in 2022, electric drives are implemented in all installations for Europe.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



CIRCULAR BUSINESS MODELS



REPUMP

ENERGY-EFFICIENT
REMANUFACTURING OF
HYDRAULIC PRESSES

FAGOR ARRASATE, PRODUCER OF FORMING LINES, together with the hydraulic equipment supplier, **GLUAL**, and **IKERLAN**, the Technological Centre specialised in advanced controls, have proposed **REPUMP**, a modular hydraulic drive not based on load loss that improves the energy efficiency of the hydraulic presses as well as advanced control necessary to achieve it. This new technology would improve the life cycle and end-of-life phases of presses and affect the design and production of new presses.

COLLABORATORS



DRIVING FACTOR



CIRCULAR BUSINESS MODELS



GUIBE SERVICE

NEW TECHNICAL SERVICE FOR INDUSTRIAL GEARBOXES OF ALL BRANDS

GUIBE, THE COMPANY BEHIND THIS PROJECT, specialised in the design and manufacture of gearboxes adapted to each company in the sector, seeks to set up and develop a new business unit dedicated to maintenance and repair of such machinery. Through Industry 4.0 innovations, GUIBE can monitor and diagnose the gearbox, thereby improving after-sales service quality and capacity to adapt to market requirements.





OBJECTIVES

- Offer an analysis and verification service of our own gearboxes and/or those of other manufacturers to redesign, repair and/or upgrade them with the aim of optimising and boosting their performance.
- Install a monitoring and diagnostic system called SMART-G in gearboxes to enable preventive maintenance, real-time monitoring and continuous analysis of the gearbox condition.
- Use SMART-G to store data to analyse both the energy efficiency of the gear unit and the entire production process.
- Provide a technical advisory service and preventive maintenance approach by identifying the critical components in each case.



RESULTS

- Significant reduction of both resource consumption and CO₂ emissions through repair and reuse of existing materials.
- 5% contribution to the company's turnover and 1% increased market share.
- Implementation of the SMART-G Cyber-Physical System for analysis and monitoring of the condition of our own gearboxes and those of other manufacturers.
- Establishment of the GUIBE SERVICE business unit with the aim of providing both maintenance and installation services for SMART-G.
- Contribution to job creation at GUIBE with the new department.



CONCLUSIONS

- Monitoring facilitates preventive maintenance to improve gearbox performance and assess its energy efficiency through data analysis.
- Participation in energy efficiency projects is expected, based on the data collected through the monitoring system, which with an optimistic forecast, could achieve energy savings of up to 10%.
- Remanufacturing reduces resource consumption and promotes job creation.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



BEST PRODUCTION TECHNIQUES

HRE Automation

BeCold

MINIMUM LUBRICATION AND CRYOGENIC COOLING IN MACHINING PROCESSES

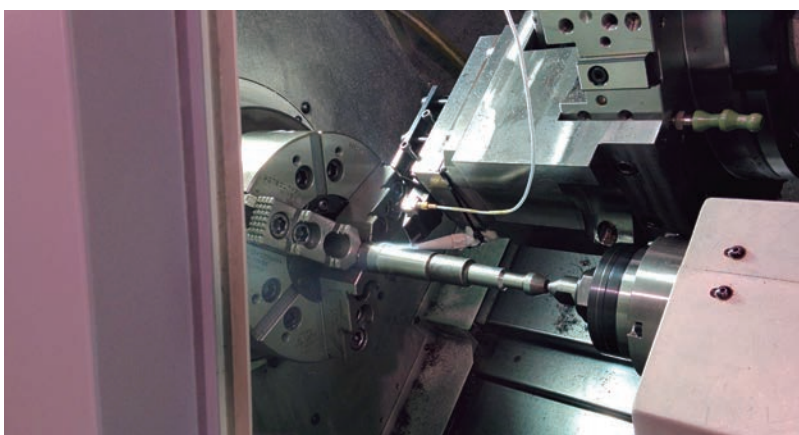
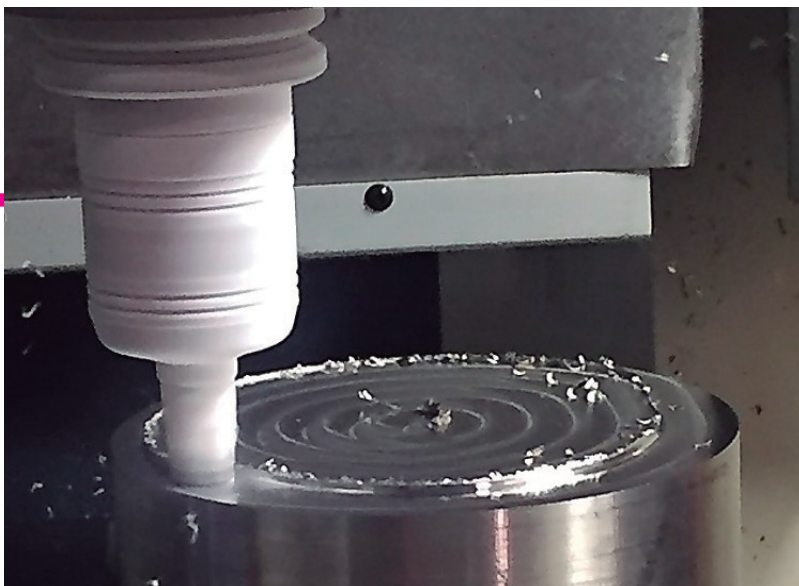
DRILL COOLANT AND CUTTING OILS ARE TWO COMPONENTS WIDELY USED IN MACHINING PROCESSES.

They account for between 8% and 16% of the manufacturing costs of a part and have a negative impact on the environment and workers' health. To address this, the design and manufacture of BeCold equipment seeks to minimise these consequences by combining minimum quantity lubrication (MQL) and cryogenic cooling.

HRE is a global supplier of industrial fluids that seeks to generate an innovation framework that promotes the development of new business lines. For this project, HRE has worked with TECNALIA Technology Centre and the Centre for Advanced Aeronautical Manufacturing (CFAA) of the University of the Basque Country (UPV/EHU).

COLLABORATORS





OBJECTIVES

- Reduce negative impact from the use of cutting fluids, creating cleaner and more environmentally-friendly environments.
- Align the company's 2030 vision with Sustainable Development Goals.
- Expand the market using a marketing strategy to gain notoriety and brand image.
- Strengthen alliances and collaborations with technology centres and universities that contribute to product development and optimised results.



RESULTS

- Tool life was increased by 25% to 300% in tools used in machining tests carried out on different materials, many of which are difficult to machine and include among others: Ti6Al4V, 1.4410 super duplex steel, AISI 316 (stainless steel), AISI 4340 (Cr-Ni steel), ASP23 (HSS) steel, Ti6Al4V - CFRP, Inconel 718, and hardened steel (40HRC)
- All costs arising from the purchase, use, leakage and treatment of drilling oils were removed by up to 16 % of manufacturing cost.
- Improved working conditions, with an absence of CO₂ saturation problems affecting the quality of workshop atmosphere.
- Savings of 20-30% compared to direct competitors thanks to accelerated cutting speed, reduced tool wear due to temperature control, maintained surface integrity, use of cryogenic cooling with low pressure CO₂ injection, lower CO₂ consumption, and simpler installation.
- Detection of national and international market potential, in countries with high metal manufacturing production and machining such as Germany or Italy.
- 4 different versions of the product were obtained so that they can be adapted to different needs.
- Validated accessories necessary for correct system operation.



CONCLUSIONS

- It is important to maintain fluid and constant communication with project partners and collaborators in order to achieve results as effectively as possible
- BeCold has made it possible to plan an optimal marketing strategy: market research, marketing plan, new agreements and partnerships or economic balance.
- The product's strengths and opportunities were clearly defined on the one hand; as well as threats and weaknesses, on the other.
- Between 2021 and 2022, the first 8 units have been quoted and deals are in the process of being closed for full industrialisation (including one for Japan and another one for Costa Rica for the manufacture of medical components).

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



AQUITANIA

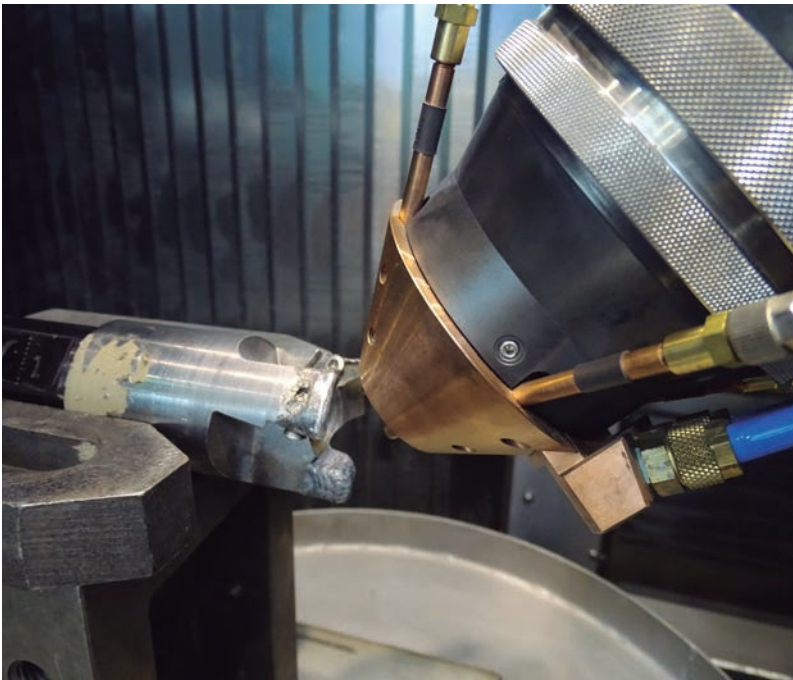
REPAIRING CUTTING TOOLS USING NEW TECHNOLOGIES

MANITEK'S MAIN ACTIVITY IS THE REPAIR OF REPLACEABLE TIP CUTTING TOOLS, which is normally carried out manually by means of TIG welding for the repair of cutting tools. Tools become damaged with use, blows, deformities or broken supports where the tip sits, and their recovery is an activity in demand due to economic and environmental criteria. The functionality of repaired tools is validated by experience, but there is a need to increase the level of automation in the process in order to reach a larger number of highly demanding customers.

MANITEK has led AQUITANIA, with the support of TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Demonstrate the application of new alternative technologies for the repair of cutting tools, such as: micro-laser deposition and LMD (laser metal deposition), additive manufacturing (AM) technologies.
- Increase productivity and productive capacity.
- Gain access to new customers and markets.
- Eliminate the environmental impact associated with manufacturing this type of tool.



RESULTS

- Accessibility study to assess tool positioning and potential constraints related to collision between the workhead and the workpiece to be repaired.
- Feasible micro-laser repairs, where three different tools requiring reduced surfacing volume are selected. A two-stage experiment was carried out to assess accessibility and different surfacing methods, as well as quality of welds.
- Feasible repairs by LMD technology using two types of filler materials.
- The micro-laser process allows welding with reduced heat and higher precision, which facilitates learning the welding technique. However, correct process execution requires a lot of training for laser positioning and moving, and no significant productivity increase was observed. For this reason, micro-laser technology has been discarded in favour of LMD.



CONCLUSIONS

- Cutting tools have complex geometries and difficult-to-access areas, therefore limitations posed by this factor need to be consider.
- AM technologies currently being developed are valid for implementation in SMEs, and have the potential of making a real impact on boosting the circular economy.
- In addition to technical feasibility, other critical aspects such as training for employees, raw material supply and equipment maintenance need to be assessed. Introducing this technology into the production process involves a significant economic investment.
- A more concise and applied study of LMD technology within MANITEK's production activity is necessary.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



POLLUTION MINIMISATION

TEKNIMAP
ENERGÍA Y MEDIO AMBIENTE

SIDEPI

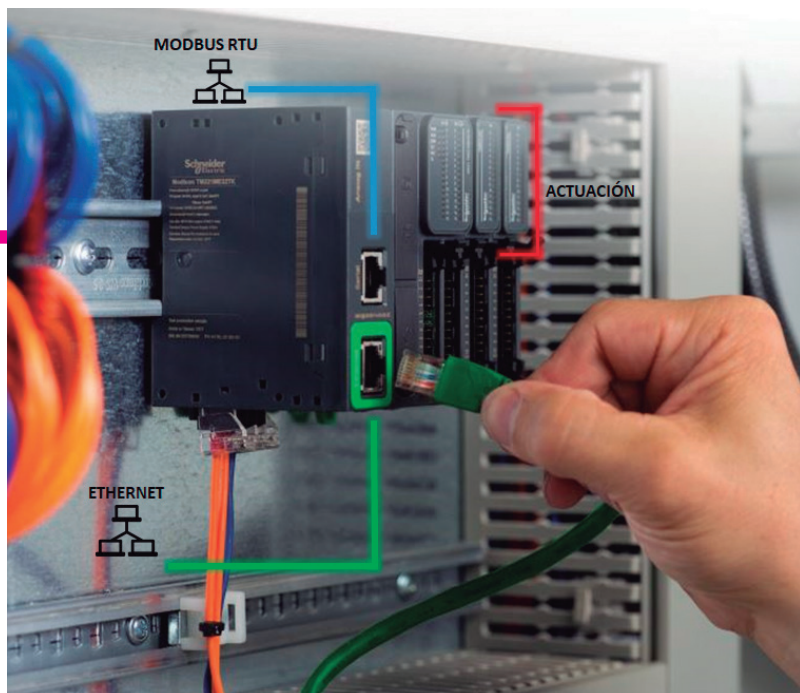
SMART DETECTION AND REMOVAL OF PARTICULATE MATTER EMISSIONS FROM INDUSTRIAL SOURCES

DIFFUSE POLLUTION LAWS ARE SCARCE, UNDEMANDING AND DIFFICULT TO APPLY, but they are very relevant for industrial facilities, both in industrial and urban areas, where they can have the greatest impact. The control technology available is expensive, ineffective and/or not smart, which inhibits large-scale implementation and regulatory development. SIDEPI will provide a new integrated smart technological solution for diffuse pollution control and abatement at a contained cost, based on the innovative integration of three technologies: two existing technologies, i.e., monitoring and abatement, and a new intelligence module.

TEKNIMAP, specialised in environmental monitoring and inspection services, is leading SIDEPI, with the participation of TALANTIA.

COLLABORATORS





OBJECTIVES

- Develop an integrated innovative technological solution to eliminate the impact of diffuse pollution (and in particular cases, confined) of particulate matter emissions generated by industrial activity, and capable of adapting to the variable nature of the phenomenon with high efficiency.
- Carry out development and demonstration pilots in three representative real-life scenarios in the Basque Country, adapting the solution to each case and optimising automation.



RESULTS

- Completed development of the first smart prototype.
- Ongoing integration of the smart module with the rest of technologies.
- Diffuse emission characterisation in one of the industrial scenarios.
- Installation of the integrated solution in one of the industrial scenarios.



CONCLUSIONS

- The involvement of manufacturing companies is important to perform minor adjustments to commercial technologies (monitoring and abatement).
- The first prototype of the smart module is perfectly integrable in Industry 4.0 systems.
- In addition to the smart module algorithm, particle measurement technology needs to be adapted to each real industrial scenario.
- There is potential for innovation and circularity in the ancillary elements of the solution (load-bearing structure and consumption supply).
- The needs of the industry predict a high corporate client base potential; in the Basque Country alone, many companies are reporting emissions from diffuse sources in their Integrated Environmental Authorisations (IEA).

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT

ZAYER

SCOT

REDUCING ENERGY CONSUMPTION USING IMPROVED-PRECISION MACHINE TOOLS

MACHINE TOOLS WORKING IN ENVIRONMENTS WITH HIGH TEMPERATURE VARIATION require high energy consumption due to the use of cooling systems. This consumption can be reduced by making the machines more tolerant to temperature changes, optimising the accuracy of machine operation. In turn, this significantly reduces energy consumption at the production centre where the machine is installed, throughout its service life.

ZAYER develops milling machines and machining centres with the highest quality and most advanced technology. For the implementation of SCOT project, the company collaborated with GRUNVER SOSTENIBILIDAD, specialists in LCA, and TEKNIKER technology centre, specialists in new precision technologies.

COLLABORATORS



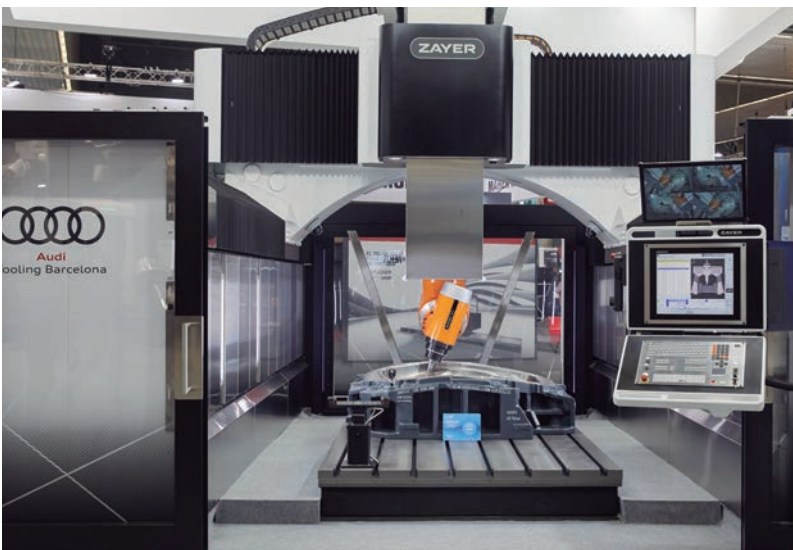
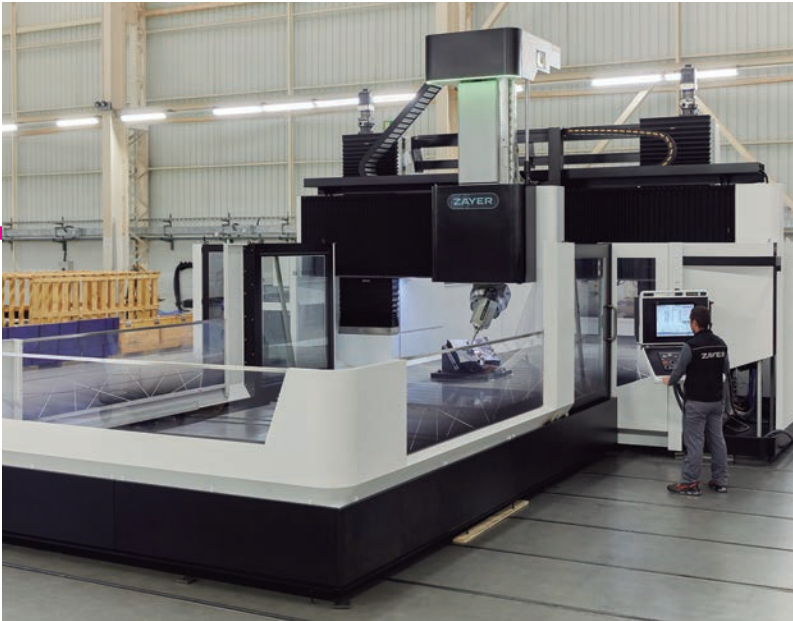
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Reduce energy consumption of machines by 3%.
- Reduce by 30% the use of cooling systems, which produce high GHG emissions.
- Ensure 8 μ m accuracy and 5 μ m repeatability in non-cooled production environments.



RESULTS

- 35% reduction in the average use of machine cooling systems.
- Reduction of 2 to 5% in energy consumption of machines, depending on the model.
- 60% increased tolerance to room temperature changes, guaranteeing maximum machine precision.



CONCLUSIONS

- Although committing to use passive energy and lower environmental impact systems is more difficult from the start, the result gives rise to more value with less complexity, and customers welcome innovation in this direction.
- SCOT's results demonstrate that environmental objectives can be a powerful catalyst driving new ways to improve products, generating new insights to guide the company's innovation pathways.

CHALLENGES



GENERAL

- Increasing the added value of products as a means of differentiation versus industrial price reduction (metallurgy and metal products).
- Tailor-made value proposition and turnkey solutions.
- Collaboration in and between sectors.



ENVIRONMENTAL

- Reducing pollution, emission and disposal.
- Reducing dilution effect of key materials.
- Increase recycling rate.
- Reinforcing recovery and subsequent use of steel making slag from electric arc furnaces.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Waste recycling and landfill reduction
- Advanced materials (alloys).
- Best Available Techniques (BAT).
- Clean technologies (machining and forming systems and equipment, near net shape).
- Increased responsible consumption and corporate transparency.



COMPETITIVE IMPROVEMENTS

- Waste recovery (isostatic, salt slag, PVC waste stream, etc.).
- Re-introduction of waste from the steelworks and rolling mill areas into the production chain.
- Recycling waste to be used in other sectors (construction, etc.).
- Search for secondary material alternatives.
- Waste prevention and recycling criteria.
- Reducing industrial land contamination that promotes the dispersion of pollutants.

METAL



DRIVING FACTOR



BEST PRODUCTION
TECHNIQUES



HyperDeepScrap

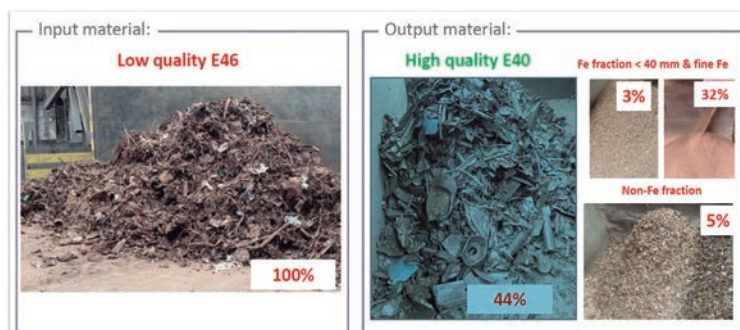
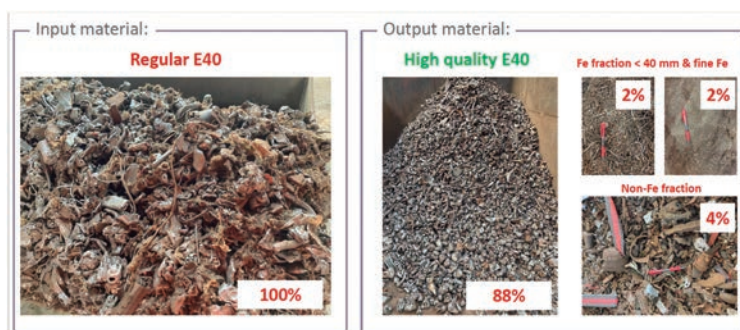
ADVANCED SORTING OF
FERROUS METAL SCRAP WASTE

ARCELOR MITTAL (AM) SESTAO MANUFACTURES HIGH QUALITY FLAT STEEL PRODUCTS from recycled scrap in an electric arc furnace. The main drawback is that scrap contains harmful residual elements such as copper (Cu), tin (Sn), chromium (Cr), nickel (Ni), etc., which cannot be removed in the manufacturing process and must be diluted to guarantee the final quality of the steel to be produced. For this reason, AM Sestao has historically combined a mix of raw materials: 60% - 85% high-quality imported scrap; and 15% - 40% HBI/DRI (hot briquetted iron or direct reduced iron). However, since 2017, AM Sestao is committed to consuming 100% local scrap. In this new context, installing a scrap treatment plant could be of interest to improve the plant's operational performance.

Currently, the steel industry in the Basque Country has a recycling capacity of 8.3 million tonnes per year, which represents a cost of €2.2 million/year. HyperDeepScrap will enable AM Sestao to become a manufacturer of high-quality flat steel products from scrap metal using Electric Arc Furnace in Europe, and on the other hand, make the AM Basque Country Research Centre a global leader as a R&D and Innovation centre in the development of scrap metal management technologies. TEKNIKER Technology Centre has also participated in the project.

COLLABORATORS





OBJECTIVES

- Provide AM Sestao with advanced tools for the characterisation of ferrous scrap that allow it to optimise purchasing strategies for obsolete scrap as main raw material.
- Increase knowledge of existing technologies and capabilities of industrial scrap cleaning processes.
- Analyse in detail the distribution of materials that make up waste from cleaning processes and assess their recovery potential and environmental impact of the recovery processes.
- Develop new technologies for automatic sorting of materials in processed scrap streams under industrial conditions.
- Reduce energy consumption and consumption of ferroalloys and fluxes.



RESULTS

- Improved scrap quality by re-fragmentation of fragmented scrap, with a decrease in non-ferrous and non-metallic materials (Cu reduction by 0.20%; 50% increase in bulk density; and increased Fe content).
- Improvement in most impact categories (between 30% and 50%) assessed by a comparative life cycle analysis (LCA) with and without scrap sorting.
- Development of a pilot sorting facility for ferrous materials capable of detecting percentage in pixels of materials such as Cu, Ni, Zn, Al and sterile materials in acquisitions captured by hyperspectral cameras.



CONCLUSIONS

- The technical, economic and environmental potential of scrap cleaning techniques is high and given the results obtained, new lines of work have been opened in terms of improving the quality of ferrous scrap.
- The development of a pilot sorting facility for ferrous materials enables the detection of harmful materials, which improves the iron and steel process and also facilitates separated material by the facility to be recovered, reducing the environmental impact they have on electric arc furnace processing, reducing fluxes and waste generated (slag and emissions).

DRIVING FACTOR



RAW MATERIALS
COSTS AND SUPPLY

BEFESA

ALUREC

OBTAINING PRIMARY ALUMINIUM FROM RECYCLED ALUMINIUM

BEFESA GENERATES 60,000 TONNES OF PAVAL PER YEAR, a by-product of the recovery of salt slag with more than 60% weight of aluminium oxide, which also contains aluminium hydroxide and a series of salts and oxides that prevent its recovery by electrolysis to obtain primary aluminium. The mixture of metal oxides that makes up Paval offers the possibility of obtaining complex aluminium alloys with these metal elements from their oxides, which would reduce the need to obtain these alloying elements (copper, titanium, manganese) through other electrolytic processes and further processing required to be incorporated into the final alloy, thus drastically reducing the energy required and metal wastage that occurs during alloying.

BEFESA, a leading company in technological solutions for aluminium recycling, leads ALUREC with the collaboration of ECOINDAL, aluminium producing and processing company, and TECNALIA Technological Centre.

COLLABORATORS



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Demonstrate the technological possibility of obtaining calcined alumina in sufficient quality to be used as a raw material in the manufacture of primary aluminium alloys by electrolysis, from low-quality alumina from the recovery of salt slags (paval).
- Assess the feasibility of a line to obtain aluminium alloys from paval by electrolysis and validate the product value chain, through the participation of ECOINDAL to evaluate new alloys from the production and quality point of view.



RESULTS

- Validation of aluminium alloys for die casting using aluminium alloy obtained by electrolysis of calcined secondary alumina.
- Prototypes of real parts were obtained in a real environment
- Verified mechanical properties of the tested parts meeting the requirements of the end customer.
- Trade secret and a patent (at application stage) were obtained to protect the project results.
- This implementation will save 28,000 tonnes of CO₂ equivalent emissions per year and 20,000 tonnes of raw materials per year.



CONCLUSIONS

- The economic viability of the project has also been determined, setting up the approximate costs of industrialisation and paval processing, as well as industrial margins. Investment and energy costs are high, but the estimated operating margin is similar to that estimated at the start of the project.
- Efforts to market the developed product need to be oriented to companies producing primary alloys worldwide, while maintaining the possibility of implementing the process internally in the future.
- Primary aluminium manufacturers have been approached to conduct semi-industrial trials with the calcined alumina obtained, focusing on a closed-loop process that avoids the emission of large amounts of CO₂ and red sludge.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



BEST PRODUCTION TECHNIQUES



LINAVU

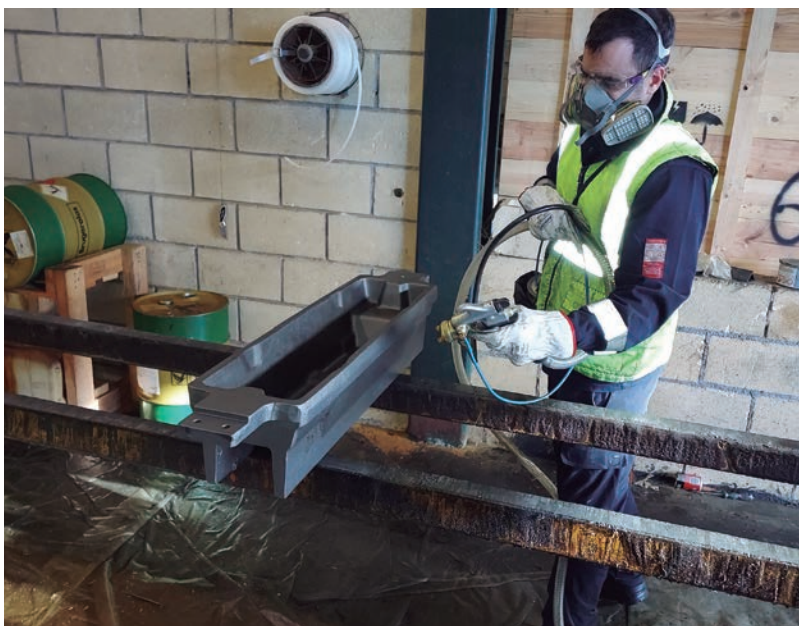
INCREASING THE SERVICE LIFE OF ALUMINIUM FOUNDRY INGOT MOULDS

ALUMINIUM CASTING INGOT MOULDS ARE A PRODUCT ESTABLISHED ON THE MARKET and currently designed intuitively based on experience, but no comprehensive wear and fatigue studies have been carried out to modify or reinforce weaknesses. Likewise, there has been no effort to gather in-depth knowledge of the steel alloys used, which is usually the reason for surface deterioration of these parts, ending their useful life. Currently, BEFESA has more than 65 aluminium ingot moulding lines on the global market.

BEFESA, the European leader in hazardous waste recycling services for the aluminium industry, has worked with the AZTERLAN Metallurgical Research Centre to develop LINAVU.

COLLABORATORS





OBJECTIVES

- Achieve improved design and manufacture of ingot moulds for metal casting operations in aluminium foundries.
- Study the behaviour, materials and production process of second fusion alloys of two ingot moulds with different sizes, and the existing market benchmarks.
- Increase ingot mould useful life by 50-100%, depending on size.
- Reduce the volume of waste generated by approximately 50%.



RESULTS

- Study of two ingot moulds of two different sizes, both existing on the market: 23 kg and 700 kg of metal.
- The alloy used, WC6 steel, is optimal for this application.
- Two new designs (for each size) are proposed without total mass variations, which imply a reduced thermal fatigue, strengthening the weaknesses that lead to deterioration.
- Estimated increase in durability of 20%, as well as 16.5% reduction in environmental impact.



CONCLUSIONS

- The development of new designs for each size of aluminium casting ingot mould according to eco-design criteria has resulted in improved competitiveness.
- Increasing the lifetime of ingot moulds by 20% contributes to a waste reduction that benefits the entire value chain of the aluminium industry.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



RAW MATERIALS
COSTS AND SUPPLY



GRANALUM

SHOTBLASTING MATERIALS
RECOVERY IN THE ALUMINIUM
INDUSTRY

IN TRADITIONAL SHOT BLASTING PROCESSES, a metallic residue called spent shot is generated as a result of a successive reduction of the particle size of the shot and due to abrasion caused by the impact on the parts to be cleaned. In the aluminium industry, iron (Fe) needs to be added to many commercial alloys, and iron and aluminium (Fe, Al) powder of specific particle sizes is used in the form of alloy tablets. BOSTLAN, the company behind GRANALUM, is one of the world's leading producers of these tablets, while WINOA is a global leader in the manufacture of Fe granules.

COLLABORATORS





OBJECTIVES

- Implement a comprehensive treatment process for spent shot waste.
- Save up to 500 tonnes of primary Fe per year without significant quality loss at BOSTLAN.
- Improve competitiveness in ferroalloy products for the aluminium industry.
- Reduce landfilling of spent shot.
- Raise awareness among companies generating spent shot regarding the fact that good waste segregation can bring them economic benefits.



RESULTS

- Conditioning and sorting of waste shot generated in different shot blasting processes and machines.
- Treatment and recovery of the grit obtained by means of the project's own technology.
- Use of recovered grit for the industrial production of aluminium alloy tablets, with appropriate results in industrial production and excellent Fe recovery in aluminium baths.
- Potential use of recycled Fe shot in 50% of products, with potential savings of 150 tonnes per year over three years, and up to 350 tonnes of CO₂ equivalent per year.
- Reduced unit cost of production by 8%.



CONCLUSIONS

- The ability to introduce recovered shot into the production of aluminium alloy tablets has been demonstrated.
- GRANALUM's performance depends on full knowledge and control of the value chain. Collaboration with spent shot generators and aluminium smelters is key to creating new business opportunities leading to reduce the environmental impact of the value chain in an economically viable way.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



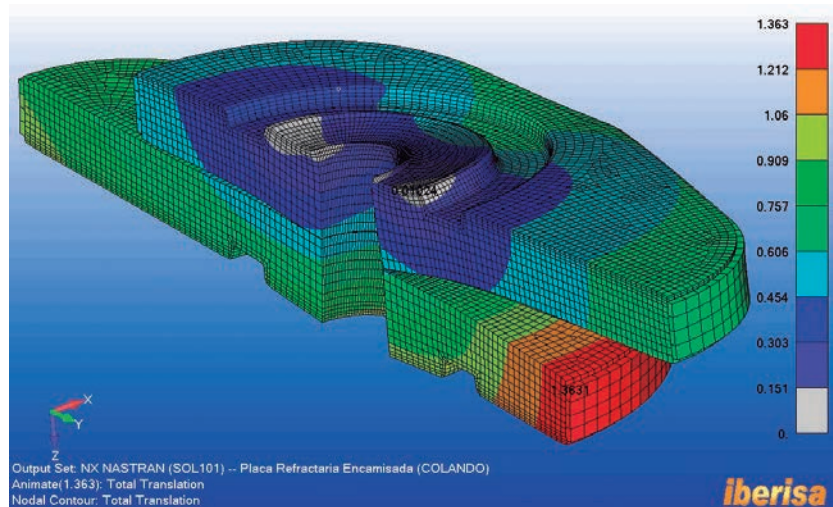
RAW MATERIALS COSTS AND SUPPLY



ALRE

HIGH-PERFORMANCE REFRACTORY ELEMENTS MADE FROM RECOVERED MATERIAL

THE RISING PRICE OF REFRACTORY RAW MATERIALS and China's dependence on bauxite and very high aluminium oxide ((Al₂O₃) raw materials has encouraged European refractory producers to look elsewhere for new synthetic and recovery alternatives. DEGUISA designs, manufactures, installs and commissions refractory linings for furnaces.





OBJECTIVES

- Reduce dependence on natural resources in the manufacture of refractory materials in furnaces.
- Recycling refractory raw materials.
- Reuse refractory slide valve parts and achieve the same performance in use as new parts.
- Design new, more appropriate geometries in wear and corrosion areas of refractory parts.
- Reduce energy consumption.



RESULTS

- Registration of 5 new designs of iron ladles and ditches that have been commercially exploited.
- 7 new prototypes of ladles, partitions and gutters.
- Viable recovery and reuse of high-performance refractory materials, adequately processed and designed, in steelworks slide valve systems and cast-iron ladles.
- Reused high added value $\text{Al}_2\text{O}_3 \cdot \text{ZrO}_2 \cdot \text{C}$ refractory materials in slide valve plates and applied in steel ladles.
- Development of structural designs that prevent premature refractory wear.
- Integration of a refractory waste selection and recovery process applied in the manufacturing process of formed and unformed refractory materials.



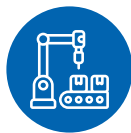
CONCLUSIONS

- ALRE has been able to expand, maintain and distribute DEGUISA's insight and external knowledge of technical recovery processes.
- Working closely with client companies such as FAGOR and ARCELOR, which have collaborated in the recovery and use of the refractory materials used in ALRE, has contributed to overcoming the entry barrier into the recycled refractory product market in the sector.
- Given that it is possible to recover and reuse high-performance refractory materials in steelworks slide valve systems and cast iron ladles, specialised refractory recovery plants can be proposed, taking advantage of synergies with existing recovery plants, and carrying out a project on refractory waste from aluminium industry salts.

DRIVING FACTOR



REDUCTION OF GREENHOUSE GASES (GHGS)



BEST PRODUCTION TECHNIQUES



I-CABLE 4.0

MANUFACTURING SMART CABLES FOR ELECTRIC ARC FURNACES

ELECTRIC ARC FURNACES ARE USED TO PRODUCE CARBON AND ALLOY STEELS mainly by recycling ferrous scrap. In an electric arc furnace, ferrous scrap is melted together with other materials such as ferroalloys to convert the mixture into high-quality steel. Melting of these materials requires the use of high-power electric arcs formed between the electrodes of the furnace, through which a high electric current is passed to form the arc. The heat generated by this arc melts the scrap metal. Maintenance operations on these cables can lead to production stoppages at high costs and with a significant environmental impact on the facilities.

GECSA is a company dedicated to design and manufacture special electrical conductors, automation, Industry 4.0 and industrial processing control, as well as electrical engineering. IK INGENIERÍA, Life Cycle Analysis (LCA) experts, has also been involved in the I-CABLE 4.0 project.

COLLABORATORS



IK / INGENIERIA





OBJECTIVES

- Implement a system for continuous sensing and measurement of the condition of power cables in electric arc melting furnaces.
- Improve process efficiency by means of sensors that allow identifying the condition of cables in a preventive manner.
- Extend the service life of cables.
- Increase reliability.
- Reduce the use of materials and resources used in maintenance.



RESULTS

- Reduced environmental impact on climate change by 23%.
- Reduced environmental impact on ozone layer destruction by 38%.
- Reduced environmental impact of fossil fuel consumption by 37%.



CONCLUSIONS

- Capturing high intensity signals must be conducted using galvanically isolated cabinets and high-power connectors.
- Once the project results are validated, GECSA will carry out actions to disseminate and communicate the new technology to current and potential corporate clients.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



LOHIBAL

RECOVERY OF GRINDING
SLUDGE IN THE
METALLURGICAL INDUSTRY

GRINDING SLUDGE GENERATED IN BASQUE METAL-MECHANICAL INDUSTRY AMOUNTS TO 3,700 TO 4,600 TONNES PER YEAR and is usually disposed of. However, its high metal content (over 50 %, and reaching values of over 90 % in some companies) and hazardous nature, are increasingly attracting the interest of industries and environmental administrations in minimising and recovering it. However, although magnetic filtering systems for grinding machines are included in the Basque List of Clean Technologies, no implementation is known in any company in the Basque Country.

MOSNIC-IRUDEX, a specialist in the manufacture of auxiliary elements for the machine tool industry, has led LOHIBAL, where GEARBOX BY GAMESA, SCHAEFFLER and TEKNIMAP have also participated.

COLLABORATORS





OBJECTIVES

- Separate metallic and non-metallic parts of grinding sludge by using powerful rare earth based magnetic separators.
- Identify possible recovery routes for potentially interested companies. The solution proposed by LOHIBAL combines a magnetic separator with a briquetting press.



RESULTS

- Elimination of the use of oil-impregnated cellulose filters used in conventional technology, also recovering the oil that impregnates these filters, and facilitating subsequent waste treatment.
- Reduction of oil present in waste to concentrations below 2.5% through the use of a briquetting press.
- Declassification of waste as hazardous waste, due to reduced oil concentration.
- Recovery of oil included in waste (with concentrations varying between 10% and 50%), facilitating its transport and subsequent handling at the recovery plant.



CONCLUSIONS

- LOHIBAL has reduced waste generation by 7% to 47%, as well as oil consumption in the facility, by recovering the oil used; and has modified the hazar-dousness of waste.
- At the end of the project, the possibility of recovering briquettes produced is still being tested by recovery companies, including the results of tests allowing other important criteria for recovery to be established (granulometry, waste conditions, TOC, etc.).
- General declassification of waste as hazardous waste was not possible.
- Applicability in all types of industries cannot be guaranteed.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIAL COSTS AND SUPPLY



visuAL

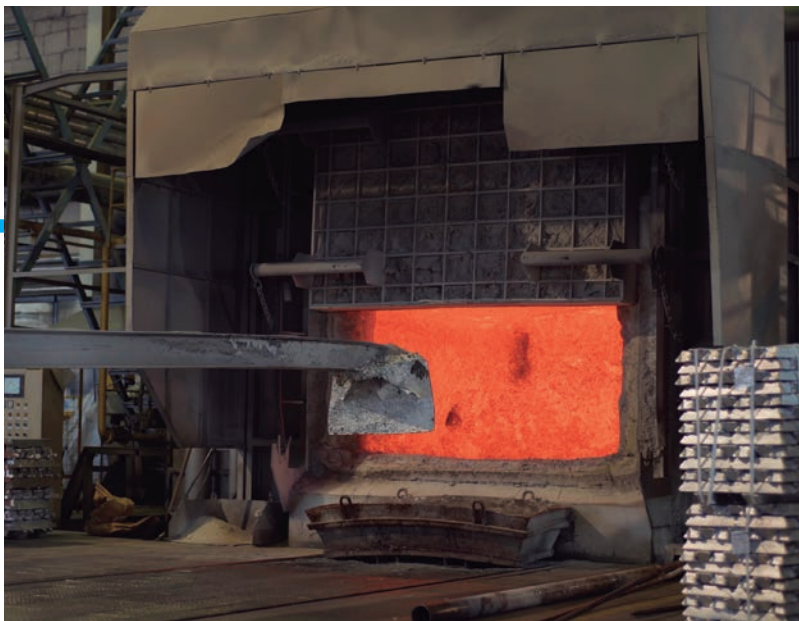
ALUMINIUM ALLOY SEPARATION BY OPTICAL DISPLAY

ALUMINIUM IS A CIRCULAR MATERIAL THAT CAN BE RECYCLED INDEFINITELY with significant energy savings; but the secondary alloys obtained through the recycling process are used for smelting processes that lead to a loss of value of the critical metals included in aluminium alloys. This downcycling is not usually considered in Life Cycle Assessment studies, and affects the metallic fraction composed of aluminium obtained in the treatment of waste materials from End-of-Life Vehicles (ELV) and Waste Electrical and Electronic Equipment (WEEE).

REFIAL is an aluminium refinery dedicated to the supply of second smelting aluminium, and is part of the OTUA GROUP. At visuAL, REFIAL has collaborated with INATEC, one of the Group's R&D unit.

COLLABORATORS





OBJECTIVES

- Upcycle the degree of utilisation of critical metals in secondary aluminium alloys.
- Perform effective separation methods of the different alloys present in secondary aluminium.
- Scale this separation in quality and added value.
- Recover wrought alloys (family 6xxx) and cast alloys (family 46xxx), which correspond to the two major fractions of materials processed.



RESULTS

- Design, optimisation and implementation of a process for separating aluminium alloys based on their colour when exposed to different dyeing processes. The process consists of an initial pickling pre-treatment and five dyeing stages to separate the metal parts according to their main alloy.
- Alloy recovery from different ELV and WEEE source materials, throughout the treatment scheme, and process completed for aluminium recovered from ELV shredder light waste (aluminium Fluff) with a chemical pickling pre-treatment.
- Testing the effectiveness of treatment on a semi-industrial scale by colour separation in an automated system with fragments larger than 10 mm.
- 5% contribution to company's turnover, with a 5% increase in market share and investment of EUR 5 M.
- Estimated potential savings of 6,200 tonnes per of CO₂e/year.



CONCLUSIONS

- Due to the heterogeneity of the input material, it is considered necessary to design different treatment schemes depending on its origin. There are clear differences in content and composition of aluminium from heavy or light shredding of WEEE or ELVs. Polymeric coatings on some aluminium streams, for example, involve high management costs.
- Effluents are generated during the treatments carried out, which could be reused in several treatment cycles.
- visuAL has visually separated aluminium alloys on the basis of Si, Mg and Cu content. This line of work offers an entry into the secondary aluminium market with interesting economic impact: cost reduction for companies using this type of alloys and increased margins for recycling companies.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIAL COSTS AND SUPPLY



Al-ReX

USING X-RAY SENSOR TECHNOLOGY FOR SORTING ALUMINIUM ALLOYS

IN THE TREATMENT OF END-OF-LIFE VEHICLES (ELV) AND WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE), a metallic aluminium fraction (Al) is obtained, which is a mixture of different casting and wrought alloys. Currently, all secondary Al alloys obtained through the recycling process are used for casting processes, mostly for Al injection moulding (HPDC), which represents a clear loss of material value. Overall, it is estimated that 6.1 Mt of wrought alloys are degraded each year in moulding products.

Demand for 6xxx series aluminium alloys is estimated to grow from 2.3 to 6.5 million metric tonnes, between 2010 and 2030. Aluminium scrap (mixed alloys) is also expected to beat the demand for casting alloys with high impurity tolerance. Over 30% of the metals processed in the EU come from recycling, although variation between metals is high and only 12% of Al comes from recycling.

REYDESA, part of the Otua Group, is a leading company in the recovery of ferrous and non-ferrous metals that manages a wide range of metal waste. Al-ReX was developed in collaboration with the Group's R&D unit, INATEC.

COLLABORATORS





OBJECTIVES

- Overcome the current inability to perform effective separation methods on forging/moulding grades from recovered aluminium fractions.
- Obtain secondary alloys of forging and casting quality by means of X-ray separation, increasing quality and added value.
- Compare the best techniques analysed within the OTUA GROUP to separate aluminium alloys and to lead a recycling initiative for upcycling in the Basque Country.



RESULTS

- Three different grades of low, medium and high Al recovered alloys were obtained through X-ray identification technology.
- Technical feasibility of the technology, which improves the results of those currently implemented.
- Savings of 565 kg in CO₂e emissions per tonne of metal waste treated.
- 97.4 % reduction in aggregate impact potential (Pt), compared to the treatment considered.



CONCLUSIONS

- The results enable higher specification and higher priced casting alloys to be obtained at REFIAL, the Otua Group's aluminium alloy smelter and refinery.
- Technology implementation suffers from the variability in sample composition.
- The technology is dependent on the material granulometry, which means different production capacities and industrial schemes must be maintained according to particle size.
- The contamination found in purer aluminium streams with impurities makes it necessary to maintain a manual separation stage for impurities.
- REYDESA continues to work to complement additional separation processes to meet aluminium forging market specifications.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



BEST PRODUCTION TECHNIQUES



COLOR

COLOUR SEPARATION DURING PCB PROCESSING

PRINTED CIRCUIT BOARDS (PCB) ARE USED TO LOCATE THE VARIOUS ELEMENTS that make up a circuit and the electrical interconnections between them. Most PCBs contain a variety of strategic metals, such as precious metals (gold, silver, palladium and platinum), and base metals (nickel, copper, aluminium, zinc, tin, lead and iron). During decontamination of WEEE material, tonnes of PCBs are generated and sent out of the country for disposal. The Basque Country alone consumes more than 472,000 tonnes per year of main non-ferrous metals such as aluminium, copper, nickel, molybdenum, chrome, zinc and tin, worth EUR 1,420 million per year.

REYDESA, part of the Otua Group, is a leading company in the recovery of ferrous and non-ferrous metals that manages a wide range of metal waste. For the COLOR project implementation, the company worked with INATEC, the Otua Group's R&D Unit. Since 2016, it has conducted several research projects in the search of copper and precious metal extractive processes, with the aim of defining a treatment process for these materials, and has recently acquired optical separation technology to be used in other processes, potentially applicable to the treatment of PCBs.

COLLABORATORS





OBJECTIVES

- Carry out industrial tests that demonstrate the technical, economic and environmental feasibility of a technology based on optical sensors applied to the material resulting from PCB treatment throughout their mechanical processing, in order to recover the strategic metals contained in PCBs.
- Reduce the flow of PCBs managed outside the country, to recover strategic metals within the Basque Country and improve the results of WEEE recovery.
- Reduce hazardous gases and effluents generated during traditional treatments, through a new, more environmentally friendly process.
- Compare this new technique with the current treatment of PCBs.



RESULTS

- Low separation efficiencies by replacing the traditional density separation treatment in mechanical treatment by separation with the new technology. The colouring of particles that form part of the material is not always a sign of metallic content and as a consequence, the desired metallic content cannot be concentrated in the fractions segregated by colour. This defines the new sensor-based colour separation method as not technically feasible to concentrate metal contained in crushed PCBs.
- Improvement of the quality of the metal concentrate obtained by implementing the new technology after the density separation treatment: good separation performance in this case as the metal fraction has less variety of colours, facilitating adequate separation, as a result.
- Savings of 159.7 kg of CO₂e emissions per tonne of PCB treated using the traditional mechanical treatment scheme and incorporating the new technology at the end of the process to improve the quality of the separated metal concentrate.
- Environmental improvement of 19.3% in aggregate impact potential (Pt) values, compared to pyrometallurgical treatment, considering the traditional mechanical treatment and incorporating the new technology at the end of the process.



CONCLUSIONS

- The low concentration of strategic metals within separated metal concentrate means there is loss of metal material in the reject as part of plastic parts. Possible solutions include further grinding or introducing a different type of detector capable of detecting metal-containing parts to improve separation performance.
- The interference of debris on materials may require a pre-cleaning step, which consumes water and produces effluents.
- The new technology is considered a part of the mechanical treatment to improve the quality of metal concentrate, but not a replacement for the traditional density separation treatment.

DRIVING FACTOR



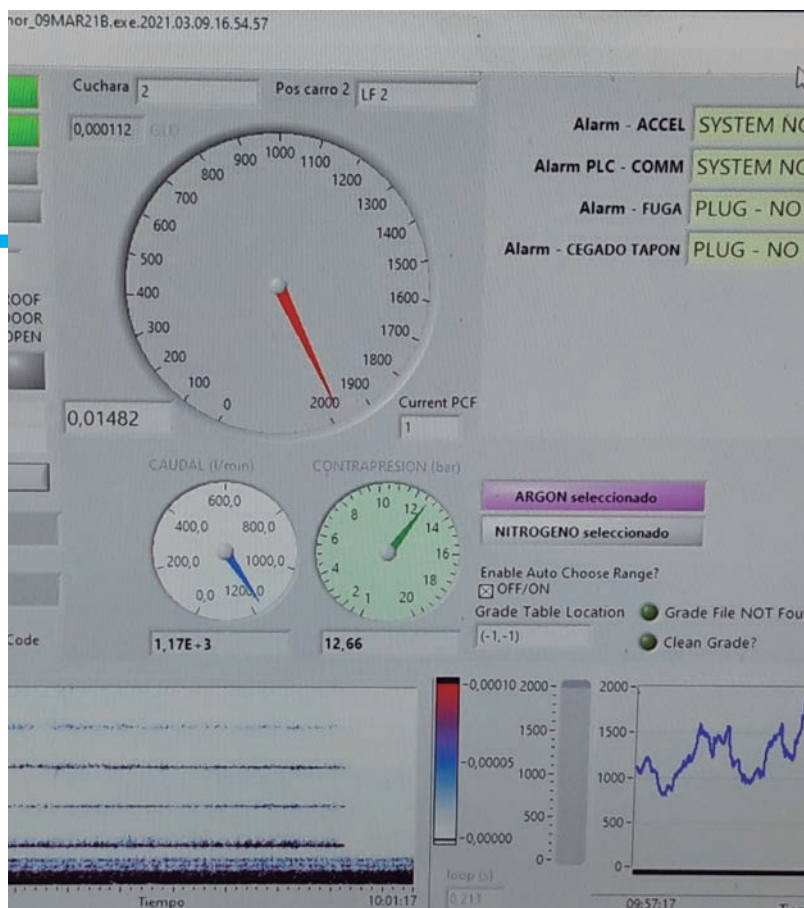
BEST PRODUCTION
TECHNIQUES



STIRLADLE ON-LINE STEEL STIRRING CONTROL SYSTEM

RESEARCH INTO THE OPTIMISATION AND MONITORING OF CURRENT STEEL stirring processes in the ladle have been conducted for years to ensure better process indicators and the correct diagnosis of equipment conditions. However, practical implementation has not achieved the expected theoretical results, and the process continues to entail excessive consumption of raw materials and energy. This is a poignant issue for SIDENOR and for the steel industry, as new environmental regulations, a demand for higher quality products and high competition on the market, demand modernisation and the adoption of new technologies. SIDENOR is a company dedicated to manufacture and transform steel, leading the European segment of long special steel products.





OBJECTIVES

- Develop and implement a monitoring system for accurate control and characterisation of the stirring energy of the steel ladle; and analyse stirring information provided by the smart sensors implemented.
- Improve productivity, thanks to the optimisation and control of processes through new monitoring systems.
- Improve steel quality index, and therefore reduce defective steel, which will lead to better resource efficiency.
- Improve energy efficiency and reduce environmental impact.



RESULTS

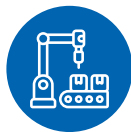
- Technical validation of the monitoring system for the control and accurate characterisation of steel ladle stirring.
- Development of an interface to differentiate vibrations caused by general process gases.
- 0.4% reduction in production scrap, which means a saving of 3,000 tonnes of steel per year and more than EUR 0.5 M per year.
- Annual of CO₂ emissions by 641 tonnes.
- Reduction by half in the number of reprocesses carried out and substantially improved castability.



CONCLUSIONS

- The IT architecture in the installation is key to integrate data from the vibration sensors and other production control systems.
- Technical parameters affecting the vibration pattern may require correction factors.
- The newly developed system can be applied to clean steels or steels with high quality requirements to improve steelmaking performance, adjust steel process production for the transition to climate neutrality or preparation of raw materials to produce green steels.
- STIRLADLE opens a new possibility of installing sensors of the same type in other steel facilities in the Basque Country.

DRIVING FACTOR



BEST PRODUCTION
TECHNIQUES

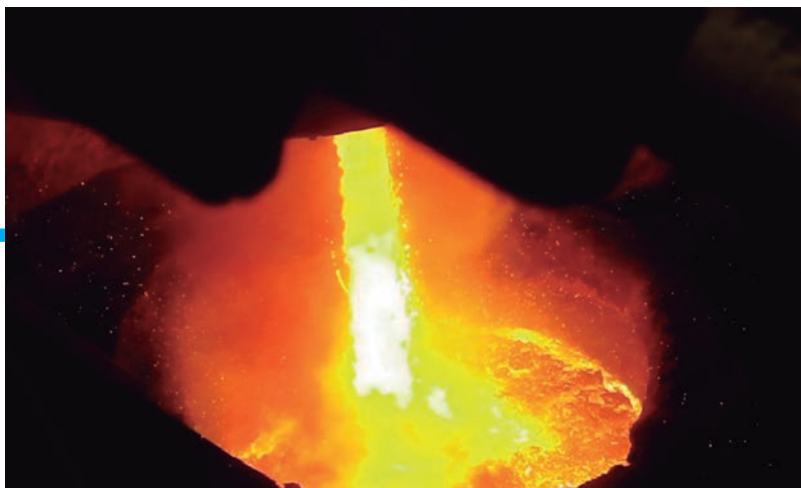


TERMOSLAG ON-LINE SLAG DETECTION SENSOR IN EAFs

THE TAPPING PROCESS IN ELECTRIC ARC FURNACES (EAF) has been extensively researched, but operationally it is still not possible to detect the exact moment when slag starts passing from the furnace to the ladle, and this prevents process optimisation. The current slag monitoring equipment is a thermographic camera, which only measures slag passing through the front surface of the jet during tapping, so that anything that passes inside or through the rear of the jet is invisible to monitoring. These current limitations prevent the information collected on-line from being representative of what is actually happening during tapping.

SIDENOR is a company dedicated to manufacture and transform steel, leading the European segment of long special steel products.





OBJECTIVES

- Achieve on-line control of slag movement during the tapping of liquid steel in EAFs through Eccentric Bottom Tapping (EBT) by developing an on-line sensor.
- Reduce the amount of slag passing into the steel.
- Reduce raw material and energy consumption by optimising the process as much as possible.
- Improve steel quality by avoiding Si or Mn recoveries from slag to steel due to slag passage.



RESULTS

- Overall, significant improvement in terms of internal steel quality, lower costs and more efficient use of resources have been achieved.
- Optimised secondary metallurgy processes thanks to accurate monitoring of EAF slag, a process parameter that had not been controlled until now.
- Minimised slag (up to 10%) during steel tapping by strengthening information.
- Reduced dephosphorisation, improved cleanliness and castability, increased alloy yields, reduced use of deoxidisers and lower electricity consumption. Emission savings of 970 tonnes of CO₂e.



CONCLUSIONS

- The development of the virtual sensor has helped to optimise the refining stage, which accounts for up to 20% of total emissions in steelmaking process; and it has also facilitated an analysis of the impact of the slag movement on other parameters of the refining stage that currently could not be addressed.
- System validation is required over a longer period covering all grades and scenarios of SIDENOR's production, so that system validity can be demonstrated in reality.

DRIVING FACTOR



**ENVIRONMENTAL
POSITIONING AND
TRANSPARENCY**



HAMBEMET CO-ORDINATED PEF IMPLEMENTATION IN METAL PANEL MANUFACTURING COMPANIES

THE PRODUCT ENVIRONMENTAL FOOTPRINT (PEF) measures the environmental impact of a product or service throughout its life cycle. The Life Cycle Assessment (LCA) takes into account the different processes that are carried out to obtain the final product. Based on this analysis, Environmental Product Declarations (EPD) are made under the scheme promoted by the European Commission for PEFs. PEFs require environmental information on the product and its processes, and allow the company to differentiate itself from its competitors, anticipate legislation, penetrate in new international markets and strengthen its environmental commitment.

This certification is relevant for the Basque steel sector, as a manufacturer of metal panels, one of the priority products for the Basque public administration in these sectors. The HAMBEMET project is led by SIDEREX (Spanish Association of Steelworks Exporters), the Basque Steel Cluster, along with EKOTEK and FACTOR CO2 as partners, and TECNALIA as subcontracted Technology Centre. Companies participating in the cluster included ARCELOR MITTAL, ARANIA, TATA STEEL, PRODUCTOS TUBULARES and TUBOS REUNIDOS.

COLLABORATORS





OBJECTIVES

- Coordinated implementation of the methodology to calculate the European Environmental Product Footprint of metal panels manufactured by Basque companies.
- Apply the rules corresponding to the product category "Product Environmental Footprint Category Rules (PEFCR) for Metal Sheets for Various Applications" (June 2019) to a representative group of companies in the Basque steel sector, in a co-ordinated and collaborative process.
- Apply the PEF methodology to obtain the Environmental Footprint of other companies in the iron and steel sector, calculating the Environmental Footprint of their products, even if there is no explicit PEFCR.



RESULTS

- The PEF of one product from each of the five participating companies was calculated.
- A specific tool was developed to calculate the PEF of steel panels or upstream products in the value chain.
- Using a circularity formula in order to model the end-of-life phase of the product or system under study.
- Promotion of project replicability, demonstrated by PEF calculation in tubes.
- Dissemination of the project and tool.



CONCLUSIONS

- With currently high raw material and energy prices, the calculation of PEF is particularly relevant as it allows companies to identify clearly and concisely the main stages and processes in the life cycle of products where savings in materials and energy can be made; thus, considerably reducing environmental impact and production costs.
- Since the environment is a key competitive factor, starting PEF implementation as soon as possible is essential to be prepared in advance for what seem inevitable future market and legislative requirements, which are becoming increasingly important and could put unprepared companies out of business.
- The tool developed in the project will be made available to SIDEREX so that it can be used by other companies in the Basque steel sector that are interested in improving their environmental performance and reducing production costs.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



RAW MATERIAL COSTS AND SUPPLY



SEPMANREC

AUTOMATED SEPARATION OF SINTERED NdFeB MAGNETS TO BE RECYCLED AS BONDED MAGNETS

THANKS TO PREVIOUS MAGNET RECYCLING PROJECTS and close cooperation with companies in the value chain, one of the key issues regarding the performance and continuity of this activity was identified as the need for an automated system to separate magnets from the rest of the ferrous scrap (casing, electrical steel, etc.). At present, this separation is not carried out: magnetic materials are treated together with the rest of ferrous scrap and sent to steel mills where scrap and other raw materials, necessary to obtain the desired chemical composition, are melted down. During this process within steel plants, where the material received is melted down, rare earths, due to their affinity with oxygen, oxidise and form part of the waste slag. The SEPMANREC project, a sequel to a previous project (FABRIMANREC), focuses on the needs and concerns of the industrial sector in this area.

STADLER is dedicated to the design and manufacture of metal parts by powder metal pressing technology, and has relied on the CEIT Technology Centre and the Otua Group organisations REYDESA and INATEC for the SEPMANREC project.

COLLABORATORS





OBJECTIVES

- Develop an automated separation process for sintered NdFeB magnets from the rest of the electrical-electronic scrap that is treated in recycling plants.
- Study the recycling processes currently used: separation of material sources, shredding, sorting materials according to differentiated properties.
- Study separation methodologies that allow separating ferrous materials destined for steelworks from magnetic materials.
- Adapt the separation methodology to material recovery processes currently implemented in recycling plants.
- Classify the NdFeB permanent magnets obtained.
- Demonstrate the feasibility of recycled material in new machines of the companies contacted in the industry focus group.



RESULTS

- REYDESA has implemented different methods of separation and concentration of magnetic material within the plant's current separation lines.
- CEIT has treated synthetic mixtures of scrap and magnets with quantities similar to those expected in a normal flux starting from 2% concentration, and reaching magnet concentrations of up to 85% today.
- The recycled magnets are comparable to those obtained with fresh powder. Prototype magnets bound from recycled material can be produced industrially for use in commercial equipment.



CONCLUSIONS

- Separation of the scrap according to the grade of NdFeB permanent magnet it contains is not possible; therefore, it is necessary to sort them into batches of recycled material, once separated.
- Thanks to SEPMANREC, ensuring greater resilience in supply chains is possible, by implementing separation processes that are not currently conducted in the Basque Country.
- Among the most suitable techniques for separation that have been studied, those that can be implemented in an established industrial recycling process will be developed, generating the knowledge and technology necessary to complete the value chain.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIAL COSTS AND SUPPLY



KRITEUS

CRM STRATEGY FOR THE BASQUE COUNTRY

THE LIST OF CRMS (CRITICAL RAW MATERIALS) FOR THE EU

published in 2017 by the European Commission (EC) includes 27 CRMs, of which 216,000 tonnes are consumed annually in the Basque Country (corresponding to EUR 415 million/year). The most important in terms of turnover are chromium, silicon (ferrosilicon), niobium (ferroniobium) and magnesite. Aluminium, copper, zinc and nickel are the most important non-ferrous metals for the Basque economy, with an approximate consumption of 271,000 tonnes per year (EUR 1.120 billion/year). The industrial sectors most dependent on CRMs are metallurgy and electrical equipment, although they are also critical for sectors such as the manufacture of synchronous motors and refractory materials. Basque industry systematically perceives less criticality than that established by the EU, given that CRMs are frequently embedded in components used in product manufacture or equipment production: permanent magnets, machining tools, catalysts, etc., firms consider they have an “indirect” dependence on CRMs and that risk or price is not associated with the criticality of raw materials.

The SUPREN (Sustainable PProcess ENgineering) research group of the Department of Chemical Engineering and Environment of the UNIVERSITY OF THE BASQUE COUNTRY (UPV/EHU) leads KRITEUS. TUBACEX, the manufacturer of long steel and nickel products, DIGIMET, a company specialising in the recovery of high-value metals and TECNALIA Technology Centre have also collaborated in the project.

COLLABORATORS



DIGIMET

tecnal:a

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE





OBJECTIVES

- Establish relevant R&D & Innovation lines on strategic materials which may be considered critical for supply (due to shortage and/or price) for companies which include them in their products and/or production processes; or because they may become an opportunity to develop new companies or lines of business to be set up in the Basque Country with advanced preparation proposals for reuse and/or recovery of these materials.
- Demonstrate the viability of recovering strategic non-ferrous metals from waste from the stainless steel industry using DIGIMET technology.



RESULTS

- Analysis of 15 CRMs which are relevant for the Basque Country (10 of them in depth: chromium, silicon, niobium, magnesite, magnesium, cobalt, graphite, wolfram, fluor spar and neodymium-dysprosium); and assessment of strategic non-ferrous metals (aluminium, copper, nickel and zinc).
- Definition of responses to minimise the vulnerability of Basque industry to CRMs.
- Creation of a "Company-Sector vs Critical Raw Materials" matrix, which identifies potential lines of development and R&D & Innovation in priority value chains, and explores business opportunities in reuse through new uses of already exhausted materials.
- Pilot plant validation of DIGIMET technology for the treatment of steel dust from suction systems from stainless steel manufacture, obtaining a high recovery rate of critical metals such as Cr or Ni.



CONCLUSIONS

- The knowledge developed in the KRITEUS project matrix has used information from previous projects, statistical data available from official sources, and consultation with professional experts (up to 31 people).
- Potential R&D & Innovation lines have been established for reuse, recycling, recovery and replacement of valuable CRMs.
- Potential business areas to be promoted include waste mining or the recovery of silicon from solar panels.

CHALLENGES



GENERAL

- Efficiency and cost reduction.
- Manufacturing processes and service monitoring.
- Development of existing and new products/ market niches.
- Internationalisation (emerging countries).
- Improving user experience in mobility.



ENVIRONMENTAL

- CO₂ and other GHG emissions.
- Energy efficiency and fuel savings
- Alternative fuels.
- Reduced use of raw materials in the construction of infrastructures.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Eco-design of components, vehicles and infrastructure.
- Re-manufacturing of vehicles and components.
- Improved processing techniques and vehicles.
- Integrated logistic chain driving effect.
- Increased responsible consumption and corporate transparency.
- Recyclability of vehicles.



COMPETITIVE IMPROVEMENTS

- Lighter components.
- Components made from waste.
- Design of infrastructures contributing to reduce consumption.
- Standards, technologies and products facilitating recyclability and reusability.
- Replacement of non-ferrous and lighter metallic materials.
- New composite materials facilitating end-of-life management .
- Surplus energy recovery systems.
- Environmental impact calculation.
- More demanding environmental standards.
- Transparency and environmental information for the user.

○ **OTHER MEANS
OF TRANSPORT
(RAILWAY, SEA, AIR)**



DRIVING FACTOR



PLASTICS



RAW MATERIALS
COSTS AND SUPPLY



RCARBEFILL CARBON FIBRE 3D PRINTING

THE CARBON FIBRE-REINFORCED COMPOSITES OR CFRC

INDUSTRY, generates large volumes of waste from prepregs, blankets and fabric offcuts: 24,000 tonnes of carbon fibre out of the 79,000 tonnes consumed in 2015 became waste during the composite conversion and manufacturing stages, and only 10% was recovered through recycling. In addition, this is also an industry with major growth forecasts due to the need for weight reduction in sectors such as aeronautics, wind power, automotive, transport, shipbuilding, etc. AERNNOVA generates waste from carbon fibre offcuts pre-impregnated with resin, which amount to 20 tonnes in the Basque Country. Once cured in an autoclave, composite parts undergo an edging process to give the part the final geometry desired, and it is in this process when the carbon powder is generated.

AERNNOVA, a leading company in the design and manufacture of aerostructures, has directed the project RCARBEFILL, where the company 3R3D and GAIKER Technology Centre have also participated.

COLLABORATORS





OBJECTIVES

- Obtain a monofilament for 3D printing by FDM (Fused Deposition Modelling) technology with high mechanical performance and electrical conductivity properties. Performance should be equal or superior to commercially available products.
- Use recycled powdered material obtained from carbon composite scrap to produce such monofilament.



RESULTS

- Characterisation of materials obtained as waste in the transformation processes of the composite materials obtained in AERNNOVA's machining hoppers, determining their composition and main properties.
- Definition of a safe waste handling process and determination of the self-ignition properties. This phase was used to rule out the possibility of obtaining electrical conductivity and the need to screen the waste for the intended application.
- Determination of the most suitable end product composition by formulation and compounding tests.
- Mixtures with a structure very similar to that of commercial monofilament were obtained.
- Validation through filament manufacturing and production of FDM 3D printed parts using recycled material from post-consumer PET and carbon fibre recovered from machining scrap.



CONCLUSIONS

- The intended aim of achieving electrical conductivity or high mechanical performance has not been achieved as the materials do not have sufficient conductivity; plus, the uncertainty of recycled materials and the lack of process repeatability lead to a dispersion which does not facilitate obtaining favourable conclusions.
- However, there is a substantial improvement in the material behaviour with the addition of a small amount of filler: increased dimensional stability, facilitated processing in printing equipment, minimised warping of parts, improved adhesion to the printing bed and significantly modified aesthetic appearance of the parts.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



GREEN PUBLIC PROCUREMENT



OVERGY MINIMISING RISK IN RAILWAY REHABILITATION

ADVANCED RAILWAY REFURBISHMENT SERVICES IMPROVE SUSTAINABILITY IN MOBILITY by modernising fleets: offering more efficient, more environmentally-friendly trains, while consuming less raw materials (steel and aluminium), and increasing service life by 100%. This results in less waste generated and a lower energy requirement. However, the risk of a train rehabilitation business requiring structural modifications of body and bogies on a vehicle whose design, maintenance or operation throughout its service life may be unknown, and assuming its durability for another 15 to 20 years, is huge.

The OVERGY project is led by CAF Engineered Modernizations, supported by mechanical and structural engineering experts from ALTRAN.

COLLABORATORS





OBJECTIVES

- Develop a proprietary methodology that predicts the real condition of structures and the necessary solutions required to extend their useful life, minimising risk in comprehensive railway rehabilitation.
- Analyse the structural response of the different railway rolling stock components such as: body, bogie and coupling structures, among others.
- Extend the useful life of these assets by 90% (adding 15-20 years of life).
- Increase the train efficiency by replacing obsolete technologies with more modern, efficient, intelligent (IoT), less maintenance-intensive, predictable (easier and predictive maintenance) technologies.
- Capture and maintain as much value as possible in existing trains and on-board systems that will not be replaced, reducing waste generation and avoiding consumption of new raw materials.
- Adapt rolling stock to new environmental regulations.
- Engage operators, maintenance companies and suppliers in the value chain in the field of eco-innovation.



RESULTS

- Knowledge Data Base
- Predictive modelling for optimisation of rehabilitation engineering solutions.
- Methodology for bidding phases based on advanced repair techniques that minimise risk in the railway refurbishment business, engaging operators, maintenance companies and suppliers in the value chain in the field of eco-innovation.
- Test protocol and results of experimental measurements.
- Estimated cumulative damage calculation at each measurement point.
- Reinforcement solutions as structure repair methods.
- Contrasted results between theoretical models and experimental results.



CONCLUSIONS

- There are risks in the development of predictive models. A critical issue is the availability of quality data for accurate prediction models. In many cases, the information shared by client companies is vague, inaccurate and inconsistent.
- CAF Engineered Modernizations has analysed railway structures such as bogies and bodies. Remaining useful life studies are essential for correct decision making in terms of sustainable development and long-term investment. This analysis supports investment teams by helping them to optimise their asset management strategy.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



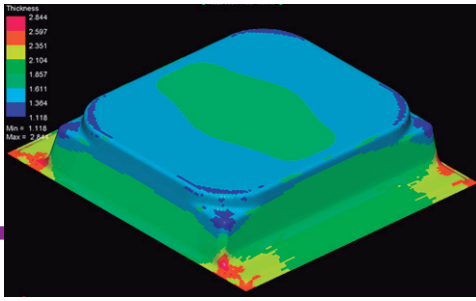
ALSPF

SUPERPLASTIC FORMING TO MANUFACTURE ALUMINIUM COMPONENTS FOR THE RAILWAY AND AUTOMOTIVE INDUSTRY

THE CURRENT TREND IN THE RAILWAY AND AUTOMOTIVE SECTOR IS THE INCORPORATION OF ALUMINIUM (Al) to replace polymeric composite materials used in recent years. This is due to the need for recyclability, which Al provides compared to polymers. The engineering firm EKIDE has worked alongside MONDRAGON UNIBERTSITATEA to demonstrate the viability of the superplastic forming process to make this transition possible.

COLLABORATORS





OBJECTIVES

- Demonstrate the feasibility of SPF (superplastic forming) for the manufacture of Al components with excellent mechanical properties for the railway and automotive industries.
- Save 26 tonnes of materials per year.
- Reduce energy consumption by 74% - 82%, thanks to shorter cycle times and lower furnace consumption.
- Minimise the weight of existing products by up to 33% and improve mechanical and flame-retardant properties.



RESULTS

- Reduced processing time by almost half (55 to 26 minutes) with satisfactory technical results.
- Reduced consumption by 16 tonnes of Al per year thanks to the use of the new technology.
- Characterisation of two new materials in superplastic state.
- Design of manufacturing process and moulds to produce scaled parts and study of the process limits. Manufacture of moulds, system fine-tuning and manufacture of demonstrators of a railway part in different Al alloys using SPF.
- Highly accurate process simulation.
- Using a steel mould not prepared for high temperature, 20 tests were carried out without any problems.



CONCLUSIONS

- The feasibility of the solution has been demonstrated by favouring the use of aluminium for forming and increasing the possibilities of recyclability as a composite substitute.
- Knowledge of superplastic forming has been obtained through a simulation using Abaqus® and Pam-Stamp® (already known simulators but not for this type of transformation).
- Alloys that are more sensitive to temperature heterogeneities in the mould may generate breakage when forming.
- Aluminium seems the future alternative to replace composite in the railway sector, offering better mechanical properties than composite, while being recyclable at the end of its useful life at the same time, and reusable for other applications.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY



FUNDITREN REDUCING THE ENVIRONMENTAL IMPACT OF RAILWAY COMPONENTS

THE PARTS USED IN RAILWAY BRAKE ASSEMBLIES ARE USUALLY MADE OF CAST STEEL. On the one hand, steel offers better mechanical properties than standard nodular cast iron, but poorer heat dissipation, an important parameter in braking systems as they need to dissipate the heat generated during braking. On the other, cast steel only achieves its mechanical properties if the part is subjected to a standardised thermal treatment process, which involves taking the part from room temperature to approximately 850-900° C. The Basque railway components sector is made up of more than 70 companies that account for over 80% of the total railway exports in our country. FURESA, a manufacturer of high added-value nodular cast iron parts for various sectors, leads FUNDITREN and has collaborated with TECNALIA Technology Centre in the project implementation.

COLLABORATORS

tecnalia

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

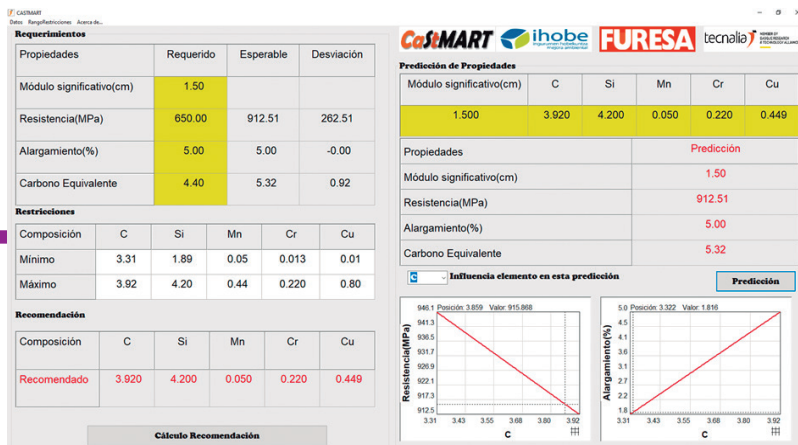
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Reduce energy consumption in the parts manufacturing process; reduce consumption of alloying elements (including critical metals such as chromium, nickel and molybdenum); minimise the generation of slag; and lighten parts.
- Establish a new working methodology to standardise the manufacturing process and predict the final properties of the parts in a systematic way, choosing the most suitable alloy composition at the lowest cost.
- Reduce production costs (raw materials and energy) by 12% compared to steel parts manufacturing.
- Increase FURESA's market share by 5%.



RESULTS

- Approximate reduction of 31% in energy consumption.
- Approximate reduction of 51% and 28% in ferroalloys consumption and slag generation, respectively.
- Reduced environmental impact between 8 and 24% for the categories studied (acidification, eutrophication, climate change, photochemical oxidation, ozone depletion).
- 2% reduction in part weight.
- Development of a smart self-regulating algorithm for strength and elongation calculation, which proposes a specific alloy composition, making it possible to obtain the required properties for the parts.
- Savings of 12% in overall manufacturing costs when working in nodular cast iron.



CONCLUSIONS

- FUNDITREN has achieved a significantly improved process systematisation, which is now less dependent on human factors. Forecasting results based on alloy composition reduces part rejection and raw material costs. Once the process was fine-tuned and results verified, the working methodology has been incorporated, including staff training.
- This development allows FURESA to expand in the railway market with a more competitive product.
- The LCA carried out identified a potential significant reduction in the environmental impact from selected steel scrap consumption compared to using blast furnace ingots. This requires a new development to be materialised in a new circular economy proposal.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



POLLUTION MINIMISATION



BUAP

ECO-DESIGN OF BALLAST WATER TREATMENT SYSTEMS

AROUND 10 MILLION TONNES OF BALLAST WATER ARE TRANSPORTED AROUND THE WORLD EACH YEAR, along with

animals, plankton, bacteria and viruses, which are discharged into remote waters when ballast water is landed. The UN considers this unintentional spread of so-called invasive species to be one of the main threats to the marine environment. International maritime authorities require the implementation of Ballast Water Treatment Systems (BWTS) from September 2024 on all ships carrying ballast water between different areas. The development of accredited BWTS products started in 2016, with no national agents or manufacturers.

The Ballast Water Purification Plant (BUAP, for its acronym in Basque) 250 is a ballast water treatment plant located between the ballast pumps and the ballast tanks along the water intake route, and between the deballasting pumps and the ballast water outlet to the sea on the discharge route. It handles all the ballast water flowing in each cycle through the different unit processes (filtration, disinfection, monitoring and auxiliary cycles) that make it up, and encompasses elements such as physical modularity and high-quality treatment.

For the BUAP project, GARABI, a business group specialised in developing and implementing industrial technologies, collaborated with NAVIERA MURUETA, as activity and business partner, and the BASQUE MARITIME FORUM for the promotion and dissemination of the project in the sector, as well as IK INGENIERIA, a consultancy specialised in LCA.

COLLABORATORS



IK / INGENIERIA

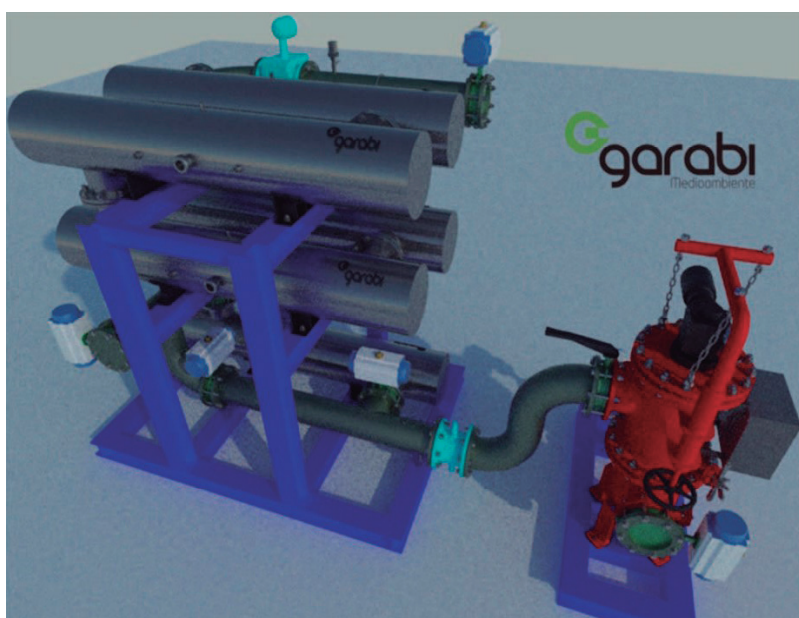
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Create a BWTs eco-design that meets the requirements of the new regulations in order to achieve type accreditation.



RESULTS

- Determination of the main environmental impact of BUAP 250 prototype: energy used during the operational phase (90%)
- Reorganisation of cycle flows to reduce energy consumption according to water quality.
- Implementation of new control, measurement and automation components (turbidimeter, valves, automatism and control), in an attempt to minimise energy consumption to the minimum necessary.
- Integration of operational and physical modularity (equipment adapts operation to the conditions of the water to be treated and adapts to the space conditions in vessels).
- Increased durability, estimated at more than 20 years in the operational phase.
- Reduced environmental impact by 36% in CO₂ equivalent in the use phase, and 33% in all life cycle phases.



CONCLUSIONS

- The eco-design of BUAP equipment is eligible for an Environmental Product Declaration, which is particularly well suited to the current needs of the Basque sector and manufacturing industry.
- The development and construction of BUAP equipment is part of a new project to be addressed after BUAP completion.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



POLLUTION MINIMISATION



BUAP II

BALLAST WATER TREATMENT PROTOTYPE ELIGIBLE FOR ACCREDITATION

IMPLEMENTING BALLAST WATER TREATMENT SYSTEMS (BWTS)

on ships is an obligation imposed by international maritime authorities as of September 2024, with the aim of preventing unintentional spread of so-called invasive species that occurs when ballast water is discharged in different and remote waters. This is damaging for the environment, poses a risk to human beings and entails significant repair costs. GARABI, a business group specialised in developing and implementing industrial technologies, has recently led the BUAP project, which entailed the eco-design of BWTS equipment eligible for Environmental Product Declaration (EPD) certification. For BUAP II, GARABI has collaborated with NAVIERA MURUETA, as activity and business partner, and the BASQUE MARITIME FORUM for the promotion and dissemination of the project in the sector.

COLLABORATORS



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Turn GARABI into a recognised BWTS manufacturer with type accreditation, introducing the company in the naval sector in a new but absolutely necessary niche in forthcoming years.
- Apply technologies verified with shipyards and shipping companies (UV, advanced oxidation, filtration, automation and remote control, etc.) in the prototypes developed to implement BWTS solutions that do not involve major adaptations to the vessel.
- Start the project business development, which, once launched, will have to cover around 200 BWTS installations within the next 5 years at national level alone, with an investment of more than €30 million.



RESULTS

- Eco-design of a range of BWTS equipment which is compliant with stringent treatment requirements and with the possibility of operating in global waters.
- Operational modularity of equipment according to the quality characteristics of the water to be treated.
- Physical modularity (sizing and positioning of reactors and filter).
- Remote Access, Servitisation and Preventive Maintenance.
- 25% reduction in equipment sizing.
- 10% reduction in operating costs.
- Up to 50% reduction in maintenance requirements.
- 30% reduction in environmental impact.
- Improved price competitiveness.



CONCLUSIONS

- The shipping industry has not made a definite decision regarding the demand for BWTS, which goes from disbelief of the final applicability of regulations, the demand for quality products, to the demand for facilities that simply comply with the law.
- Only 8% of existing merchant ships have a BWTS installed. The market is expected to grow rapidly at a compound annual growth rate of 37% over the period 2019-2025, reaching \$172.5bn by 2025. Ferries and general cargo vessels have the lowest implementation rate (only 1- 2% have installed a BWTS). On the other hand, countries with more owned ships (e.g., Greece or Norway) have above-average implementation ratios of up to 17%.
- Approximately 30 companies are developing BWTS with filtration and UV technology. Most of them are companies which have been in operation for over 10 years, are part of large groups, have track records and are positioned in other areas of the marine business.
- The accreditation of new BWTS equipment for the shipbuilding sector is a hard barrier to entry into the industry. Accreditation and approval activities for this type of equipment have a financial and time-frame impact that is not matched with the assessments of the activities to be carried out, nor is it explained by the levels of responsibility required.

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



INGEBER STANDARD ENERGY RECOVERY IN RAILWAY SYSTEMS

INGEBER IS A CONVERTER CONNECTED TO THE CATENARY OF RAILWAY SYSTEMS which recovers energy from braking in trains and uses it for internal consumption of installations, returning surplus to the grid. This very competitive product on the energy market was first launched in Metro Bilbao, and installed in cities such as Malaga, Vienna, Bielefeld, Barcelona, etc. The business model is based on savings: if the equipment achieves energy savings in the railway system, then it pays for itself after some time. This innovative product is the first to take advantage of existing technology to harness the energy lost by the train when braking.

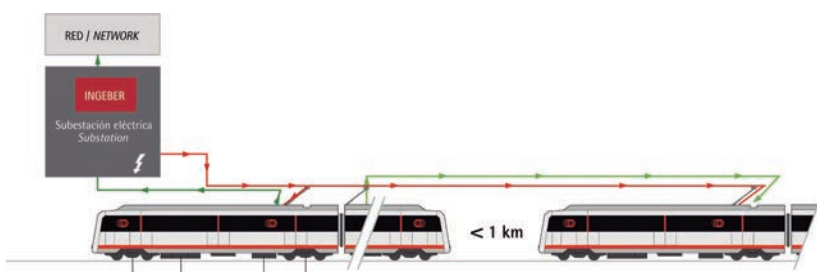
INGETEAM, power conversion specialists, has led the INGEBER STANDARD project, with the collaboration of eco-design and LCA consultancy, IK INGENIERIA.

COLLABORATORS



IK /
INGENIERIA





OBJECTIVES

- Analyse the environmental optimisation achieved with the product standardisation process (reducing metres of cable and losses in cabling; less movement of people due to simplified equipment commissioning)
- Provide useful environmental information during the production phase to avoid/reduce possible environmental impacts from production, transport or distribution on end customers.



RESULTS

- Environmental analysis comparison using IPPC 2013 methodology (carbon footprint) and RECIPE methodology (environmental footprint) of the non-standard INGEBER product implemented in Madrid metro and standard INGEBER implemented in Barcelona metro.
- More than 50% of the total impact from the non-standard product is 3-phase inductance. The impact is slightly lower on INGEBER standard.
- In the non-standard INGEBER, the INGEBER converter (10%) and the 636A 1.25 mH inductance (7.5%) are also significant. In the case of the standard INGEBER, other components start to become representative of the product's impact: the control cabinet (13%), the substation cell (11%) and the converter (9%).
- INGEBER STANDARD does not directly reflect an environmental impact improvement of standard INGEBER (122 tonnes of CO₂ equivalent emissions compared to 108 tonnes for non-standard INGEBER). However, considering energy savings achieved by INGEBER STANDARD in the use phase, an annual energy saving of 10-15% of current conditions is observed, which reduces the climate change impact from the standard INGEBER model.



CONCLUSIONS

- INGEBER STANDARD standardisation work has led INGETEAM to create ad-hoc products for each railway case, and to become more agile when it comes to designing and developing modular solutions.
- In the manufacturing phase, more work is required in the final implementation of the product for environmental improvement of the different components which are the highest contributors to the environmental impact. Moreover, in the use phase, comparison work of improvements against the intended function of the product, i.e., energy managed throughout its useful life, must be maintained.

DRIVING FACTOR



ENVIRONMENTAL
POSITIONING AND
TRANSPARENCY



RAW MATERIAL COSTS
AND SUPPLY



IMACERFA

CERTIFICATION AND USE OF
MATERIALS FOR ADDITIVE
MANUFACTURING OF
AERONAUTICAL COMPONENTS

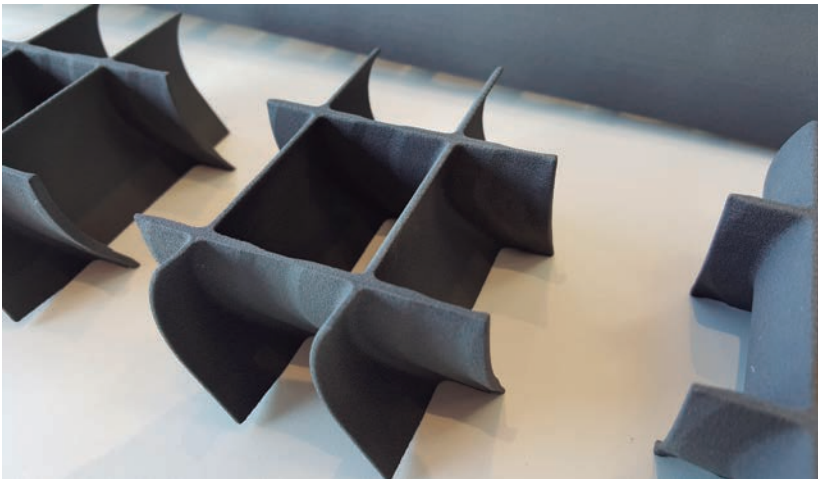
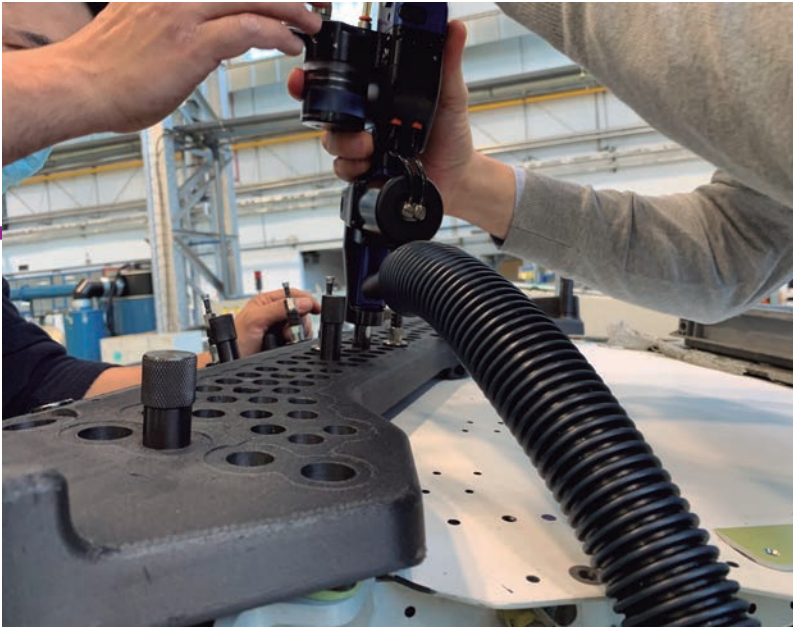
THE AERONAUTICAL SECTOR ACCOUNTS FOR AROUND 3% OF GLOBAL CO₂ EMISSIONS. One of the ways to curb emissions in the sector is reducing aircraft weight. Additive manufacturing (AM) technology can achieve lighter aircraft, but it also requires materials to be certified based on the requirements of the aeronautical industry. MIZAR, a leading AM company, has observed that clear success cases have failed due to a lack of quality documentation of manufacturing processes. This project deals with the certification of different materials with high expectations in aeronautical applications, and MIZAR has relied on EOS and STRATASYS, companies specialising in 3D printing, and the GAIKER Technology Centre, for its execution.

COLLABORATORS

Gaiker

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE





OBJECTIVES

- Include MIZAR in the portfolio of aeronautical companies' suppliers, as a leader in additive manufacturing processes in the sector.
- Certify two specific materials: PEKK+CF and Nylon+CF, to produce aircraft components with additive manufacturing processes.
- Develop the manufacturing process of metallic materials in DMLS (Direct Metal Laser Sintering) with variable layer thickness for aeronautical certification.
- Characterise titanium alloys in EBM (Electron Beam Melting) technologies to be used in topology optimisation in the aeronautical sector.



RESULTS

- Improved dimensional tolerances of flat drilling jigs made with Nylon+CF and production of curved drilling jigs being tested on aircraft.
- Simultaneous production of parts of different thickness in DMLS.
- 44.7% weight reduction of aircraft fittings through AM.
- MIZAR was invited by Airbus Defence & Space to produce an application note describing the developed application, which is available at the following link <https://mizaradditive.com/en/aerospace-additive-manufacturing/>



CONCLUSIONS

- The production of curved Nylon+CF sections is a technically challenging process, which has been successfully achieved and is currently being tested on the market.
- Relevant in-house know-how has been developed working with parts with less than standard layer thickness in DMLS, with the possibility of working on several thickness simultaneously, resulting in interesting added cost savings.
- The certification process of materials for the aeronautical sector requires technical solutions and continuous approval work with corporate clients. Input from the value chain, including Airbus in this case, is mandatory.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIAL COSTS AND SUPPLY



ADDIECO

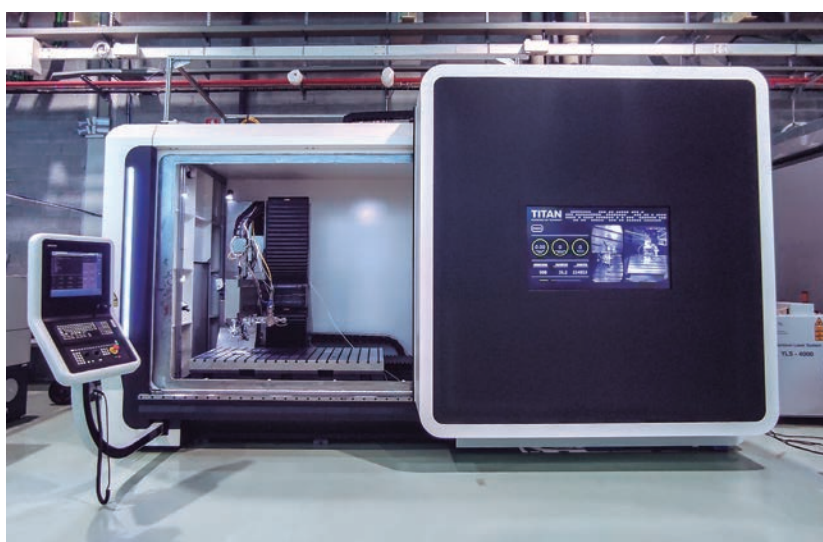
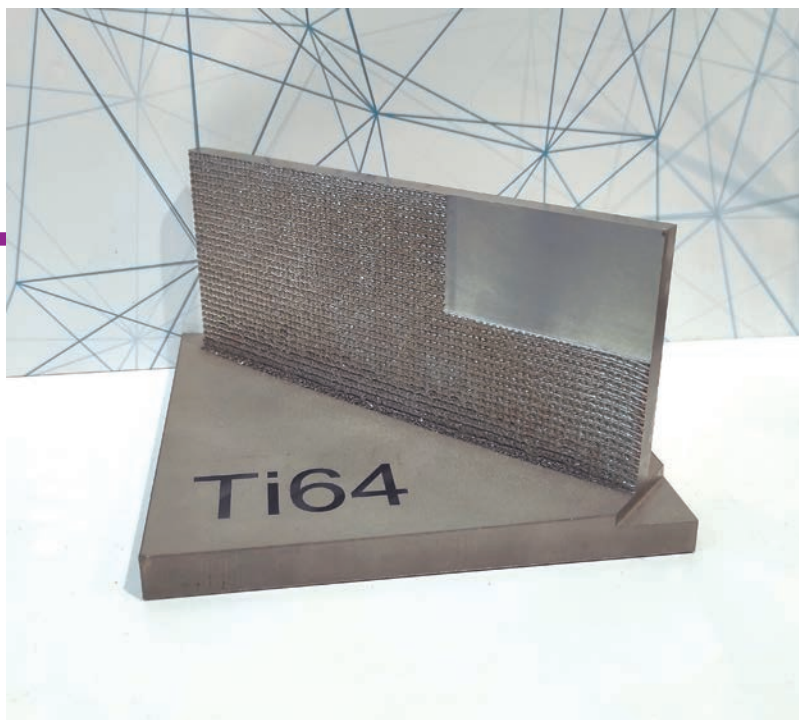
ADDITIVE VS SUBTRACTIVE MANUFACTURING OF AERONAUTICAL COMPONENTS

METAL-MECHANICAL MANUFACTURING, ONE OF THE MOST TRADITIONAL AND WELL-ESTABLISHED SECTORS IN THE BASQUE COUNTRY, is gradually adopting additive manufacturing (AM) technologies focused on the manufacture of structural components to replace forging and billet machining in the aerospace sector, for example. LMD (Laser Metal Deposition) is a direct manufacturing technique where metal powder or wire is injected into the base material and fused onto it by the action of a high-power laser beam. This process is faster with a higher material deposition rate and lower initial set-up cost, than other additive technologies; but it is also coarser and less accurate, although with good reproducibility and often requires further finishing.

TEKNIKER Technology Centre leads ADDIECO, and has worked in the project execution with DELASER, a company specialising in laser technology.

COLLABORATORS





OBJECTIVES

- Develop a hybrid technology based on AM by LMD (Laser Metal Deposition) for the aeronautical sector.
- Establish a sustainable, clean manufacturing methodology with minimal waste generation, as opposed to conventional technologies based on subtractive processes (machining or material removal).
- Reduce the use of energy, materials and consumables (tools and fluids).



RESULTS

- The new LMD additive manufacturing process reduces swarf by 98.5%, coolant by 68.8% and raw material by 90.1%.
- Reduction of process energy by 12.25%, with overall consumption falling from 19.25 kWh in conventional manufacturing to 16.89 kWh in hybrid technology.
- An excellent result was obtained in terms of final part finish.
- There are further impacts related to argon consumption and higher electricity consumption (although total energy consumption is reduced), although the comparative Life Cycle Assessment (LCA) between the conventional and the hybrid processes shows that these impacts are offset in the overall result of huge reduction in raw material and coolant requirements.



CONCLUSIONS

- ADDIECO needed to set up two work cells, one for powder and the other for wire, where titanium and steel-based parts were worked on, with a focus on developing complex geometries. The hybrid manufacturing process was completed by milling with a drill mill, which followed the AM process, without any major difficulty thanks to the good precision of the LMD process.
- LMD has been validated as a clean technology for the aerospace industry, following the optimisation of the LMD process based on both powder and wire, and the development of a geometric control capable of maintaining a uniform part manufacturing process.
- ADDIECO has led to a prototype of an AM machine for metal wire deposition using laser technology, and the registration of TekAM software on the generation of trajectories for AM.

CHALLENGES



GENERAL

- Need to comply with strict regulations (REACH, RoHS, ErP, etc.).
- Improving the - global and environmental - image of the sector.
- Ongoing training for the sector.



ENVIRONMENTAL

- Reducing the use of substances and compounds preventing circular economy processes.
- Reducing the environmental footprint of the sector.
- Proposing viable chemical solutions to complex environmental challenges.
- Financing facilities.

THE ROLE OF THE CIRCULAR ECONOMY



PRIORITY STRATEGIES AND APPROACHES

- Increasing the use of recycled raw materials in chemical processing.
- Implementing practical CO₂ sequestration processes in industrial symbiosis settings.
- Promoting the use of renewable energies in processes.
- Eco-designing products (designed for recycling)-.



COMPETITIVE IMPROVEMENTS

- Reducing the use of additives.
- Blending virgin and recycled raw materials.
- Reducing the use of organic solvents.
- Reducing discharge pressure due to chemically treatable materials.



CHEMICAL



DRIVING FACTOR



PLASTICS



ECOSERVICE

HUB TO INTRODUCE SUSTAINABLE PLASTICS IN BASQUE INDUSTRY

THE PLASTICS VALUE CHAIN IN THE BASQUE COUNTRY IS

EXCESSIVELY LINEAR: there is a lack of complex waste management and transformation companies, no industry consuming secondary plastics, and in addition, the Basque Country receives a net quantity of plastic waste combined with other materials of interest (generally metal) which feed its landfills with added streams. Over 300,000 tonnes of plastic waste are sent to landfill; over 50,000 tonnes go to energy recovery, and around 60,000 tonnes are recycled but almost in its entirety not consumed by Basque industry.

GAIKER, a Technology Centre specialised in recycling, has led ECOSERVICE. ZICLA, innovation with waste specialists and HASTEN VENTURES, a consultancy firm specialised in new business models, have collaborated in this project.

COLLABORATORS

ZICLA®





OBJECTIVES

- Trailblazing the Basque plastics value chain towards introducing sustainable plastics and improve post-industrial and post-consumer plastic waste processing in the Basque Country.
- Test a business model based on a line of services for industries related to the plastics cycle in the Basque Country, oriented towards sustainability throughout the value chain, with the aim of becoming a business role model in plastic materials sustainability in an economic area of interregional influence.



RESULTS

- Definition of plastic materials value chains of the highest interest in the Basque Country, using commercial, technical and strategic criteria.
- Definition of a potential business model which is initially contrasted against the market and reviewed according to the results.
- Identification of a strategy to introduce recycled chippings currently available on the market as the quickest strategy to test market readiness.
- Identification of opportunities not used until now, for integrating the use of secondary plastics in regular production by companies, leading to demonstrative actions and specific projects for interested companies.



CONCLUSIONS

- The need for services focused on the plastics circular economy to fill gaps in information, qualities, materials, specifications, certification, etc. that are detected in the value chain, has been identified.
- It was decided that as a business model providing ECOSERVICE with the appropriate trading form for the current environment, a collaboration agreement to maximise GAIKER's development and innovation capabilities and ZICLA's industrial and commercial relations to carry out larger-scale pilots will be subscribed.
- The critical importance of having an industrial partner factory with relevant capacity to act as a driver of secondary plastics value chains has also been noted, i.e.: a physical plant generating confidence and supporting the sector.

DRIVING FACTOR



PLASTICS



WASTE DISPOSAL
REDUCTION



REQUIPLAST CHEMICAL RECYCLING OF PLASTIC WASTE

AROUND 520,000 TONNES OF WASTE WITH A HIGH PLASTICS content and a material value of at least EUR 12.4 million end up in landfill in the Basque Country every year. The main plastic waste streams involved are: plastic rejects from waste electrical and electronic equipment (WEEE) treatment and from packaging sorting plants; end-of-life vehicle (ELV) shredders; paperboard treatment; and mechanical-biological treatment plants (MBT).

Pyrolysis treatments are very versatile chemical recycling processes for recovery of some waste, but several factors continue to determine their implementation. The downstream oil/gas sector plays a key role in the definitive implementation of improved industrial processes based on these technologies.

PETRONOR leads the REQUIPLAST project with the collaboration of GAIKER Technology Centre.

COLLABORATORS

Gaiker

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE





OBJECTIVES

- Demonstrate that pyrolysis is a suitable method with sufficient technological maturity for treatment of plastic waste generated in the Basque Country.
- Obtain an oil stream with a composition tailored to PETRONOR's requirements for new plastic manufacturing (*Plastic2Plastic*).
- Effective promotion and boosting the market associated with the use of pyrolysis oils from plastic waste.



RESULTS

- Definition of specifications for pyrolysis oil acceptance as feedstock in the PETRONOR refinery.
- Development of a replicable characterisation methodology for plastic rejects from the Basque Country and waste conditioning processes for their inclusion as raw material in pyrolysis facilities.
- Prioritisation of plastic waste streams susceptible to treatment according to quantity, composition and quality of the oil generated in the Basque Country and yield to oil.
- Activation of a focus group including the main companies generating the waste streams studied in the project.
- Potential annual savings in CO₂e emissions amount to 15,000 tonnes per year by treating up to 75 tonnes of plastic waste per day.



CONCLUSIONS

- REQUIPLAST is essential for PETRONOR, as it replaces the traditional model of waste management and fuel and plastics manufacturing with a new one whereby the refinery becomes a tool for managing plastic waste whose only destination today is landfill.
- PETRONOR has detected a high level of interest in all the organisations involved in the value chain, from waste management to the end-user companies of the products (new plastics and other chemical products), including pyrolysis plant operators and large industrial processing engineering firms.
- The project has a simplified environmental assessment by means of Life Cycle Assessment (LCA), and an economic assessment that has enabled launching an industrial project with investment in plastics pyrolysis in the port of Bilbao.

DRIVING FACTOR



PLASTICS



RAW MATERIALS COSTS AND SUPPLY



GOMAZKO

INDUSTRIAL NETWORK FOR THE RUBBER SECTOR CIRCULAR ECONOMY

ITS SHAPE, SIZE, COMPOSITION AND THERMOSTABLE NATURE make it difficult to manage technical and industrial rubber waste, which, except for energy recovery of some streams, has no viable solution in the Basque Country. This post-industrial rubber waste does not come from tyres and it is normally generated by SMEs that produce up to 200 tonnes of waste per year in most cases. These companies lack the possibility of sorting waste into the different types of rubber families they work with, and the process becomes even more difficult due to the prevalence of black-coloured products. The volume of this type of waste generated in the Basque Country amounts to 2,000 tonnes per year, i.e., 20% of technical rubber waste at national level.

POLIELASTIC, a developer and manufacturer of all types of rubber compounds, has led GOMAZKO, with the collaboration of the rubber parts manufacturer VULCANIZADOS ALGOR, the waste management company ZORROZA, GAIKER Technology Centre and the circular economy specialist consultancy, ZICLA.

COLLABORATORS



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Define a new circular economy route for non-tyre industrial vulcanised rubber waste.
- Demonstrate the possibility of developing technical rubber formulations incorporating this shredded waste. It is estimated that it could reach 1,000 tonnes of potential rubber waste in the Basque Country.



RESULTS

- Mapping and classification of the Basque market of rubber manufacturing and waste generating companies.
- Collection of technical and industrial rubber waste streams from 15 waste generating companies.
- Individually shredded materials are obtained from generating companies in ZORROZA, discarding those materials that could not be shredded due to technical difficulties. Individual shredded materials have been offered to their own generating companies.
- Manufacture and characterisation, in POLIELASTIC and from these materials, of 4 mixtures with 5 to 40% recycled rubber content, in standard formats for the sector, in EPDM and with the necessary technical additives in each case. The mixtures have been offered to the generating companies interested in them, giving rise to some interest among corporate clients that have provided parts manufactured with the mixtures sent.
- ALGOR obtains final parts also from these mixtures, meeting customer requirements by using up to 10% recycling in at least 25% of the company's usual applications.



CONCLUSIONS

- The industrial companies generating the waste have given different responses to the offer to incorporate their own shredded materials into their production: some producing companies are not interested or cannot incorporate them; while others would like to know their characteristics; and finally, others have requested them to run their own tests.
- The collaborative response of waste generating companies has been remarkable, and the main value of GOMAZKO is the good closure of the value chain due to its capacity to produce industrial shredding with the necessary technical characteristics in the waste collection environment and by a company that also has the necessary logistics, closing the cycle in facilities in the Basque Country and not only allowing products with a smaller footprint to be obtained, but also achieving a reduction close to 2.5% in the consumption of imported raw materials.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



ECOSIL

RE-USING VULCANISED SILICONE

SILICONE IS A THERMOSETTING MATERIAL WHICH, ONCE VULCANISED, cannot return to its previous state due to the strength of the chemical bonds it contains. On the other hand, the raw material from which silicon is produced is silicon metal, which has been included in the European Commission's list of critical raw materials (CRM) for the EU, due to the risk of shortages. Thus, the possibility of reusing silicone waste as a secondary raw material proposed by ECOSIL fits in well with the Circular Economy Strategy of the Basque Country 2030.

SILAM, a leading company in silicone materials in the Iberian Peninsula and a benchmark in Europe, designs, manufactures and sells extrusion mixtures and components for multiple sectors, including but not limited to automotive, food and lighting. These sectors are demanding the application of the principles of circular economy.





OBJECTIVES

- Analyse the technical and economic feasibility of reusing silicone waste as a new raw material.
- Reuse vulcanised silicone generated in SILAM's production process, as well as that from other client companies.
- Implement a grinding process to obtain reusable silicone powder in the manufacturing process of new products.
- Reduce the cost of waste management at SILAM.



RESULTS

- Comprehensive study on the state-of-the-art technology of the processes involved
- Selection of residual raw materials and obtaining potentially recyclable material, with laboratory tests and tests in accordance with clients' standards.
- Mass production and shipment of material to corporate clients in different sectors for industrial approval.



CONCLUSIONS

- ECOSIL is the first large-scale circular economy project carried out at SILAM and as such, it has enabled this concept to be introduced into the organisation and to inform corporate clients (multinationals) of the company's commitment to sustainability and LCA implementation.
- However, ECOSIL has shown a non-viable economically result, due to the shredding process difficulty.



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EUSKO JAURLARITZA
GOBIERNO VASCO

EKONOMIAREN GARAPEN,
JASANGARRITASUN
ETA INGURUMEN SAILA

DEPARTAMENTO DE DESARROLLO
ECONÓMICO, SOSTENIBILIDAD
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