

ECO-INNOVATION IN THE BASQUE COUNTRY

74 NEW CIRCULAR SOLUTIONS



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Sociedad Pública del

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"Europa egiteko modu bat"

ECO-INNOVATION IN THE BASQUE COUNTRY 74 NEW CIRCULAR SOLUTIONS



PRESENTATION



Arantxa Tapia

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

The Basque Country's dependency on resources is very high and means that over 75% of the tonnes of materials that we use are imported. On the other hand, raw materials, not including energy, already accounted for 61% of the cost structure of Basque companies prior to the current supply crisis. This situation is common to the other European regions and countries, and structurally affects our economy's competitiveness and sustainability. There is a pressing need for businesses to seek innovative solutions aimed at reducing consumption of raw materials and increasing the durability of products. Thanks to its Green Deal and its Circular Economy Plan, the European Union has reacted to this challenge with the ambitious commitments and instruments of the last three decades. We already know that the circular economy is one of the pillars to mitigate climate change, as reducing greenhouse gases by over 40% in Europe can be achieved by ecodesigning, cutting production waste, or better recycling materials such as steel, aluminium, plastic and cement. This challenge can only be addressed by private-public partnership and with a commitment to ecoinnovation. The 2030 Basque Science, Technology and Innovation Plan (PCTI) has therefore been aligned with the Basque Circular Economy Strategy, and with ecoinnovation and the



Each public Euro invested has mobilised an additional annual turnover of €21 on the private market

circular economy established as priority areas. The Circular Ecoinnovation Programme is one of the main tools to deploy the established objectives. I am delighted to present the new datasheets for 74 completed projects of the Circular Ecoinnovation Programme, a sectoral programme that goes far beyond grants. According to the majority of the participating companies, the programme likewise contributes strategic criteria, business alliances, essential data and a rigorous market focus, thanks to close monitoring by the professional team of Ihobe, the environmental management agency. With this second round of new datasheets on top of those showcased at the Basque Circular Summit 2022, we have increased the demonstrator and ecoinnovative projects to 179, included in the results summary.

In recent years, we have driven business projects of the Circular Ecoinnovation Programme with just over €7 million from the public purse. According to the results of the successful projects, the companies envisage an additional annual turnover of €130 million in the coming years, along with 22 new business lines, nearly 200 new jobs, annual savings of 228,000 tonnes of greenhouse gases not emitted, and over 300,000 tonnes of waste diverted from landfill.

Each public Euro invested has mobilised an additional annual turnover of €21 on the private market. But that is not all: those ecodesign projects – retaining product value, metals, plastics and construction materials – have created a collaborative business culture that will make it easier to embark on the country's great circular opportunities and challenges. And still more important: the results are used to generate accessible ecoinnovative benchmarks and transfer successful circular solutions to our SMEs. Beginning to share the results of those projects presented below is therefore so important. I would like to end by thanking the promoter companies, the industrial partners, the technology centres and knowledge agents, the Ihobe team, the members of the Basque Government's Environmental Sustainability Office, as well as the European Regional Development Fund (ERDF) for their dedication to and support of this Circular Ecoinnovation Programme. Given the positive results achieved, I am certain that we will continue to back it in the coming years.



INTRODUCTION

This publication contains the results of over 74 projects completed as part of the Circular Ecoinnovation Programme between 2017 and 2023. The programme, managed by Ihobe, the environmental management agency of the Basque Government's Ministry for Economic Development, Sustainability and the Environment, drives ecodesign, circular economy demonstration and strategic ecoinnovation in Basque companies. Even though 24% of the new circular solutions developed or demonstrated in the projects are already operational or available on the market, the results of all the projects completed as of this date and validated by companies have been included. The market, commercial, economic, technical or environmental feasibility of each project has been graphically included in each datasheet of the publication to show where barriers exist and the need to focus in future R&D&i. Thus, new collaborative projects built on the prior experience will be able to be relaunched, according to the lessons learnt. The completed project datasheets have been allocated to the destination sector of the new materials, product or service developed, with the sector in which a problem



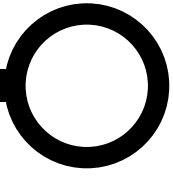
This new publication contains the results of over 74 projects completed as part of the Circular Ecoinnovation Programme between 2017 and 2023.

or waste originates pushed to the background. The projects have been ordered in alphabetical order of the project promoter within the nine main sectors. We are aware that over 30% of the projects include other industrial partners and that nearly all of them have technology agents, most of which are technology centres assigned to BRTA or part of the Basque Science & Technology Network; these are mentioned in detail on each datasheet. At the same time, Ilobe has deemed it to be necessary to highlight the main motivating force for embarking on each of the projects at the time, such as equipment ecodesign, circular business models, reducing greenhouse gases (GHGs), environmental positioning and its transparency, green public procurement, extended producer responsibility, plastics, best production techniques, cost and supply of raw materials, cutting waste ending up in landfill, and zero pollution. Each one of the datasheets contains the project title and acronym, the context, goal, the business, environmental and technical results obtained, along with the conclusions and lessons learnt that may be useful for third parties.

This new edition of project has the new feature of ten projects driven by the “Circular Ecoinnovation Project Factory” pilot scheme. The “Factory” consists of Ilobe contributing to an optimum design and approach with two objectives. The first, to ensure those projects are aligned with the 2030 Circular Economy Strategy and, second, to facilitate access to external financing sources, in general, European funds of the Horizon Europe and Life programmes. The contribution takes the form of co-financing the design and/or technical-environmental and strategic support that increases the likelihood of the project being successful. The structure of the datasheets of those ten projects is slightly different to the rest.

As of the time of completing this document, over 30 projects of the Circular Ecoinnovation Programme are still underway, whose datasheets will be progressively incorporated, along with the projects of the subsequent calls, to future regular updates of this document.





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A white line-art icon of a car.

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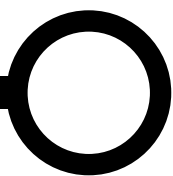
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FEASIBILITY

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

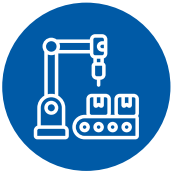


PLASTICS

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%2DPRTR%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.

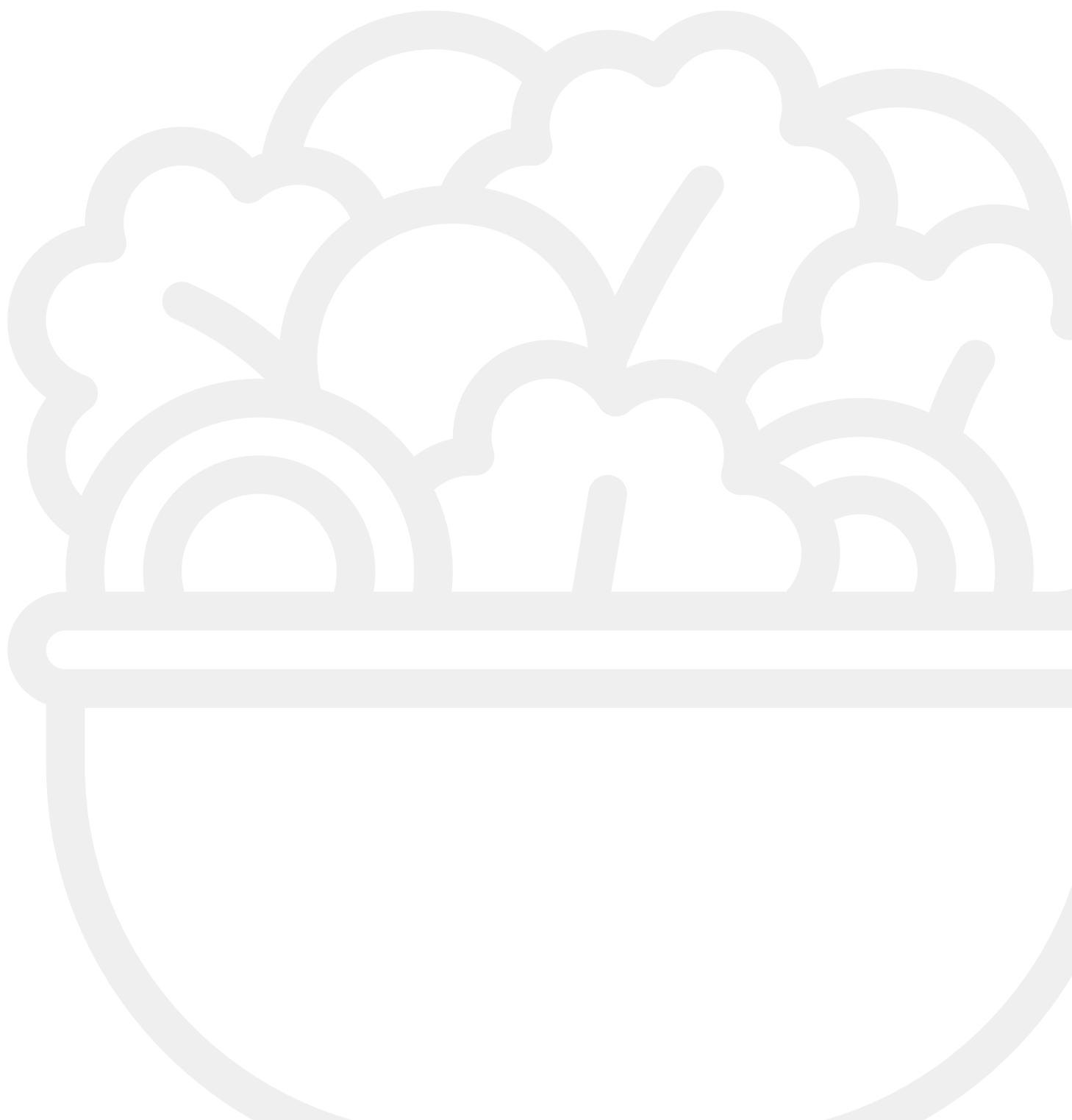


COMPETITIVE IMPROVEMENTS

- 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



ENVIRONMENTAL
POSITIONING
AND TRANSPARENCY



HORECA ZERO

**CIRCULAR ECONOMY
SOLUTIONS TO REDUCE THE
ENVIRONMENTAL IMPACT OF
RESTAURANTS**

REDUCING FOOD WASTE IS BECOMING INCREASINGLY IMPORTANT AS A STRATEGY TO COMBAT CLIMATE CHANGE

and contribute to more responsible production and consumption that fosters sustainable development, as reflected in Target 12.3 of the SDGs. There is a clear commitment from Europe to address this global problem at all levels. In the Basque Country, food waste generated in the agri-food value chain exceeds 310,000 tonnes each year, which is equivalent to 142 kg of food waste per person per year. Waste from the HORECA sector amounts to 13.9%, 29,640 tonnes each year. Currently, there are not many studies on the environmental impact of the possible options that can be implemented by catering establishments, which hinders decision-making.

AKELARRE Restaurant, awarded with three Michelin Stars, is leading HORECA ZERO, a project on which it has worked with the Technology Centre specialising in gastronomy, BASQUE CULINARY CENTER INNOVATION (BCCInnovation), and the consultancy firm specialising in the Circular Economy, BILIBIN KOOP. LABe, ESPACIO OTEIZA and HOTEL AKELARRE RELAIS & CHÂTEAUX restaurants have participated as collaborators.

COLLABORATORS





OBJECTIVES

- Put forward a methodology to reduce food waste in the HORECA sector, incorporating the environmental impact criteria of different circular economy solutions.
- Identify the type, quantity and location where waste is generated in the value chain.
- Analyse different circular economy solutions for the identified waste through Life Cycle Analysis (LCA).
- Implement circular economy-based solutions in pilot restaurants to make use of the identified food waste.
- Convert the results into a methodology that can be adapted to different types of restaurants.



RESULTS

- Methodology for the reduction of food waste and implementation of circular economy solutions for catering establishments.
- Guided process to analyse the process of a kitchen in order to understand, quantify and characterise the food waste in restaurant kitchens and where it is produced.
- Environmental impact calculator implemented in the methodology, which enables the environmental impact of different circular economy solutions for the selected waste to be easily analysed and compared.



CONCLUSIONS

- Awareness and training needs to be improved in the catering sector in order to ensure that waste management is properly implemented. HORECA ZERO has provided valuable information in order to apply appropriate measures in the use of ingredients and efficiency of processes.
- The development of specific tools for catering establishments has been key in order to understand and be aware of the tools that help to improve their sustainability.

DRIVING FACTOR



**ENVIRONMENTAL
POSITIONING
AND TRANSPARENCY**



EUSKOPEF

**NEW PROCEDURE FOR
THE CALCULATION OF THE
ENVIRONMENTAL FOOTPRINT
OF FOOD PRODUCTS IN THE
BASQUE COUNTRY**

THE EU FOOD AND BEVERAGES VALUE CHAIN IS RESPONSIBLE FOR 17% OF GREENHOUSE GAS EMISSIONS, 28% of material resource use, 60% of terrestrial biodiversity loss, 33% of degraded soils, and overexploitation of 20% of water resources. The food system is not only the cause but also a victim of these environmental and social impacts, so it is necessary to change food production and consumption habits. In 2013, the European Commission defined a common method to measure and communicate the environmental performance of products, services and companies by means of a comprehensive assessment of the environmental impact throughout the life cycle: the so-called Product Environmental Footprint (PEF), for which there are no tools on the market for its calculation and validation.

AZTI, the organisation that leads EUSKOPEF, is a Technology Centre specialising in the marine environment and food. The EROSKI distribution chain, the software engineering company, INGENET, and the craft beer brand, BOGA, have worked together on this project, which is the result and continuation of the previous ELIKAPEF project.

COLLABORATORS





OBJECTIVES

- Reduce the environmental impact of food production by facilitating the standardised calculation of the Environmental Footprint of food following the guidelines of the European Commission (COM/2013/0196 final).
- Foster responsible consumer behaviour through an environmental product information system that enables consumers to effectively understand the environmental consequences of their purchasing decisions.
- Provide SMEs in the food sector with the keys to sustainable production.



RESULTS

- Development of an innovative tool that calculates the Environmental Footprint of food products and a tool for use by distribution chains that facilitates the management of information for the calculation of PEF and the comparison of products and supplier companies based on environmental criteria.
- Validation of the tool, which is a pioneer at national level, through the calculation of the PEF of a reference Pilsen beer.
- Development of a Sustainable Purchasing Guide aimed at facilitating the responsible selection of food products to consumers.
- - Development of a Responsible Purchasing Guide for food suppliers.



CONCLUSIONS

- The tool has been validated with BOGA and the EUROSKA distribution company. However, due to the innovative nature of EUSKOPEF, the European Commission's PEF methodology has been developed in parallel to the project, so that some aspects were still under development at the end of the project and had not yet been included in the tool.
- EUSKOPEF has consolidated the project Consortium. AZTI and INGENET, owners of the calculation tool, will be responsible for its commercialisation, and EROSKI will benefit in terms of use and enjoyment. The Responsible Consumer Purchasing Guide has been published and disseminated by EROSKI (<https://comprasostenible.consumer.es/>), while AZTI will be responsible for publishing and disseminating the Responsible Purchasing Guide for food suppliers on its website.

DRIVING FACTOR



**ENVIRONMENTAL
POSITIONING
AND TRANSPARENCY**



ENVIROSCORE RESPONSIBLE CONSUMPTION AND ENVIRONMENTAL TRACTION IN THE BASQUE AGRI-FOOD CHAIN

THE FARM TO FORK STRATEGY, WHICH IS PART OF THE EUROPEAN GREEN DEAL, details the need for producers and distributors to offer products with a smaller environmental footprint, as well as the EU's intention to promote environmental communication schemes to consumers. Among the factors that hinder more responsible purchasing, the lack of information on processes and the product stands out above all, which is why the majority of consumers (80%) consider that product labels should include information on product sustainability. Furthermore, consumer choices towards products with lower environmental impacts could encourage the food industry to improve its practices and motivate producers to be part of the solution to the climate crisis. A clear example is the EU energy label (EU 2017/1369): 90% of the refrigerators and washing machines sold have achieved a higher A rating since its introduction up until 2017.

Fostering more sustainable diets while driving the food chain towards more efficient production is in line with the targets of Sustainable Development Goal 12, and ENVIROSCORE, an environmental labelling system based on the Product Environmental Footprint developed by AZTI and KU Leuven, focuses on this. The project, which aims to validate the use of ENVIROSCORE, is led by EROSKI, the leading distribution company in the Basque Country, and has been carried out with the AZTI Technology Centre as a subcontractor, as well as with the collaboration of EUSKABER (poultry cooperative), ARROYABE (canning company), S.A.T. KARRANTZA and GRUPO TGT (milk production and packaging).

COLLABORATORS



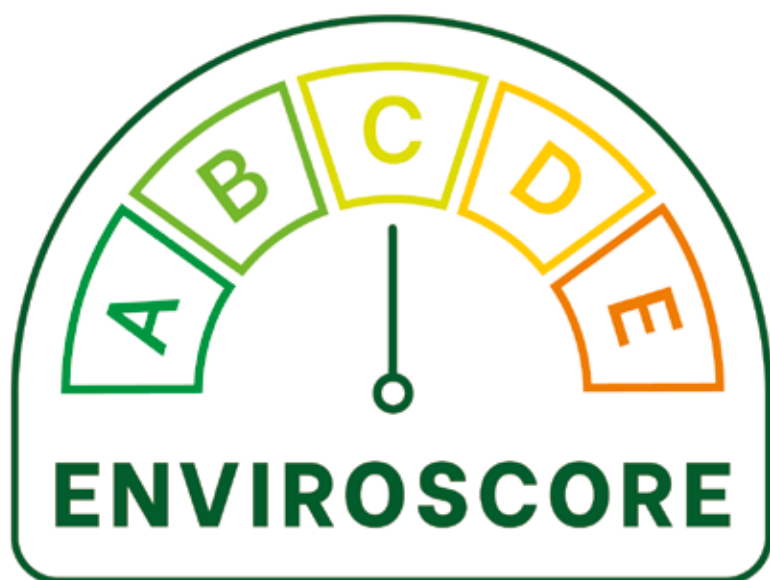
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Validate the use of the ENVIROSCORE ABCDE environmental impact communication system as a tool to generate a shift in food production and consumption towards more environmentally friendly models.
- Drive the entire value chain of 5 selected products: organic eggs, free-range eggs, canned bonito, canned tuna and full fat milk towards a change of ENVIROSCORE letter.
- Place food production and distribution companies in the Basque Country at the forefront of environmental transparency and eco-design of foodstuffs.
- Foster continuous improvement in production models.
- Reduce the environmental impact generated in the value chain.



RESULTS

- Proposal for specific actions to reduce environmental impact in egg production (improved feed production for both hens and pullets), tuna canning (reduction of diesel consumption on fishing boats, oil coverage and canning packaging) and dairy products (environmental mitigation measures on raw milk farms).
- Savings of 1,670 tonnes of CO₂ equivalent emissions and 15 million m³ of water use equivalent.
- Communication and dissemination of the project results in order to maximise its impact on society.
- 67.3% of customers claim that they take action in their daily lives to be more environmentally friendly, with a medium-high level of awareness of the products in their shopping baskets.
- Environmental information on a label brings value to 69.6% of customers and the majority would like to see this type of labelling on all food products. 38.3% would be absolutely willing to pay a little more for environmentally friendly products.



CONCLUSIONS

- The application of environmental labelling and its communication fosters an appetite for products with a higher score and drives companies to make changes based on the eco-innovation of their production processes (better use of natural resources, water and energy savings, reduction of food waste, reduction of waste, optimisation of transport, improvement of packaging, etc.), as well as in the design of products, optimising their life cycle and generating cost reductions and competitive improvements.
- Local Basque products and/or products with short marketing chains have a better chance of penetrating the markets than imported products from far-off countries with environmentally unfavourable production standards.
- EROSKI's customers have a high environmental awareness, but call for increased clarity in the co-existence of environmental and nutritional labelling on product packaging.

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



RAW MATERIALS COSTS AND SUPPLY



PLASTICS



RECOMPFI

MANUFACTURE OF STRUCTURAL PARTS FROM PREPREG WASTE

THE AERONAUTICS AND SPORTING GOODS INDUSTRIES USE HIGH VALUE-ADDED COMPOSITE MATERIALS based primarily on carbon fibre. The production processes of the parts and components associated with these sectors produce prepreg (or pre-impregnated) waste material that cannot be used in other parts due to its non-repetitive, irregular and generally small geometry. On the other hand, these remnants of prepreg material, which is a flexible material similar to a fabric impregnated with liquid in its initial state and is often not preserved properly, reach their gel point and irreversibly lose their flexibility due to the hardening of the thermosetting resin.

BRONYMEC, whose activity focuses on the construction of components made from long fibre composite material, is leading RECOMPFI. The TEKNIKER Technology Centre has collaborated in this project.

COLLABORATORS





OBJECTIVES

- Reuse high value-added composite waste generated in industries using long fibre composites and thermosetting resins as raw material to manufacture structural components for the land transport sector (automotive, railway) by means of composite forging processes.
- Use composite forging processes to take advantage of waste material.
- Prevent prepreg remnants from becoming a difficult-to-treat waste when hardened
- Enable BRONYMEC to design and manufacture lightweight components; anticipating the future mass entry of composites to replace metal parts in sectors such as the automotive industry.
- Develop lighter structural solutions, reduce energy consumption in transport and limit pollutant emissions from vehicles (cars, buses and trains) manufactured with the technology developed at RECOMPFI.



RESULTS

- Successful production of various three-dimensional geometries in 100% recycled epoxy and short carbon fibre material (up to 7mm maximum) with very interesting strength and lightweight properties for structural applications.
- Design, construction and testing of tooling-moulds for the manufacture of recycled composite parts.
- Commissioning of the composite forging process.
- Definition of collection and storage processes.
- Characterisation of properties and validation of results of parts made from recycled materials.



CONCLUSIONS

- Parts have been successfully manufactured using waste prepreg material that was going to be treated as waste, thus helping to reduce waste.
- The industrialisation of RECOMPFI requires a protocol to be defined for the separation of remnants with and without protective plastic at source and the development of an automatic cutting and grading system for remnants to adapt them to the geometries required in each case of use.
- It is relevant to involve industries that require solutions based on composite materials generated from prepreps (in most cases based on carbon fibre and epoxy) for the production of products with higher added value in the process, such as the sports industry (surfboards, skateboards, skis, helmets, etc.) and the industrial industry for specific applications (e.g. hand tools with a lower mass).

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



PLASTIFICA RECYCLABLE POLYPROPYLENE IN ELECTRIC AND HYBRID VEHICLES

THE COOLING CIRCUIT OF VEHICLES IS ONE OF THE SYSTEMS in which rubber is prevalent. However, the non-recyclability of rubber means that Basque car component manufacturers are looking for new recyclable solutions to replace it. Furthermore, the rise in electric and hydrogen vehicles means that two new requirements are being imposed in addition to recyclability: lightweighting and even more critical thermal management, to optimise the performance and lifetime of electrical components, especially the battery.

CIKATEK is the research, development and innovation unit of CIKAUTXO and is leading PLASTIFICA within its activities as a developer of innovative polymeric products.

COLLABORATORS





OBJECTIVES

- Research and formulate a new, fully recyclable, lightweight, thermoplastic material with high thermal insulation capacity for the cooling pipes of electric vehicles.
- Facilitate the entry of products with a smaller environmental footprint to replace critical and key materials for the Basque Country in collaboration with large car manufacturers.
- Reduce the thermal losses of the cooling line by up to 10%, thus increasing the autonomy of the batteries and extending their useful life.
- Reduce the use of virgin raw materials by up to 30%.



RESULTS

- New material based on polypropylene (PP), specifically formulated for electric vehicle cooling lines, which competitively meets the objectives set.
- Savings of more than 6,200 tonnes of CO₂ equivalent emissions per year, considering all phases of the product cycle.
- Savings of 10% in raw materials consumed in production, with a cost saving of 15%.
- 10% increase in market share forecast within three years.



CONCLUSIONS

- PLASTIFICA's success has enabled a new fully recyclable thermoplastic material based on PP that is lightweight and with high thermal insulation capacity for the cooling pipes of electric and hybrid vehicles to be researched, formulated and implemented, replacing rubber and thus contributing to minimising the use of key materials and compliance with the legal requirements of the automotive sector.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



KOSEL

USE OF SUSTAINABLE MATERIALS IN VEHICLE SUSPENSION

THERE ARE A LARGE NUMBER OF THERMOPLASTIC MATERIALS ON THE MARKET, but their functionalities have never come close to competing with “thermoset” rubber materials in terms of performance in the field of light vehicle anti-vibration in products, such as suspension and shock absorber silentblocks. One of the major handicaps of thermoplastic materials is their lack of stability in anti-vibration performance in the working range of the passenger vehicle, since their performance values when compared with extreme working temperatures, both hot (+80°C) and cold (-40°C), vary by at least one order of magnitude, although they present interesting data at 23°C. This makes it impossible to use such materials as anti-vibration solutions in components with cyclic load stresses.

CIKAUTXO, a leading company in the development and production of rubber and plastic components for various applications, promotes KOSEL, a project in which the expert mobility engineering company, EDAG, and the LEARTIKER Technology Centre have collaborated.

COLLABORATORS



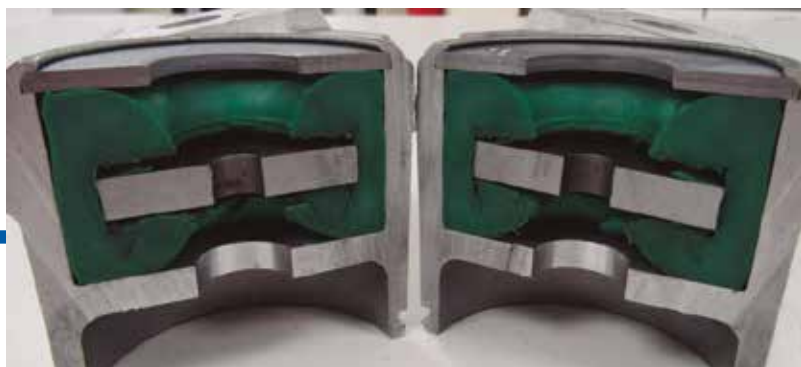
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Identify or generate thermoplastic material with anti-vibration capability that is able to match the specification of a thermoset material for passenger vehicle anti-vibration, mainly in suspension.
- Validate the material at test tube level against a specification established by a premium OEM manufacturer.
- Validate the component as a functional prototype dynamically and its durability on a test bench.
- Offer CIKAUTXO's customers recyclable alternatives for anti-vibration solutions in the field of passenger vehicle suspension.
- Manufacture parts from recyclable material, with the minimum possible economic impact.



RESULTS

- The market analysis carried out at the start of the project has not found a commercial grade capable of competing with natural rubber.
- Design and development of an alternative, recyclable material that has been satisfactorily tested to a premium customer specification.
- Prototypes made with the new material developed, with better results in static and dynamic tests compared to natural rubber.
- Satisfactory test bench durability results with prototypes of the new material.
- 38% savings in CO₂ equivalent emissions.



CONCLUSIONS

- An alternative to the conventional thermoset (non-recyclable) product has been successfully put on the market in the form of a recyclable thermoplastic material with improved dynamic properties and equivalent durability performance, capable of meeting the specifications currently required by automotive OEMs.
- The price of the component will be higher than the existing thermosetting solution in natural rubber for the time being, as it is a new material and its synthesis cannot yet be carried out on an economy of scale.
- If environmental regulations require passenger vehicles to contain at least a percentage of recyclable components, the material developed may well be attractive in order to meet this requirement.

DRIVING FACTOR



BEST PRODUCTION
TECHNIQUES



ECOTUBO

INNER AND OUTER
PROTECTION OF THE
PRECISION-CALIBRATED STEEL
TUBE

HIJOS DE JUAN DE GARAY MANUFACTURES PRECISION STEEL TUBES whose packaging must prevent damage and corrosion during storage and transport. For this purpose, packaging is currently used which consists of a protective oil coating, followed by drying and draining of the tubes, which are then wrapped in recycled LDPE film. The company has selected this operation within the tube life cycle in order to reduce the environmental impact of the packaging through eco-design and to offer customers a more sustainable end product, whilst also improving its shipping. ECOTUBO is aligned with increased competitiveness through more efficient products and processes as a line of action of the "Environmental Framework Programme 2020".

HIJOS DE JUAN DE GARAY is leading ECOTUBO with the help of the GAIKER Technology Centre for its implementation.

COLLABORATORS

Gaiker

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE





OBJECTIVES

- Integrate the eco-design methodology in the design of the pipe protection system.
- Use raw materials with a lower environmental impact.
- Reduce environmental impact at the plant in the tube protection and packaging processes.
- Ensure high durability of the tubes even in adverse environmental conditions.



RESULTS

- Identification of the aspects with a greater environmental impact by means of a Life Cycle Analysis (LCA) and proposal of improvement strategies that increase the sustainability of the process: elimination of diffuse emissions of volatile organic compounds, generation of less packaging waste, lower consumption of raw materials, easier handling and operation, and improvement of the shipping and post-treatment stage.
- Selection of the most sustainable packaging system for the packing and protection of the tube thanks to this analysis: a film with corrosion inhibitors that is more environmentally friendly over the entire life cycle despite its higher impact during the manufacturing and distribution phase.



CONCLUSIONS

- The future strategy for action is based on analysing the integration of the alternative packaging system within the machinery and validating the final quality of the product with customers. The alternative system is a more expensive, labour-intensive and time-consuming product, so it will be necessary to assess the potential bottleneck that may arise in the overall process.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



ECO-DESIGN OF EQUIPMENT



MW-ICP

MICROWAVE CURING OF 3D PRINTED SAND CORES

3D PRINTING OR ADDITIVE MANUFACTURING IS AN EMERGING TECHNOLOGY, which, using sand as a raw material, enables sand cores with significant advantages over traditional methods to be manufactured. Aware of this enormous potential, LORAMENDI began working in this field in 2017, seeking 3D industrial sand manufacturing to obtain cores. Therefore, ICP - INDUSTRIALIZATION OF CORE PRINTING, the world's first fully automated integrated 3D printed sand core production solution, was presented at GIFA 2019, offering a serialised process capable of competing with today's mass production. However, the traditional post-processing of core manufacturing by 3D printing in operation with Drying and Curing equipment requires considerable energy consumption (15 kWh/cycle on equipment designed to operate 24 hours a day) and a cycle time that can be improved by about 25 minutes overall. The energy cost, and therefore the cost per part, of the cores is quite high and the process needs to be improved.

LORAMENDI, a company whose activity focuses on the design and supply of global foundry solutions, has developed MW-ICP. BEMENS, a company specialised in the industrialisation of processes that apply microwave technology, and IK INGENIERÍA, an environmental consultancy firm specialising in Life Cycle Analysis (LCA), have been involved in its development.

COLLABORATORS



IK / INGENIERIA





OBJECTIVES

- Demonstrate the technical, economic and commercial feasibility of new sand core drying and curing equipment by Additive Manufacturing on an industrial scale, incorporating microwave technology and the automation and high vacuum suction required for a serial industrial process in the automotive sector.
- Reduce post-processing energy consumption by 40%.
- Reduce greenhouse gas (GHG) emissions by 50%
- Reduce cycle time by more than 60%.



RESULTS

- 50% savings in energy consumption compared to the current alternative.
- 50% GHG emission savings compared to the current alternative.
- Reduction of the overall environmental impact of the process by 38%.
- Cycle time has been reduced by 75% from the initial 25 minutes.
- The implementation of MW-ICP contributes 6% to LORAMENDI's global turnover and provides a 40% reduction in the product manufacturing unit cost.



CONCLUSIONS

- Microwave technology is proving to be very efficient in the drying of foundry cores in inorganic processes. Although its implementation and control is complicated, it offers process improvements with a huge impact.
- LORAMENDI has applied for and published a unique company-owned patent related to the drying of sand cores.
- The state of the market (supplier companies, available information in general) in which LORAMENDI finds itself in terms of the information required to carry out an LCA is still very precarious. It is not easy to calculate the environmental impact of a product at the present time.
- MW-ICP will continue its full implementation with technological improvements in microwaves and process optimisation (cycle times, etc...).

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



REDUCTION OF GREENHOUSE GASES (GHGS)



CHANCE

SECONDARY ALUMINIUM ALLOY FROM END-OF-LIFE VEHICLES FOR THE MANUFACTURE OF AUTOMOTIVE COMPONENTS

REDUCING EXTERNAL DEPENDENCE ON THE SUPPLY OF

ALUMINIUM, innovating in recycling processes and optimising the management of internal and external scrap from steelworks and foundries is a priority in the Basque Country. The value of the key metals consumed in the Basque Country annually exceeds €3.3 billion and consumption of critical metallic materials amounts to €164 million. The value of metals currently landfilled as complex waste (grinding and polishing sludge, galvanic sludge, aluminium sludge, etc.) is estimated to be €12 million annually. The intensive use of primary aluminium for the manufacture of vehicle components is therefore a problem for the environmental sustainability requirements of the automotive sector. Royal Decree 265/2021 of 13th April on end-of-life vehicles sets the target of ensuring that 95% of the vehicle is reusable and recoverable and 85% is reusable and recyclable.

NEMAK, a leading company specialising in the development and production of aluminium components for vehicles, has developed CHANCE, a project in which it has collaborated with the AZTERLAN Technology Centre, SINDOSA industrial automation engineering company and the GDE I+D+i innovation consultancy firm.

COLLABORATORS





OBJECTIVES

- Research and develop an AlSi10MnMg secondary aluminium alloy obtained from post-consumer scrap, suitable for use as a raw material in the manufacture of automotive components with high technical requirements.
- Develop and implement a specific and optimised melting and metal treatment methodology to obtain the new secondary alloy.
- Study and optimise the high-pressure die casting (HPDC) process, to adapt it to the new material to be used.
- Implement digital metallurgical quality control systems in melting and metal treatment processes.
- Reduce the emission of more than 194,400 tonnes of CO₂ into the atmosphere each year.



RESULTS

- Full melting and treatment (degassing, salt cleaning, etc.) of alloys using different proportions of virgin raw material and post-consumer scrap (70%/30% and 30%/70%).
- Similar results in chemical composition, macro-inclusion and micro-inclusion analysis, metallographic analysis and density index of both metal mixtures.
- Manufacture of injected components for the automotive sector in compliance with the necessary requirements in both cases.
- 95% reduction in energy consumption for the manufacture of second-melt aluminium. 850 kWh are required for 1 tonne of this product, compared to 17,000 kWh for 1 tonne of pure aluminium.
- Reduction of CO₂ emissions from 8,600 tonnes to 500 tonnes in the manufacture of 1 tonne of aluminium, using the higher scrap content ratio.



CONCLUSIONS

- CHANCE has proven that it is possible to manufacture high mechanical performance components from high value-added alloys obtained from degraded and recycled material, such as high-grade aluminium scrap.
- The existing high-pressure die casting (HPDC) process needs to be optimised for use of the newly developed aluminium alloy as a raw material. Analysis of mechanical properties and internal structure indicate that parts made from the new alloy offer good strength performance and excellent elongation performance. Furthermore, positive results are obtained in terms of stability.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



EXTENDED PRODUCER RESPONSIBILITY (EPR)



RESDE

RE-MANUFACTURING OF ELECTRONIC STEERING SYSTEMS

ELECTRONIC VEHICLE STEERING SYSTEMS HAVE BEEN ON THE MARKET SINCE AROUND 2000.

They started out using basic technology, with easy access to the re-manufacturing of these elements, which, over time, have undergone significant evolution with the introduction of new advanced communication protocols, which means that access to this technology now presents serious difficulties. The original manufacturers of these systems strive to make these elements tamper-proof so they are extremely difficult to access for repair or re-manufacture, in order to consolidate their position as the only aftermarket alternative. Currently, the market offers management machines through different suppliers that help to detect problems in which an element fails and has to be replaced by a new one.

WAT is specialised in the re-manufacturing of steering systems, and has led RESDE, in which it has worked with ELECTROCHIPS, a company specialising in the repair and operation of electronic components in vehicles.

COLLABORATORS





OBJECTIVES

- Re-manufacture defective electronic steering units and re-introduce them into the aftermarket as a guaranteed alternative replacement.
- Increase competitiveness by acquiring know-how and objective commercial capacity in the international market.
- Reduce pollutants in steering systems.
- Extend the service life of reusable elements by up to 10 years.
- Lower the price of the end product.



RESULTS

- Extension of the catalogue with an average of four new references per month, increasing WAT's offer in the market.
- Savings in the emission of 89 tonnes of CO₂ equivalent per year, and 31 tonnes of materials per year
- Increase in the company's overall turnover by more than 6%.
- Study of the frames to define the appropriate verification and control parameters for the correct diagnosis of each reference.
- Development of communication between the different test benches and the references developed.
- New verification systems adaptable to test benches to obtain a higher quality finished product.
- Investigation and detection of errors on steering systems, for pumps and for columns and racks, their causes and possible solutions.
- New, more reliable tooling and fittings that reduce re-manufacturing time for much of the catalogue.



CONCLUSIONS

- The lessons learned in RESDE can be extrapolated to other product families, such as racks or pumps.
- The new WAT website will include the new references developed, and its tool already incorporates a data feed system for the TecDoc Catalogue (a worldwide search tool), which will include all these additions.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



PLASTICS



ROLLING PLASTICS

RECYCLING OF PLASTIC PARTS FROM END-OF-LIFE VEHICLES

THE MAIN PROBLEM IN THE RECYCLING OF PLASTIC FRACTIONS from end-of-life vehicles (ELVs) is the poor separation of the different plastics that make up these fractions. The ELV recycling sector has always focused on the recovery of the metal content of the vehicle, which is easily recovered in shredding processes, but this is not the case for other materials (plastics, textiles, rubber, wood, leather, etc.). Selective sorting at source, which currently only occurs to a very small extent (hardly any end-of-life tyres), is the best solution for the recovery of these materials.

ROLLING PLASTICS has been developed by ZICLA, a company devoted to innovation in circular economy products, supported by the GAIKER Technology Centre and the circular economy consultancy firm, ECONIA.

COLLABORATORS





OBJECTIVES

- Demonstrate the possibility of reintroducing up to 1,600 tonnes/year of plastic materials from 70,000 potential ELV parts into the Basque plastic market by obtaining high quality pellets
- Obtain marketable pellets from at least three types of plastic parts in ELVs.
- Remove plastic materials from the scrap package arriving at the shredders, decreasing the volume of the light shredding fraction that is mostly landfilled at present and increasing the recycling weight of ELV by 2%.
- Increase the production and sales of plastics processors in the Basque Country.
- Increase the turnover of the authorised treatment centres (CATs) by selling a scrap package with a higher concentration of metal and plastic parts extractable from the ELV.
- Raise awareness of the ELV plastic fractions that are recoverable.



RESULTS

- Production of marketable polypropylene (PP) pellets from extraction at the CATs and subsequent processing of front and rear bumper parts, wheel arches, torpedo rain guard, tool tray and spare wheel holder.
- Obtain marketable acrylonitrile butadiene styrene and acrylonitrile styrene acrylate (ABS/ASA) pellets from the front grilles of ELVs.
- The process yield for PP is 55%. Within the 45% of improper waste, 3.5% corresponds to usable scrap.
- Savings of up to 8 kg of CO₂ equivalent per tonne of recycled PP.
- Definition of the working model for CATs, including available and appropriate technologies for separation and triage, tearing and washing, in order to offer suitable material to plastic recyclers.
- Determination of the work protocol and times for the extraction of parts in the CAT.



CONCLUSIONS

- Existing CATs and plastic recyclers in the Basque Country are not prepared to implement the work protocols required to carry out the process.
- The process is not economically viable due to the 45% improper content and the fact that the existing scrap package is sold at a price that does not take into account whether it has more or less plastic content.
- An extension of the project at a CAT in Catalonia proved to be economically viable due to the larger size of the CAT, which was able to handle larger quantities of plastic.
- The project demonstrated the need to concentrate the CAT sector in the Basque Country and the need for a pre-treatment plant for plastic waste.

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



RAW MATERIALS COSTS AND SUPPLY



WASTE DISPOSAL REDUCTION



FIBRACAT RECOVERY OF SLUDGE FROM THE PAPER INDUSTRY AS ABSORBENT MATERIAL

MORE THAN 50% OF THE ALMOST TWO HUNDRED THOUSAND TONNES of pulp and paper sludge generated in the Basque Country each year is still destined for landfill. Most of the Basque paper mills are located within 50-75 km of Araia, headquarters of FIBRACAT, the leading manufacturer of ecological absorbents.

For industrial applications, the absorbent materials sectors value parameters such as granulometry, ease of collection, slip resistance and end of life, while odour, colour and binding characteristics are also valued in pet markets. Mineral absorbents (sepiolite, attapulgate, silica gel) and vegetable absorbents (sawdust, paper) are normally used. Today's market for pet bedding amounts to more than €9 million and €500 million in Spain and Europe, respectively.

FIBRACAT has led this project, in which companies from the paper sector, such as IBERPAPEL, MUNKSJÖ and PAPRESA, have collaborated.





OBJECTIVES

- Demonstrate the technical and economic feasibility of using sludge from the pulp and paper industry as an innovative high-end absorbent material for domestic and industrial use (oil spills, hydrocarbons), as a recycled alternative to the mineral materials traditionally used, such as sepiolite.
- Improve the existing high performance of 300% liquid retention, increase odour retention and have new colours, to enter the industrial market and market a high-end range of absorbents with an additional added value of 25-50% compared to the first products that have been developed to date.
- Assess the suitability of sludge from nine Basque paper mills, which would be a potential solution for de-inking sludge and sludge with vegetable fibre.



RESULTS

- Development of 3 products focused on the 2 main markets identified: the domestic cat and small rodent market and the industrial absorbent market.
- Identification of the main properties and characteristics that these products should have, such as their density, absorption capacity, colour, etc.
- Development of 2 product ranges (FibraCat Absorbent) for the domestic market: basic range, with good absorption and odour control, and high-end range, which also incorporates specifications, such as colour and agglomeration capacity. Both use less material to absorb the same amount of urine compared to mineral absorbents, reaching up to 25% less material in the high-end product.
- Development of a hydrophobic product for the industrial absorbent market (FibraCat Industrial) that reduces the amount of absorbent material to be used by using only the same amount of industrial absorbent as the polluting liquid, leaving the water completely clean.



CONCLUSIONS

- The absorption capacity of FibraCat Absorbent products for the domestic market is higher than traditional absorbents, which leads to significant financial savings for the end user and a less waste generation.
- The formulation of the FibraCat Industrial product for the industrial market also represents significant savings compared to traditional sepiolite absorbents, which absorb liquids indiscriminately, thus requiring the same amount of absorbent material as total spillage, even though a large part of the spillage is non-toxic water that would not need to be absorbed.
- FibraCat Industrial reduces the volume of hazardous waste to be treated by the authorised waste management company and replaces mineral materials from mineral deposits with recycled materials from waste in the paper industry.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



PLASTICS

ondarreta

SUSPLAS

SUSTAINABLE PLASTICS FOR DESIGNER FURNITURE PRODUCTS

FURNITURE PRODUCTS DO NOT REQUIRE PLASTICS WITH DEMANDING TECHNICAL

characteristics, so it is a sector that can potentially integrate recycled materials easily into its chain. Plastic, as a material, is one of the major environmental problems to be solved, considering that there is a large amount of plastic that is not being recycled, which ends up polluting the environment. However, it is necessary to analyse the most sustainable recycled plastics with the highest adaptation potential for use in the manufacture of designer furniture products, select alternatives and work with representative and formulable samples. New 3D printing technologies also enable functional furniture prototypes to be obtained easily.

ONDARRETA, the company that has led SUSPLAS, manufactures furniture based on tradition and innovation, and has worked with 3R3D (company specialising in 3D printing), URTETA (company specialising in plastic injection), the environmental consultancy firm, IK INGENIERÍA, and HABIC, the Basque Cluster of equipment, furniture and design.

COLLABORATORS



IK / INGENIERIA

ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Incorporate sustainable polymeric materials in the habitat sector to replace fossil-based virgin plastic in the manufacture of designer furniture products.
- Recover plastic waste without any loss of quality in the furniture.
- Check the feasibility of processing these materials.
- Model and disseminate value-added circular businesses.
- Design strategies adapted to the characteristics, needs and opportunities of the designer furniture sector in the Basque Country.
- Analyse which processes need to be added or modified in order to incorporate these new materials.



RESULTS

- The equivalent CO₂ emissions savings per plastic part made from the selected materials are between 34% and 62% compared to fossil-based materials
- For an optimal result, part of the virgin fossil-based raw material is mixed with recycled virgin material, achieving a reduction of CO₂ emissions equivalent of more than 40% compared to virgin material.
- The impact on the complete product, which includes steel structures in addition to plastic components, is between 19% and 28%.
- The economic cost has not been adversely affected by the replacement of existing materials.
- Validation of results and qualities of the materials obtained as suitable for market requirements. This validation has been both technical and aesthetic, a critical point in the decision to purchase designer products.



CONCLUSIONS

- SUSPLAS has obtained positive technical and environmental results, with a high potential for replicability in the future, but there are some difficulties related to the market: some manufacturing companies and customers distrust recycled materials, either because of previous bad experiences (non-homogeneous products, non-continuous service) or because they perceive it as lower quality. SUSPLAS has minimised this barrier by using suppliers with certified products and the capacity to ensure supply.
- The implementation of SUSPLAS in the Basque Country is affected by the lack of a local recycler-compounder that can offer recycled plastic materials with certification and supply guarantees. The materials used successfully in SUSPLAS come from Central European companies, which hinders the process in a sector that does not stock materials as projects are fully customised.
- Project dissemination in this consumer product is key, which is why a video has been made, which can be seen on this link: https://www.youtube.com/watch?v=tCif3n_iYUM&ab_channel=ClusterHabic

DRIVING FACTOR



GREEN PUBLIC
PROCUREMENT



RECICHAIR

ECO-DESIGN OF FURNITURE
BY ROTOMOLDING

AS A RESULT OF THE COVID-19 PANDEMIC, THE NEED TO HAVE AN OWN PRODUCT in the medical sector has been detected, and the Basque Country has the means and structures to make this possible through its industry. This would enable supply chain disruptions to be avoided and provide strategic know-how in a key sector.

The transfer chair for patients and people with mobility problems is an element that is rapidly being incorporated in different areas, thanks to increased awareness and the social integration of patients and people with reduced capacities. The pandemic revealed the importance of good disinfection of products to prevent infections in hospitals. This involves the production of lightweight products that can be disinfected with cleaning agents.

ROTOBASQUE is the only company with rotomolding technology in the Basque Country. RECICHAIR has relied on the collaboration of CTME (Miranda de Ebro Technological Centre) for the Life Cycle Analysis (LCA).

COLLABORATORS





OBJECTIVES

- Develop an eco-designed mobility chair that can be manufactured using rotomolding technology, which is more environmentally friendly than conventional devices, easier to clean, suitable for radiotherapy rooms and much lighter.
- Incorporate recovered materials in the manufacturing process.
- Introduce eco-design concepts into the device while maintaining a robust design and high durability.
- Prepare an LCA of the new chair for the quantitative assessment of the environmental impact of the developments.



RESULTS

- Verification of the technical, environmental, economic and commercial feasibility of the project, subject to the establishment of alliances with strategic agents and investment partners.
- Identification of the main environmental impact factors through an LCA of the mobility chair.
- Obtain a strategy for the tracking, monitoring and separation of industrial plastic waste for its reincorporation into production cycles.
- Own product designed with internal resources for the implementation of new business models and work methodologies.
- New relationships with public bodies and private entities for the development of new projects in the health sector.
- Start of the process for the implementation of the ISO 14006 certification within the development company.



CONCLUSIONS

- It has been proven that the company has the technical capacity to develop in-house projects of high technical complexity.
- It has been established that it is possible to recover plastic waste and systematise its separation and treatment in order to include it in the value chain in a circular economy strategy aimed at obtaining zero waste.
- New technology partners and developers are required to bring the product to market as it is a highly complex environment which requires certifications and specifications of the products developed. Entry into mature markets that do not always accept disruptive changes in the solutions used is a major barrier.
- New methodologies for monitoring the company's consumption, input and output have been established to improve the environmental monitoring and evaluation of the different activities performed.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



ENVIRONMENTAL POSITIONING AND TRANSPARENCY



LATXA ARTILE

HIGH QUALITY FUNCTIONAL GARMENTS MADE FROM LATXA SHEEP'S WOOL

THERE ARE AROUND ONE MILLION LATXA SHEEP IN THE BASQUE COUNTRY and it is a symbol of the territory. However, their wool (about 2,500 tonnes per year) is an environmental problem for shepherds because it has no commercial use and its only destination at present is landfill. TERNUA has been performing R&D&I tests since 2009, with the idea of using this raw material to make its garments, as it has very interesting technical characteristics: anti-bacterial, thermal insulation, thermo-regulating, traps air, works well in the wet, flame retardant, etc.

TERNUA GROUP is an international company dedicated to design, develop and marketing of textiles, sports equipment and fashion under the Astore, Ternua, Lorpen, Loreak Mendan and Ternua workwear brands, with a strong commitment to sustainability. It has led LATXA ARTILE, an initiative in which the MUTURBELTZ agri-ecological, artistic and cultural association (Karrantza) has participated in the selection of the wool; the LAMARIAKO AZPIKOA farmhouse (Antzuola), which produces a wide range of ecological cheeses under the AMATXO brand; and, finally, the company specialising in the manufacture of wool, ILETEGIA (Lapurdi).

COLLABORATORS





OBJECTIVES

- Validate the feasibility of using Latxa sheep wool as an insulator in the textile market.
- Significantly reduce the waste generated on sheep farms in the Basque Country.
- Reduce the carbon footprint of the thermal insulation creation process.
- Offer solutions to a traditional and essential activity.
- Enhance the value of a product with a high cultural and identity value.
- Encourage local recycling.
- Increase the competitiveness and differentiation of companies.
- Contribute to the economic development of local livestock farmers and encourage sustainable farms and farmsteads.



RESULTS

- Inventory of sheep farms with sustainability criteria in the Basque Country (Latxa or carranzana flocks of sheep, organic feeding of the flocks, free grazing and production of organic Idiazabal cheese)
- Obtain the raw material by optimising the shearing processes: around 540 kg of virgin wool suitable for manufacture was obtained from the shearing of the 300 Latxa sheep at the LAMARIANO AZPIKOA farmhouse.
- Obtain a layer of insulating wool from the combination of 66% of Latxa wool and 34% of Navarra sheep's wool, which results in a compact insulator that manages and controls humidity, absorbs interior perspiration and repels humidity from the outside, and offers comfort and performance in adverse weather conditions.
- Make and design outdoor jackets that are light, breathable, waterproof and thermo-regulating, under eco-design criteria: use of biodegradable materials (in addition to wool, corn sugar biomass is used for the membrane), recycling (post-consumer PET from bottles and textiles), water repellent treatment free of fluorinated compounds, fabric with BLUESIGN® certification and designs that facilitate separation for future recycling.
- A plant that could recycle all the wool in the Basque Country would save the emission of 1,100 tonnes of CO₂ equivalent each year and would affect 2,500 tonnes of wool production a year.



CONCLUSIONS

- The first garment designed by TERNUA with the technology arising from this project is already on sale at the brand's usual points of sale and is called Artile Jacket, with 1,200 units.
- To explain the jacket's manufacturing cycle, TERNUA has also included a special print on the inside of the jacket providing information on the steps that have been taken in its production.
- A biodegradable and easily regenerable material such as sheep's wool is an alternative to the use of petroleum-based insulation materials, with the significant environmental impact associated with their extraction and manufacture.

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

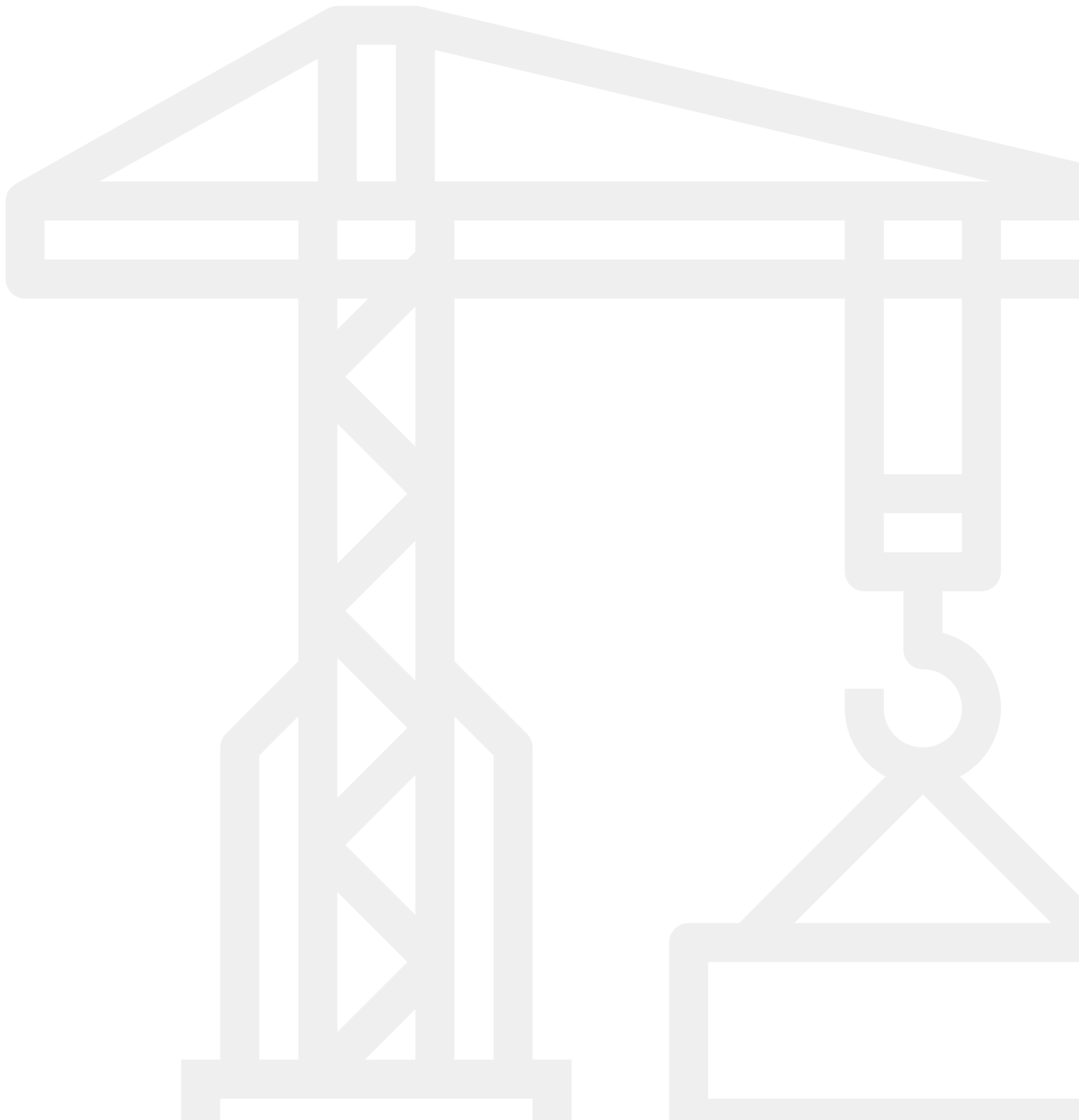
- Environmental drive of the value chain.
- Industrialised construction.
- New, more sustainable materials.
- Guides of recycled and renewable building materials.
- Taxes on aggregate extraction.



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



CEVERIO

RECOVERY OF MINERALS AND METALS FROM URBAN WASTE BY OPTICAL SORTING

SLAG FROM URBAN WASTE ENERGY RECOVERY IS AMONG THE 10 NON-HAZARDOUS waste streams that contribute the greatest mass of minerals and metals to landfills in the Basque Country. The aggregate production of this slag at the two energy recovery plants in the Basque Country (Zabalgardi and Zubieta) is estimated to be 90,000 tonnes each year. In general, the solution for this waste at a European level is to subject it to maturation processes that enable it to be used in civil works, but this is of little value from the point of view of circularity of the fractions embedded in the slag.

AGALEUS, a company devoted to the treatment and management of industrial waste, leads CEVERIO, in which it has worked with PREFABRICADOS ETXEBERRIA, a producer of prefabricated concrete elements, the TECNALIA Technology Centre and ZABALGARBI, an urban waste energy recovery plant in Bizkaia.

COLLABORATORS





OBJECTIVES

- Lay the technological and industrial feasibility foundations for closing higher value-added cycles of mineral fractions (glass and siliceous components) and metals from Urban Waste Energy Recovery slag.
- Implement innovative separation technology, combining optical systems with physical-mechanical sorting systems.
- Recover material resources of higher purity and reincorporate them into production cycles for glass (glass fraction), metals (ferrous and non-ferrous metals) and cement-based construction products (ceramic fractions, melting slag and fines).



RESULTS

- Recovery of 7.34% of the total glass recoverable by optical means. The result is much lower than expected due to the reduced performance of the equipment due to dust on the glass and the working range of the separator (10-50 mm) which only has 30% of the total glass.
- Recovery of slightly less than 50% of total metals.
- Guaranteed use of the fine recovery fraction to replace aggregate in precast concrete.
- Results above the reference in the use of the 10 to 50 mm micronised fraction instead of cement for active addition in precast concrete.
- Estimated annual savings of 1,650 tonnes in CO₂ equivalent emissions.



CONCLUSIONS

- Although it has been possible to recover the mineral fractions by incorporating them as raw materials in the manufacture of precast concretes, the project results include several uncertainties, namely the initial humidity of the slag and the need for drying, and the micronising processes involved in the recovery of the fractions.
- These two steps represent an additional cost for the recovery processes carried out, which could be particularly important in order to obtain economically viable circular processes.
- However, expectations on landfill fees favour the project.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



BITAR

BITUMINOUS MIXTURES OBTAINED FROM THE RECOVERY OF MOULDING SAND

FINDING A SOLUTION FOR FOUNDRY SAND WASTE FROM THE METALLURGICAL INDUSTRY, which is mainly destined for landfill, remains an important need for Basque industry. One is the functional and environmental suitability of these moulding sands for use as fine aggregate in bituminous mixtures for road surfaces. The proposal is based on previous pilot studies, such as the PISSAM project (Innovative cement-based products from the recovery of iron and steel by-products from moulding sands) and promising small preliminary tests of bituminous mixtures with moulding sands and iron and steel aggregate carried out by the developer in order to identify the potential risks for placing these recycled products on the market on the basis of the knowledge acquired.

ASFALTADOS OLARRA, a company specialising in the asphaltting sector, has led BITAR, in which it has worked with the TECNALIA Technology Centre

COLLABORATORS





OBJECTIVES

- Study the feasibility of a new recovery solution for moulding sands (green or chemical) by developing new asphalt mixes that also incorporate steel aggregate.
- Identify the most suitable conditions of use for milling and steel aggregate mix as a substitute aggregate for natural aggregate in bituminous concrete mixes and discontinuous mixes.
- Reduce the environmental impact associated with the use of non-renewable resources.
- Define suitable specifications that serve, on the one hand, as a basis for starting work on the voluntary CE marking of this aggregate mix for use in bituminous concrete mixes and discontinuous mixes, and, on the other hand, as a reference for its inclusion in the Standard for the Dimensioning of Road Surfaces in the Basque Country's Road Network.



RESULTS

- Compliance of the proposed mixtures with the requirements set out in the PG3 specifications
- The physical-mechanical and environmental properties of the waste studied do not prevent their use for the manufacture of bituminous concrete mixes and discontinuous mixtures.
- BITAR technical specification document for the recovery as a filler aggregate for bituminous concrete mixes and discontinuous mixes.
- Submission of the consultation form to EOTA, the European Organisation for Technical Assessment of Construction Products for construction products set up under the Construction Products Regulation.
- Savings of 36 kg of CO₂ equivalent emissions per tonne of asphalt mixes by replacing natural aggregates from quarries with the recycled aggregates proposed in BITAR.



CONCLUSIONS

- The major environmental advantages of using moulding sands and steel aggregates as raw materials for the manufacture of bituminous mixtures occur at the raw material procurement and transport stages.
- The waste used and recovered is initially suitable in the proposed percentages for use in both bituminous concrete mixes and discontinuous mixes for structural surfaces.
- ASFALTADOS OLARRA has established contacts with agents interested in the solutions proposed by BITAR to ensure the supply of moulding sand and steel aggregate in the future.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



GRAFRA

OBTAINING GRAVEL-CEMENT FROM ROAD MILLINGS AND STEEL AGGREGATES

ASFALTADOS OLARRA, LIKE THE REST OF THE COMPANIES IN THE SECTOR, generates a significant volume of road millings. Although there are regulations that allow their reuse, barely 15% are reused, mainly as part of new bituminous mixtures. The remaining 85% is landfilled. This is a generalised problem of surface maintenance companies, which can be extrapolated perfectly on a national scale, due to the fact that sufficient controls have not been carried out, although the feasibility of use has been demonstrated, or they have not been carried out in such a way to enable the material to be compared with the natural material.

Within the general situation of civil engineering construction, where there has been an appreciable reduction in margins, public infrastructures and in particular road infrastructures constitute the most of the sector's demand. In addition, the depletion of natural aggregate reserves requires the search for alternatives to increase the availability of aggregates, for which multiple projects and studies are being undertaken to replace natural aggregates with recycled aggregates from different sectors.

ASFALTADOS OLARRA, a company specialising in the asphaltting sector, has led GRAFRA, in which it has worked with the TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Obtain an effective recovery option for road surface materials that minimises the quantities of road milling and steel waste that end up in landfill.
- Demonstrate the proper functional and environmental performance of the material for the foreseen applications from a work methodology to be implemented based on an iterative process of evaluation, analysis and improvement throughout the different phases of the project.
- Develop new gravel-cement products from waste from the iron and steel sector and from surface renovation.
- Industrialise the process of a new, more sustainable soil-cement solution.
- Reduce costs for infrastructure developers due to the lower price of recycled aggregates, as well as for companies by avoiding the landfilling of significant quantities of waste.



RESULTS

- Physical-mechanical and chemical characterisation of the waste analysed with no notable incidents with respect to the characterisation of a natural aggregate.
- Experimental gravel-cement test specimens with simple compressive strength is perfectly comparable with mixtures made out of standard components.
- Full-scale pilot carried out and installed without any notable incidents and its evolution is still under study.
- GRAFRA Technical Specification Document for the recovery as a filler aggregate for gravel-cement layers.
- Submission of the consultation form to EOTA, the European Organisation for Technical Assessment of Construction Products for construction products set up under the Construction Products Regulation.
- Saving of 6.8 kg of CO₂ equivalent emissions per tonne of gravel-cement by replacing natural aggregates from quarries with steel and road milled aggregates.



CONCLUSIONS

- The evolution of the full-scale gravel-cement layer pilot project, implemented at the ASFALTADOS OLARRA facilities, leads to the conclusion that the waste used and recovered is initially suitable in the percentages proposed for use in gravel-cement layers for structural road surfaces.
- ASFALTADOS OLARRA has established contacts with agents interested in the solutions proposed in GRAFRA to ensure the supply of steel aggregate in the future. Likewise, prior contacts have been made with IHOBE and Bizkaia Provincial Council to inform them of the project's approach and assess its viability. It is also planned to involve prescribers and relevant players in the sector, including municipalities and the Surfaces Table.
- The higher density of slag in relation to the density of natural aggregate leads to an increase in the cost of transport, stockpiling and installation processes. On the other hand, the non-homogeneity of the milling waste required unforeseen conditioning, and the plant had to be adapted.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



MEBITA

REUSE OF MILLING MATERIAL IN WARM BITUMINOUS MIXES FOR ROAD REHABILITATION

IN 2013, THE BASQUE COUNTRY GENERATED MORE THAN 83,000 TONNES OF ASPHALT mix waste from road milling rehabilitation. Currently, most construction tenders include a provision for the removal of milled material to landfill and the management of the waste is left to the construction companies, which reuse it in lower value applications or it even ends up in landfill. Milled asphalt mix materials have the potential to be used again in road construction as components of new asphalt mixes or as granular materials. In recent years, there have only been two applications of milling (warm) in the Basque Country and another two in Spain, but it has not become established as habitual practice.

The CAMPEZO business group leads the MEBITA project, in which GIPUZKOA PROVINCIAL COUNCIL, the civil infrastructure engineering company, CIESM-INTEVÍA, and the asphalt company, ASFALTIA, which is part of the CAMPEZO group, have participated.

COLLABORATORS





OBJECTIVES

- Construct more road sections with a proportion of up to 80% of materials added from the milling of aged roads and with the technical performance required by the Works Management.
- Determine the environmental parameters of the use of milling in bituminous mixes warmed with bituminous emulsion (below 100°C) for roads.
- Confirm that the environmental impact during application are lower than for hot mixes and that the reduction in material and energy consumption is similar to that predicted in the technical literature.
- Obtain a protocol of good technical and environmental practices.



RESULTS

- Bituminous mixes made of warm emulsion and milled material have physical and mechanical characteristics suitable for use in medium and low traffic road surfaces as a wearing layer.
- Slightly lower water sensitivity performance in this type of mix than in hot mix asphalt mixes, due to the presence of water in the process.
- Due to the lower ageing of the binder because of the lower manufacturing temperature, the warm mixes are more deformable.
- The rigidity module of the emulsion-warmed and milled mixes is around the same as that of the hot mixes, although their cohesion is somewhat lower.
- Definition of complementary methods for the manufacture of specimens and the equivalence of rotating compaction with the usual impact compaction.



CONCLUSIONS

- Warm asphalt mixes are another alternative for producing asphalt mixes with technical characteristics suitable for medium and low traffic intensity roads.
- These mixes also have environmental advantages due to their lower manufacturing and laying temperature, as they are manufactured at around 100°C, approximately 60°C lower than hot mixes.
- Warm mixes consume less fuel due to the lower manufacturing temperature, emit fewer Greenhouse Gases (GHG) and also allow for the reuse of a waste product, the milling material from ageing roads, which would otherwise be sent to landfill.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



TRACEX

DIGITAL PLATFORM FOR
SURPLUS EXCAVATED
EARTH AND SECONDARY
CONSTRUCTION MATERIALS

THE CONSTRUCTION SECTOR MUST FACE CHALLENGES TO REMAIN COMPETITIVE and align itself with the new paradigms of the circular economy and the digital revolution. Among others: the high demand for raw materials and the inefficiency of their consumption, the high generation of waste, the waste of mineral resources with a high potential for recovery, and inefficient logistics. There is a lack of interaction between the agents involved, leading to a lack of information and the sector is clearly not digitalised. Several digital platforms created to facilitate the exchange of materials and waste between agents in the value chain (Terrass, Backacia and Inex Circular in France, Easywaste or Circular Market in Spain, etc.) have failed in their marketing, and others address different sectors and waste streams.

DE DIEGO, which is behind TRACEX, and the partner companies, BELAKO and GUTRAM, cover the entire value chain of the construction sector and the main flows of material resources. The digital services company, HERMENEUS WORLD, and the TECNALIA Technology Centre have also worked on TRACEX.

COLLABORATORS



GUTRAM



tecnal:a
MEMBER OF BARCELONA RESEARCH
& TECHNOLOGY ALLIANCE



TRACEX

El marketplace de excedentes de la construcción y de la industria.

Traces es la plataforma digital que simplifica la compra y venta tanto de tierras de excavación como de residuos de la construcción, la siderurgia y otras industrias. Hacemos fácil el proceso de búsqueda geolocalizada de excedentes, su venta, trazabilidad y documentación.

¿Necesitas productos valorizados? ¿Dispones de excedentes RCD e Industriales? Ahorra tiempo y dinero con Traces.

Quiero probar Traces gratis

Me gustaría saber más

Quiero vender mis excedentes

Necesito productos valorizados

Formulario rápido para vender

Localiza tu proveedor más cercano

Nuestros productos valorizados

Excedentes de excavación (tierras y rocas)

Áridos reciclados de hormigón

Árido reciclado asfáltico

Áridos siderúrgicos

Otros productos

Los residuos no deberían existir. Y punto.

En Traces, unos venden excedentes. Y otros compran productos valorizados. Y así, juntos conseguiremos que todo el planeta gané.

Reducimos nuestra huella de carbono y el uso de recursos naturales

Nuestro algoritmo optimiza todos los procesos: nuestros resultados se miden

Hacemos rentable el cuidado medioambiental y apoyamos el negocio local

¿Quieres calcular cuánto CO₂ evitaremos con tu operación?

280



OBJECTIVES

- Implement, prototype, demonstrate and market an advanced application for the exchange of surplus excavated earth and secondary construction materials that enables the different agents in the value chain to offer, locate and exchange material resources with other agents and quantify the environmental and economic impact of their operations.
- Integrate advanced functionalities to improve the usability and user experience of its use and its associated services.
- Launch the application on the market and create a Start-up to monetise the use of the application and supply the associated services.
- Reduce environmental impact by improving resource efficiency (10%) and reducing greenhouse gas emissions (20%).



RESULTS

- Design, development and optimisation of a digital platform based on a Market Place with advanced functionalities for the exchange of resources. The added value that differentiates it from other existing platforms is based on functionalities such as: advanced search service for resources according to final applications; geo-positioning and decision-making service; traceability management; integrated quality control; impact quantification and analysis service.
- Demonstration and technical and economic validation to obtain a functional and marketable product.
- Creation of the TRACEX Start-up to monetise the services offered by the platform.
- Savings in the emission of 2,900 tonnes of CO₂ equivalent per year, basing the impact of the application on the 10% increase in the reuse of secondary materials, and a 20% reduction in the number of trips associated with transport in the Basque Country.



CONCLUSIONS

- Digital tools have limited penetration in the sector. The lack of success of other similar tools is due to their ad-hoc use without any further obligation to do so, as there are other ways of keeping in contact with suppliers or customers. TRACEX offers functionalities that add value, such as: the calculation of environmental impact with the TRACEX seal; the generation of documentation adapted to the administration; the order management tool that improves the user experience; the personalised web page of the companies that serves as a showcase for other services.
- The competitive digital market has led to a rapid market launch of the platform, which has enabled the launch of a pioneering and unrivalled solution that has positioned itself as the benchmark. TRACEX will be implemented in other regions outside the Basque Country by adapting the search engines and the decision support service.
- TRACEX will incorporate traceability layers using blockchain technology to ensure the inviolability of the data exchanged.

DRIVING FACTOR



REDUCTION OF GREENHOUSE GASES (GHGS)



RAW MATERIALS COSTS AND SUPPLY



EGURBERRI

CROSS-LAMINATED TIMBER CONSTRUCTION SYSTEMS WITH NEW KM-ZERO RAW MATERIALS

IN THE BASQUE COUNTRY, THE WOODED AREA COVERS APPROXIMATELY 54% OF THE TERRITORY, with around 396,000 hectares. In recent years, a fungal infestation has affected almost 30% of the most populated species, the Radiata Pine, which accounts for more than 31% of the entire forest mass in the Basque Country. Forestry professionals warn that the disease threatens to collapse the timber sector. For this reason, a new path for the use of other KM-Zero timber, such as Pinus Pinaster and other hardwood species that are abundant in the Basque forests is opening up. The study of the performance of the combination of forest species favours sustainable forest management, establishes mixed forests and encourages forest owners to generate diversified landscapes that slow down the spread of future diseases or pests.

EGOIN, EGURBERRI's development company, is devoted to the engineering, design, manufacture and assembly of timber constructions and solutions for architectural projects. EGURBERRI is being developed with the support of the TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Develop new structural products in cross-laminated timber (CLT), using different species that are native to the Basque Country and are not contemplated in the manufacture of CLT panels.
- Meet current structural requirements for panels and ensure compliance with functionality, safety and sustainability specifications.
- Increase productivity and reduce production costs.



RESULTS

- Manufacture of prototypes of CLT panels with Radiata Pine wood treated for use class 2 and 3, and prototypes with a combination of species in 3, 5 and 7 layers:
 - (1) Pinaster Pine in longitudinal layers + Radiata Pine in cross-sections.
 - (2) Radiata Pine in longitudinal layers + Paulownia in cross-sections.
 - (3) Beech in longitudinal layers + Radiata Pine in cross-sections.
- Verification of the technical feasibility of the proposed species combination and manufacture of CLT with treated Radiata Pine.
- Significant increase in the CO₂ capture capacity of the species with respect to pine, especially Paulownia.
- Reducing the environmental impact of transporting raw materials by using KM-Zero wood.
- Expected 15% reduction in unit product cost, with a 4% increase in turnover, and a 10% increase in market share, especially in internationalisation.



CONCLUSIONS

- EGOIN aims to give continuity to the study of the industrial performance of the KM-Zero species studied in EGURBERRI, and thus help in the forestry policies of the Basque Country in terms of reforestation. For this purpose, it will expand its facilities with a new CLT production centre.
- The manufacture of CLT in Europe has only contemplated coniferous species, so the use of Beech, an abundant species in the Basque Country, may face the lack of compatible CE marking regulations.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



RAAC

PRODUCTION OF READY-MIXED CONCRETE FROM CONSTRUCTION AND DEMOLITION WASTE

THE COMPREHENSIVE LARGE-SCALE SOLUTION FOR THE ALMOST 600,000 TONNES per year of waste concrete, bricks, obsolete ceramics and demolition aggregate mixtures generated in the Basque Country requires the involvement of the quarrying and natural aggregate manufacturing sector to partially incorporate secondary aggregates into its product portfolio. This would reduce the extraction of more than 3.5 million tonnes of natural aggregate per year, of which less than 30% is used for applications other than the manufacture of structural concrete. The Basque Government aims to achieve a 70% recycling rate for construction and demolition waste (CDW).

EUSKAL ARIDO, the Basque federation of extractive industries and quarries, is leading the RAAC project, in which the ECALSA and AIZKIBEL/CALCINOR quarries, the TECNALIA Technology Centre, the construction and demolition waste management companies, BTB and GARDELEGI, and the environmental consultancy and engineering firm, EYP DE MINERIA Y MEDIOAMBIENTE S.L. (Eyp Consulting) have also participated.

COLLABORATORS





OBJECTIVES

- Optimise and demonstrate on an industrial scale the production of new compositions of artificial aggregates from the combination of quarry granular material and secondary granular material from the recovery of mixed Construction and Demolition Waste.
- Reduce the environmental impact as a consequence of using CDW and obtain economic improvements in the value chain by taking advantage of synergies between natural aggregates and secondary aggregates manufacturers.
- Produce the new aggregate categories in plant by means of an optimised combination of recycled aggregate and natural aggregate.
- Manufacture at least one product with sustained demand in the Basque Country that is made from these categories of artificial aggregate.
- Encourage the Administration to incorporate a new Chapter of materials with CDW in the Price Base for Building and Urbanisation at the Basque Government's Building Quality Control Laboratory, and the integration of this material in the criteria for Green Public Procurement.



RESULTS

- Technical feasibility of mixed recycled aggregates (MRA) for use in the manufacture of concrete for the proposed mixes and percentages.
- Environmental improvement by ensuring a greater metabolisation of resources embedded in mixed CDW, with an annual saving of 362 tonnes of CO₂ equivalent emissions.
- Economic and business improvement in the value chain, due to synergies between natural aggregates and secondary aggregates manufacturing companies).
- Compliance with the applicable technical regulations for the manufacture of concrete when introducing mixtures of MRA and natural aggregates (NA).
- Promotion of new employment opportunities and retention of existing ones.



CONCLUSIONS

- Increased control of the recycled aggregate product that is part of concrete is necessary, e.g. by CE marking or other additional controls.
- These actions would require the development of public policies to promote the use of recycled aggregates (green public procurement, development of eco-labels, promotion of the use of products from MRA and NAbends, etc).
- Increasing the quality of the recycled aggregates produced at the CDW management plants would help to increase the recovery of CDW.
- The development of a Sectoral Framework Agreement in order to promote the use of recycled aggregates from CDW in construction works would be interesting.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



MOSAM

TECHNICAL MORTARS FROM
THE RECOVERY OF GREEN
MOULDING SANDS

THE SO-CALLED **FOUNDRY SANDS ARE USED IN THE GENERATION OF CORES AND SAND MOULDS** to shape the morphology of parts and components for the automotive sector, the production of which constitutes the industrial activity of FAGOR EDERLAN. The company generates around 50,000 tonnes of waste from these sands every year, out of the almost 160,000 tonnes generated annually in the Basque Country. However, this sand waste has great potential for recovery and reuse in the construction sector, particularly in the manufacture of concrete and mortar.

MOSAM is a project backed by FAGOR EDERLAN, a leading company in the manufacture of automotive components, which has green moulding foundries where it generates the surplus sand waste that is the object of the project. The TECNALIA Technology Centre and the leading mortar manufacturing company, SAINT-GOBAIN WEBER, a potential end-user company, have been involved in the project.

COLLABORATORS





OBJECTIVES

- Develop and industrially validate new technical mortars manufactured with green moulding sand from FAGOR EDERLAN's Eskoriatza Foundry plant.
- Define the necessary treatment of sand aimed at improving its characteristics for use as an aggregate in mortars.
- Develop new formulations with foundry sand substitution at laboratory level, and validate them on an industrial scale.
- Reduce natural aggregate consumption by at least 20%.
- Develop new sustainable products with a lower carbon footprint.
- Reduce landfilling of foundry sand.
- Reduce CO₂ emissions by producing mortars with reused sands.



RESULTS

- Validation of foundry sand as a substitute for natural sand in technical mortars.
- Performance without any significant variation in strength, setting times and water absorption between mortars tested with foundry sand and those tested with natural sand.
- Return of the original colour to the sand thanks to its thermal treatment (500 to 600°C), as it eliminates the organic load present in the sand. This minimises the limiting factor of colour in the use of mortars due to the market demand for white mortars and concretes as opposed to grey.
- Elimination of leaching problems of foundry sands embedded in mortars, so that they can be deposited in non-hazardous waste landfill sites.



CONCLUSIONS

- MOSAM has shown the need for heat treatment to restore the initial colour of foundry sands due to market requirements.
- The possibility of manufacturing sustainable "Eco" mortars, with a significant reduction in CO₂ emissions is opened up. The generation of "Super Eco" mortars using moulding sands without heat treatment and convincing the market of their higher environmental value has not been ruled out.
- The results of MOSAM can be replicated by other mortar companies, so that the volume of green moulding sand to be reused could cover all the surplus sand in the Basque Country.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



REMIBA

USE OF SOLID URBAN WASTE SLAG IN GRANULAR LAYERS FOR ROAD SURFACES

The solid urban waste (SUW) energy recovery plant at the Gipuzkoa Environmental Complex (CMG) generates 40,000 tonnes of incineration slag each year. The usual processes to recover such waste consist of the separation of unwanted materials, mechanical crushing and screening, separation of metals and stabilisation. 70,000 tonnes of the 90,000 tonnes of slag generated annually in the Basque Country are currently destined for landfill. Only 20% of the total (the fraction below 10 mm particle size) is being reused at cement plants.

REMIBA is presented as a continuation of the BIRSU project, financed by Gipuzkoa Provincial Council. The results and experience acquired at REMIBA could also be applied at the Zabalgardi plant (Bizkaia), which would enable all of this type of waste generated in the Basque Country to be managed in the medium term.

FCC MEDIO AMBIENTE (FCC) is developing REMIBA, with the support of the TECNALIA Technology Centre and the collaboration of GIPUZKOAKO HONDAKINEN KUDEAKETA (GHK) and URBYCOLAN.

COLLABORATORS





OBJECTIVES

- Obtain secondary gravel solutions from incineration slag as an alternative to natural quarry aggregates in the production of road surfaces, while also reducing the economic cost of landfill disposal.
- Functional and environmental characterisation of the waste, on a laboratory scale and in a real use environment.
- Study new treatment alternatives in the laboratory in order to proceed, if necessary, to their industrialisation at a later stage.
- Define suitable specifications to serve as a basis for drawing up a future Basque Decree on the recovery of this waste for its inclusion in the Standard for the dimensioning of road surfaces in the Basque Country's Road Network and to obtain the CE Marking.



RESULTS

- Certain leachates and total contents obtained in the characterisation do not comply with legal limits.
- Development of new waste treatment alternatives: separation of fine fraction and irrigation of 125l/m².
- Gravel prototypes developed for T2 sections, with percentages between 35% and 75% of slag aggregates.
- Road surface pilot test implemented and experimental validation of final developments in section T3 on the EX2 esplanade on the Eskuzaitzeta Industrial Estate (Donostia-San Sebastián), 4 sections of Type 1.1 road surface with 12 cm of asphalt on gravel prototypes in 2 layers of 25 cm: a control section (0% slag) and 3 sections with 30%, 50% and 70% of slag.
- Emission savings of 9.4 kg CO₂ equivalent per tonne of gravel and reduced impact in all categories analysed compared to the use of natural aggregate from quarries, due to the raw material procurement phase and the reduction in transport costs.
- Specifications proposed to the administration with the specifications for the functional and environmental recovery of incineration slag as aggregate for road surface aggregate.
- Submission of the consultation form to EOTA, the European Organisation for Technical Assessment of Construction Products set up under the Construction Products Regulation.



CONCLUSIONS

- Marketing of the proposed solutions will require a new assessment of the leaching results and total content of the material once the Basque Government's Department of the Environment has published the specific environmental decree for the recovery of incineration slag. This reassessment is key to the decision whether or not to implement new treatment processes.
- The low resistance of incineration slag to fragmentation requires it to be mixed with other more resistant materials, which entails additional logistics management. Furthermore, difficulties arose in the compaction of the material during the implementation of the full-scale pilots, requiring longer than usual execution times.
- FCC, GHK and TECNALIA will formally proceed with obtaining the CE marking as a construction material for incineration slag within 1-2 years.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



ECO-DESIGN OF EQUIPMENT

fhimasa

OFAP

ADDITIVE MANUFACTURING FOR HIGHLY CUSTOMISED CONSTRUCTION SYSTEMS WITH CEMENT-BASED MATERIALS

DIGITAL TRANSFORMATION IS ONE OF THE MAIN DRIVING CHALLENGES FOR THE ARCHITECTURE, engineering and construction industry, creating a unique opportunity for disruptive change in the construction ecosystem and a great opportunity towards a completely new way of delivering new services and manufacturing innovative products. Integrated digitalisation of projects faces new challenges in the construction sector more competitively, such as the customisation of projects, increased sustainability or the use of new technologies, as well as addressing the greater awareness of citizens and society regarding the need to reduce the environmental impact throughout the life cycle of products. Both IHOBE (in its Eco-design Sector Guide on Urban Furniture) and AFAMOUR (Spanish Association of Manufacturers of Urban Furniture and Playgrounds) propose strategic eco-design measures in the urban equipment sector, such as the incorporation of waste materials as additives or aggregates in concrete.

FHIMASA, a leading supplier in the construction sector, is leading OFAP, in which it has partnered with companies, such as the manufacturer of cement products, BIKAIN, the designer, manufacturer and installer of production stations, INALI, and the creative industry expert in 3D printing, ESTUDIOS DURERO, as well as the TECNALIA Technology Centre.

COLLABORATORS



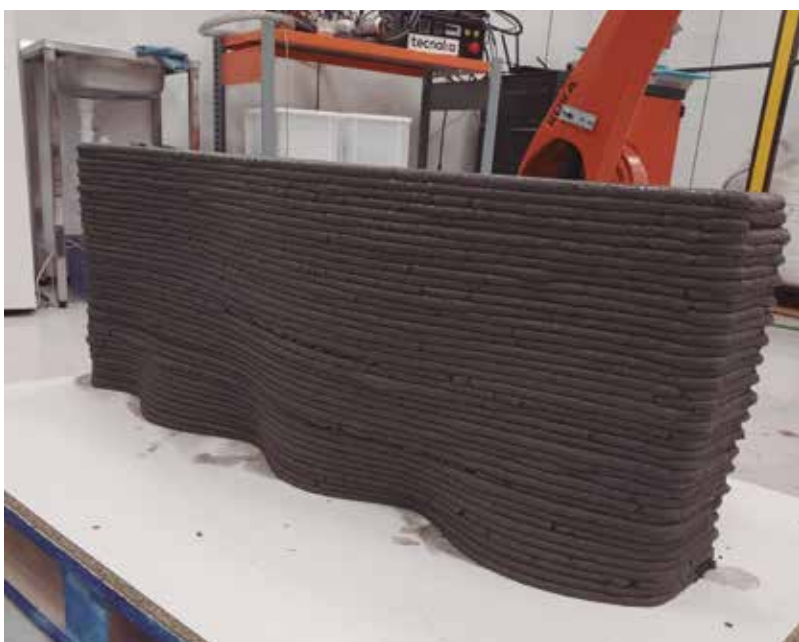
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Lay the scientific-technological foundations for the manufacture of personalised construction systems with cement-based materials applied to urban furniture.
- Develop and validate a new Ecodesign service for unique parts, as a pilot in the laboratory.
- Customise urban equipment through parametric design.
- Reduce the use of raw materials by 20-60% through topological optimisation techniques.
- Develop new robotic systems for additive manufacturing that enable any part morphology to be built without moulds.
- Develop new printable formulations using at least 20% secondary mineral resources.



RESULTS

- New digital parametric models for the design of highly personalised urban furniture.
- Eco-design criteria for complex non-structural building systems that reduce the amount of material used for their manufacture, maintain mechanical feasibility and durability, and reduce the cost of parts compared to conventional processes.
- New formulations of cement-based materials for additive manufacturing that incorporate fine secondary raw material with mineral additions from the 0 to 4 mm fraction of Construction and Demolition Waste (C&DW), thus recovering a fraction that presents greater barriers to cycle closure in conventional processes.
- New robotic cell for 3D printing of customised products with complex geometry.
- 47% reduction in the carbon footprint of the printed solution compared to the conventional solution, representing emissions savings of 23 kilos of CO₂ equivalent per bank (example taken as a case study).
- 6.7 cubic metres water savings per bench, representing a 69% reduction in terms of water consumption.
- 237 kg reduction in raw material extracted and 3.33 kg of waste sent to landfill per bank.



CONCLUSIONS

- OFAP has been conceived to offer a new eco-design service for unique urban equipment projects with exclusive and customised design and low environmental impact, which will provide a competitive advantage to FHIMASA as there is no competition, and will enable the development of unique projects more efficiently in terms of time and costs thanks to the integrated digitalisation of the project.
- The development of OFAP will enable the rest of the Consortium to offer its customers new innovative products with a lower environmental impact that will generate new business opportunities, diversify their offer, and strategically position themselves in a highly competitive market in which the possibilities of differentiating themselves from the competitors are scarce.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS

fhimasa

REHASERV

SERVITISATION IN BUILDING RENOVATION

CONSTRUCTION IS ONE OF THE KEY SECTORS IN THE TRANSITION TO A CIRCULAR ECONOMIC MODEL due to its high consumption of resources, as well as the waste it generates. There is a major need for the renovation of buildings in the Basque Country and there is a large amount of funding available for this type of intervention but, on the other hand, there are disconnections between the design, construction, use and maintenance processes and the end of life which cause poor quality interventions that fail to take into account the whole life cycle of the building.

FHIMASA, a reference supplier in the construction sector, seeks to position itself in the renovation sector by offering a quality turnkey solution, and is leading REHASERV, in which it has relied on the collaboration of the multidisciplinary engineering and architecture professional services company, I-INGENIA, the environmental consultancy firm specialising in carbon footprint and Life Cycle Analysis (LCA), GRUNVER SOSTENIBILIDAD, and the building energy renovation company, RENER.

COLLABORATORS





OBJECTIVES

- Carry out a strategic reflection, explore different servitised business models and analyse the viability of a new circular business model: servitisation in building renovation (public and private, residential and industrial).
- Drive a change in traditional business models.
- Decrease dependence on product manufacturing companies and focus on meeting market needs.
- Enable the implementation of eco-design strategies that were previously incompatible with the interests of the manufacturing company.
- Focus on a design that considers the entire life cycle of the building.



RESULTS

- Market launch of the REHASERV service (<http://www.rehaserv.com>) for building renovation projects.
- Formation of a consortium for the REHASERV service, made up of the construction firms, FHIMASA and VICONSA, the renovation company, KARBI and the engineering firm, I-INGENIA, with the support of the Basque Construction Cluster, ERAIKUNE.
- Design projects for different neighbourhoods in Bilbao and Abanto-Zierbena, and communities of owners with excellent commercial and environmental results (energy efficiency, circularity, sustainability, etc.)
- Increased turnover of around 30% is expected for each of the consortium's partner companies in the coming years.



CONCLUSIONS

- Initially, servitisation is welcome and feasible in the renovation of public and private residential buildings. Coupled with the foreseeable high demand for building renovation services, this is an incentive to launch the service on the market.
- The participation of the public administration in REHASERV has been a key factor in achieving a greater degree of complexity and scope, obtaining a clear differentiation in the market, and positioning in light of the challenges, strategies and financing of European circular economy policies.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



ADAPTATION OF URBAN AREAS IN SMALL AND MEDIUM-SIZED MUNICIPALITIES IN THE BASQUE COUNTRY



The design of the LIFE GOOD LOCAL ADAPT project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative. LIFE GOOD LOCAL ADAPT has been funded by the European LIFE programme.

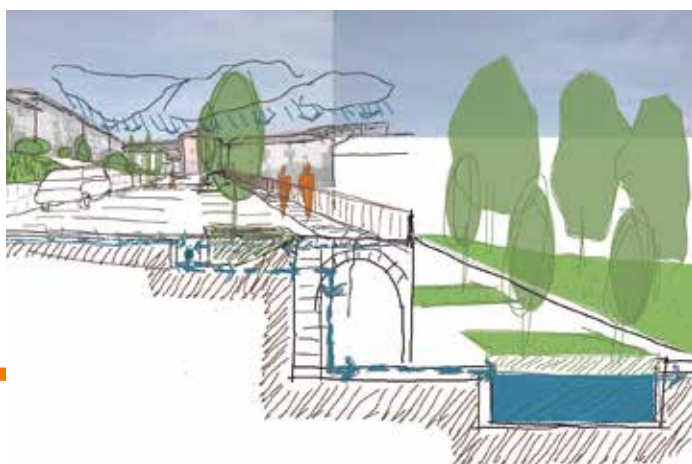
THE SUSTAINABLE COHESION OF THE TERRITORY IS AN INITIATIVE INCLUDED IN THE 2030 ENVIRONMENTAL FRAMEWORK PROGRAMME FOR THE BASQUE COUNTRY as one of its Transformative Projects, which is aligned with the actions of UDALSAREA 2030, the Basque Network of Sustainable Municipalities, which aims to foster local sustainability and promote coordination between the different levels of public administration in the Basque Country, with a special role for the municipalities. Among other objectives, this project seeks to guarantee the ecosystem services of the territory, to promote balanced social and territorial development, and to conserve the diversity of the Basque Country's landscape. Among other strategic actions, it points out the relevance of identifying the different conservation situations in each region, establishing criteria for the identification of multifunctional areas that guarantee the territory's capacity to optimise the provision and maintenance of multiple ecosystem services, continuing the work to promote green infrastructures and developing a participatory process with local institutions and citizens to assess potential pilot projects.

The consequences of climate change affect people's health and lives: according to data from AEMET, heat waves in the Basque Country that currently last 2 days will increase to 12 days by 2050, and hot nights will increase by 10% by 2050. Disease frequency will increase, infrastructure incidents will be more frequent, as will negative effects on the biodiversity and tourism.



COLLABORATORS





DESCRIPTION

LIFE GOOD LOCAL ADAPT is an initiative backed by a consortium of three companies, a technology centre and three local councils, one for each Historical Territory, and it is led by GLOBAL FACTOR. Over a period of four years, the project has worked on and come up with different solutions to facilitate adaptation to climate change in small and medium-sized municipalities, and has applied them to the cases of Amurrio, Balmaseda and Legazpi. Based on public consultation and work with citizens to identify climate hazards and select the best adaptation options for their municipalities, specific solutions have been developed and various materials have been produced, including architectural projects for the renovation of public buildings and projects for the redevelopment of public spaces with climate change adaptation criteria.

The public space redevelopment project has been implemented in the municipality of Legazpi, rehabilitating an area that is easily flooded during heavy rainfall. In this case, different solutions prioritised by the public and by cost-benefit analyses, which were previously carried out within the framework of LIFE GOOD LOCAL ADAPT, have been combined. More specifically, the architectural project includes permeable paving solutions, bio-retention areas, rainwater storage and the construction of a green pergola as a green infrastructure offering shade to citizens.

IHOBE has contributed to the design of LIFE GOOD LOCAL ADAPT by mobilising the local administration to participate in the project, as well as in the transfer of the results to the Basque Network of Sustainable Municipalities included in UDALSAREA 2030.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



2CV HASAI

PRECAST CONCRETE PRODUCTS MADE FROM STEEL AGGREGATES

BASQUE STEEL MILLS GENERATE BETWEEN 25,000 AND 86,000 TONNES of slag per year from the manufacture of stainless steel and the generation of special steels, respectively. The recycling of black slag from stainless steel production is technically more problematic than that of special steel because of its high expansivity due to a higher presence of free magnesia in the slag. This also complicates its use in bonded applications which, a priori, would be the best destination from an environmental point of view. Special steel slags, whose recycling potential was partially analysed in previous projects, require further testing to ensure the viability of long-term performance.

HORMOR, a company specialising in precast concrete, has led 2CV HASAI, with the collaboration of the steel and stainless steel manufacturers, SIDENOR and OLARRA, and the TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Incorporate black slag from the manufacture of special steels and stainless steels in cement-bonded applications in an environmentally sound and technically safe manner.
- Study the durability of steels obtained under high temperature and relative humidity conditions.
- Produce a series of precast products with the most commercially viable scenarios, demonstrating and laying the foundations for industrial production of at least 2 types of precast products.



RESULTS

- The white slag from OLARRA generally has chemical and physical-mechanical properties suitable for use in cement-based mortars: the chloride and sulphate content complies with the defined limit values, and its incorporation in cement pastes hardly modifies the setting times and the mechanical behaviour at late ages in cement pastes is similar to the standard.
- White slag from SIDENOR generally has chemical and physical-mechanical properties that are not suitable for use in cement-based mortars: its incorporation in cement pastes slightly delays the start and end of setting of the cement, it does not comply with the limits defined for chloride content, and its content of free lime and free magnesium in contact with water can give rise to slight expansivities.
- Both slags show slight pozzolanic activity, but the high percentage of some components inhibits their pozzolanic properties at 90 days.
- Masonry mortars made with simultaneous incorporation of white slag and moulding sand achieve mechanical strengths suitable for this type of product.
- 50-84% improvement in all assessed environmental impacts. The reduction in emissions is due to the less energy-intensive use of energy resources in waste treatment compared to quarrying for limestone sand.
- Economic savings of around 36% in the production costs of the new masonry mortars made with the simultaneous incorporation of white slag and moulding sand.



CONCLUSIONS

- 2CVHASAI has proven the technical feasibility of the use of OLARRA's chemical moulding sand and white slag in the manufacture of masonry mortars, minimising their environmental impact in terms of the consumption of raw materials of natural origin.
- White slag must be recovered before use. For this purpose, they must be subjected to deferrisation, removal of metal traces with a magnet and screening below 2 mm.
- A durability study of cement-based products incorporating moulding sands and white slag needs to be carried out in order to guarantee their long-term performance.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



BIRSAND

PRODUCTION OF CONCRETE AGGREGATES FROM FOUNDRY SAND

IN THE CURRENT SITUATION OF THE CONSTRUCTION SECTOR, where margins on materials are becoming smaller and smaller, the use of industrial waste as a by-product allows for a significant reduction in the cost of aggregates for the manufacture of concrete. On the other hand, finding new applications for a waste material such as foundry sand has a dual benefit from a sustainability point of view: (1) a new outlet for the material, facilitating the management of this waste, and (2) the reduction of environmental impact associated with the consumption of non-renewable natural resources.

HORMOR, a company specialising in precast concrete, has led BIRSAND, with the collaboration of the TECNALIA Technology Centre, and with foundry sand from FERROCARRILES AMURRIO.

COLLABORATORS





OBJECTIVES

- Validate the use of foundry sand, such as fine aggregate for concrete.
- Guarantee the conformity of the use of the chemical silicate sand from Ferrocarriles Amurrio as an aggregate for concrete, by complying with the common specifications for use.
- Define different scenarios for foundry sand, designing optimal concrete formulations for the initially foreseen uses.
- Define the specifications for the use of foundry sand as a raw material in concrete. And preliminary processing of the European recognition of the suitability of foundry sand for use in the manufacture of construction concrete as a basis for obtaining the CE marking.
- Achieve a more dynamic alternative to Law 22/2011 through a future voluntary CE marking, which enables waste flow from chemical silicate sand from foundry moulds to be recognised as a by-product "aggregate for concrete in construction".
- Reduce material-related costs in the manufacture of concrete for construction.
- Obtain products with significantly lower environmental impact associated with their life cycle.



RESULTS

- Validation of foundry sand for the proposed purpose from the point of view of chemical composition and leaching.
- Relative property losses are lower in concretes prepared with moulding sand than in reference HA-35 concretes.
- It is not necessary to make any additional adaptations to the recovery process of the moulding sand from FERROCARRILES AMURRIO in the existing manufacturing process used by HORMOR.



CONCLUSIONS

- The BIRSAND project has proven the technical and economic feasibility of using foundry moulding sand for concrete through the development of different pilots. The project results show that the final properties are even better in the developed product than a traditional concrete equivalent.
- BIRSAND has generated the necessary documentation so that the product can be placed on the market with all the guarantees, as well as being the starting point to obtain a regional assessment and the European technical assessment, which will lead to the preparation of the Declaration of Performance and the voluntary CE marking of the product based on the provisions of the Construction Products Regulation.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



WASTE DISPOSAL REDUCTION



MEBAM

MORTARS MADE OUT OF BY-PRODUCTS FROM THE IRON AND STEEL INDUSTRY

30% OF THE MORE THAN 600,000 TONNES PER YEAR OF STEEL SLAG GENERATED IN THE BASQUE COUNTRY comes from the production of special and stainless steel. 20% of the 181,000 tonnes of used foundry sands per year are chemical sands (phenolic, furanic or silicate-chemical), all of which are destined for landfill. The knowledge and previous experience gained in the PISSAM project with concretes based on secondary materials is a useful starting point for a new product line. The signing and deployment of the Basque Government's Voluntary Agreement with the Foundry Sector to recycle all used moulding sands requires new operational technical solutions to be available on the market.

HORMOR, a company specialising in precast concrete, has led MEBAM, with the collaboration of the TECNALIA Technology Centre, and with waste materials from various facilities in the Basque Country.

COLLABORATORS





OBJECTIVES

- Develop and validate new mortars from the recovery of industrial by-products from common steel production processes, and from the recovery of chemical moulding sands from foundries.
- Combine steel sand, from slag generated in the steel production process, and foundry moulding sands as a substitute for natural limestone sand in the manufacture of new masonry mortars and, in particular, for the construction, renovation and conservation of residential, industrial and commercial buildings.
- Boost market activation of these new mortar lines as a viable alternative by proposing and applying Green Public Procurement criteria.



RESULTS

- Manufacture of masonry mortars incorporating moulding sand and white slag, with dosages that include both materials combined, in addition to a percentage of cement, and which achieve appropriate mechanical strengths.
- 36% reduction in the production costs of the new mortars.
- 50-84% improvement in all assessed environmental impacts.
- While all three moulding sands studied were found to be valid, only one of the two sources of white slag had chemical and physical-mechanical properties suitable for use in cement-based mortars.



CONCLUSIONS

- MEBAM has proven the technical feasibility of the use of three chemical moulding sands and a white slag in the manufacture of masonry mortars, minimising their environmental impact in terms of the consumption of raw materials of natural origin.
- The white slag must be recovered before use by deferrisation, treatment, removal of metal traces with a magnet and screening below 2 mm.
- A durability study of cement-based products incorporating moulding sands and white slag needs to be carried out in order to guarantee their long-term performance.

DRIVING FACTOR



POLLUTION MINIMISATION



BIONANO 2.0 ON-SITE SOIL DECONTAMINATION

SOIL IS ONE OF THE MOST VULNERABLE ENVIRONMENTS RECEIVING POLLUTION and its impact represents a serious global problem. In the Basque Country, there are 12,448 potentially affected sites, with the risk this entails for people's health and for ecosystems, as well as the loss of economic value. Soil remediation has been and is one of the priority environmental areas, but the use of remediation technologies is very low, with excavation and landfill being the most widely used.

IRAGAZ, the company behind BIONANO 2.0, has new and improved alternatives for the recovery of on-site soils. The NEIKER and GAIKER Technology Centres, the UNIVERSITY OF THE BASQUE COUNTRY (UPV/EHU), AZKOITIA TOWN COUNCIL and the BURTZEÑA BUSINESS PARK have been involved in the development of the project.

COLLABORATORS





biona 



OBJECTIVES

- Develop viable and sustainable techniques for soil decontamination: nano-remediation using iron nanoparticles, bioremediation using compost, and mixed techniques of both.
- Offer new environmentally sustainable and competitive techniques.
- Choose the most effective technique for each case, according to contamination, time characteristics, etc.
- Eliminate transport emissions through the use of on-sitetechnologies.
- Eliminate the risk of accidental spillage through the use of on-sitetechnologies.
- Contribute to the restoration of affected areas, avoid landfill disposal and foster the use of other waste, such as compost.



RESULTS

- 33% reduction of TPH (total petroleum hydrocarbons) in 4 months using bioremediation using SUW (solid urban waste) compost. Biological activity is fostered with an operationally dynamic and monitored static biopile.
- Reduction of 35% of TPH, 50% of PAHs (polycyclic aromatic hydrocarbons) and fixation of 70% of lead, 90% of antimony and 65% of arsenic using nano-remediation using zero-valent nano-iron (nZVI), which acts as a strong non-toxic reductant capable of reacting with a wide range of metal, organic, organochlorine pollutants, etc.
- 70% reduction of TPH in 2 months using BIONA nano-bioremediation, mixed technique of nZVI nanoparticles and SUW compost. It is a sequential technology with positive synergies: more remediation in less time and a solution for mixed contamination.
- IRAGAZ obtained a patent for the mixed nano-bioremediation technique, BIONA.



CONCLUSIONS

- IRAGAZ works with 3 soil treatment techniques that are environmentally friendly and non-toxic for living beings. The most appropriate technique should be assessed in each individual case.
- IRAGAZ's innovative patented BIONA technology increases the efficiency and effectiveness of remediation, reducing time and costs and broadening the uses (e.g. for mixed contamination).
- The combination of methods opens up the possibility of considering chemical/biological oxidation-reduction reaction sequences for more specific treatments.
- Based on the results of BIONANO 2.0, IRAGAZ could generate new activity in land recovery and favour the socio-economic development of depressed areas.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



BIZKAIHUMUS

USE OF PRE-COMPOST IN
HUMUS PRODUCTION

THE TREATMENT OF ORGANIC WASTE RESULTS IN SIGNIFICANT PRODUCTION OF COMPOST at the provincial composting plants, which generates unwanted accumulations. The use of pre-compost can speed up the output of material in these plants by introducing the sufficient quantity of these materials in the production of worm humus or vermicompost, a high value-added product, which functions as a renewable substitute for peat.

LANTEGI BATUAK, a social cohesion and inclusion organisation, leads BIZKAIHUMUS, in which the employment specialists for people with disabilities, STRATEIA, and the sustainability expert, CIMAS, have also collaborated.

COLLABORATORS





OBJECTIVES

- Produce organic-mineral fertilisers based on mixtures of vermicompost and mineral components approved for organic farming as a substitute for peat.
- Generate other products derived from humus, such as liquid humic extracts for the hydroponic greenhouse sector and for biological pesticides, which are of high economic value and easy to market.
- Transfer the solution to the rest of the Historical Territories.



RESULTS

- Obtain 300 kg of solid worm humus (vermicompost) as a result of processing 600 kg of pre-composted bio-waste.
- Commissioning of a pilot plant to process organic waste at a LANTEGI BATUAK site.
- Determination of the level of mineralisation and humification of organic matter.
- Design of a system for the liquid extraction of micro-organisms contained in solid earthworm humus.



CONCLUSIONS

- BIZKAIHUMUS has demonstrated the viability of using pre-compost in the production of solid worm humus or vermicompost.
- The study of how to market the product in order to ensure the viability of the business critically identified that the current and potential markets for worm humus penalise the value of generic sales of humus, as opposed to the marketing of products with more added value, made from humus and supplemented with other materials. This factor has hindered understanding between the parties involved and represents a challenge for the project's commercial viability.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



RAW MATERIALS COSTS AND SUPPLY



ROBERT

ROBOTISATION TO REDUCE RESOURCE CONSUMPTION IN TUNNEL SUPPORT CONSTRUCTION

TUNNELS ARE INFRASTRUCTURES THAT PLAY A VITAL ROLE IN THE ECONOMIC ADVANCEMENT OF REGIONS. From the point of view of passenger and/or goods transport, the main importance of tunnels lies in their capacity to improve connections between industrial, commercial or tourist sites, reducing the distance between these points, which leads to savings in terms of time and, above all, in costs. In addition to increasing productivity, the construction sector must meet the growing demands of users for greater complexity, better performance, lower cost and shorter lead times. Similarly, major concern for climate change has been developing in recent years, with strategies such as the European Green Deal, whose objectives include increasing the circularity of resources, improving the productivity of materials, reducing the environmental footprint of products and the application of eco-designs that take into account the entire life cycle, prioritising sectors such as construction.

LURPELAN, a company specialising in the execution of underground infrastructures, has led ROBERT, a project in which it has worked with the electrical engineering company, KOMAT, and the TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Increase the productivity and efficiency of tunnel support construction processes through the research, development and validation of a robotic solution for the on-site 3D printing of these structural components on a pilot laboratory scale.
- Eco-design tunnel supports combining topological optimisation techniques and Life Cycle Analysis (LCA), and dematerialise at least 60% of the components.
- Develop new formulations of cementitious materials for direct printing on vertical surfaces or under roofs, under principles of maximum material efficiency and circularity in the use of excavation surpluses and available mineral inputs. Replace up to 20% of natural raw materials with surplus or secondary mineral resources.
- Develop printing systems based on robotic arms specifically for this application, capable of taking full advantage of the benefits of topological optimisation in structural design and reducing material loss.



RESULTS

- New formulations of cement-based materials for direct 3D printing in tunnels, validated on a laboratory scale, and with better structural features and higher performance compared to current shotcrete and with lower costs and environmental impact compared to conventional printing materials due to the incorporation of recycled materials (recycled granular material from construction and demolition waste (CDW) and/or from the excavation itself).
- New system validated on a laboratory scale and based on a specific robotic arm for on-site 3D printing of tunnel supports, capable of implementing the complex geometries of the optimised designs in such a way that it is economically viable, generating tunnel supports with a better surface finish and greater control of thicknesses compared with traditional supports executed by gunning and reducing the loss of material due to the rebound effect from 35% (current systems based on concrete spraying) to 5%.
- Lower carbon footprint impact of the printed solution compared with traditional methods only in cases where the soil to be excavated is of very low quality and therefore the support requirements are higher.



CONCLUSIONS

- The proposed solution (3D printing service for the implementation of tunnel supports) addresses the needs of the underground civil works sub-sector, generating a business opportunity that will enable LURPELAN to position itself at a competitive advantage in relation to its competitors.
- Based on ROBERT's results regarding the system for on-site 3D printing of tunnel supports, KOMAT will develop a new line of special products for a new market niche (construction sector) that will contribute to increasing its business volume in a very competitive environment, as well as developing business lines related to rental and a maintenance, user training and overhaul service.
- ROBERT spin-off developments will continue to seek complementary funding to achieve closer to market levels of development. Lines of research have been detected that could be addressed through more basic R&D projects to move further towards the feasibility of 3D printing with cement-based materials as a construction system for the implementation of tunnel supports.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



REDUCTION OF GREENHOUSE GASES (GHGS)

The design of the HISER project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative. HISER has been funded by the European HORIZON 2020 programme, with IHOBE as a partner.

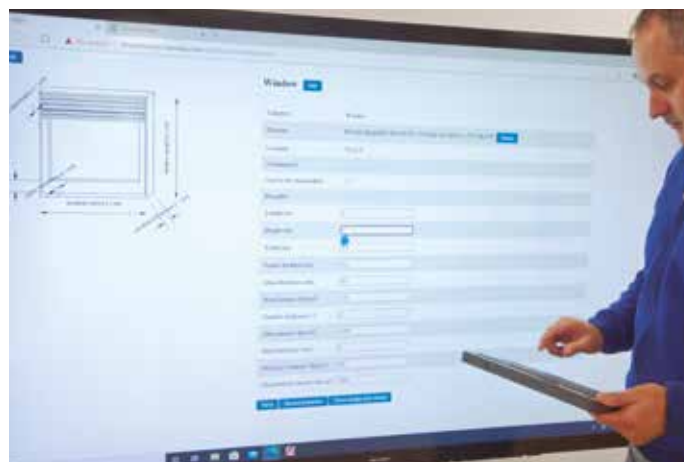


INNOVATIVE HOLISTIC SOLUTIONS TO RECYCLE AND RECOVER COMPLEX CONSTRUCTION AND DEMOLITION WASTE

THE ANNUAL GENERATION OF CONSTRUCTION AND DEMOLITION WASTE (CDW) in the EU is estimated to exceed 550 million tonnes between 2025 and 2030. CDW is becoming increasingly complex and there is a need to move away from traditional recycling approaches to innovative recycling and recovery solutions. This will guarantee greater efficiency in the recovery of mineral, metallic and organic resources contained in this priority waste stream, included as such in the European Green Deal and in the 2030 Environmental Framework Programme for the Basque Country. Therefore, the Basque Eco-design Centre's Strategic Monitoring Report includes construction waste among the keys to achieving a circular economy as one of the objects of new specific legislative proposals for the incorporation of secondary raw materials as substitutes for virgin raw materials. Its initiatives include new eco-design requirements for construction products or establishing a database as the basis for a digital passport.

COLLABORATORS





DESCRIPTION

HISER is led by the TECNALIA Technology Centre, and has a total of 23 participating entities. The project formulates, develops and tests new cost-effective and comprehensive methodological solutions and tools throughout the entire construction value chain that facilitates the collection and processing of data on types, qualities and quantities of construction waste materials for highly efficient selective sorting at source during the execution of demolition and rehabilitation works. Through the use of a new Smart BIM-SD tool and an innovative supply chain tracking system, more accurate information on waste materials from existing buildings is available. These solutions contribute to improved decision-making in the implementation process, on-site sorting and management of subsequent waste materials arising during demolition/rehabilitation of residential and non-residential buildings. Consequently, larger quantities of sorted waste materials will be generated on-site from the start of construction to the end of its service life.

Taking these as a starting point, the project develops and optimises new cost-effective construction products by partially replacing

virgin raw materials with increased quantities of high-purity secondary raw materials recovered from complex CDW. For this purpose, it applies advanced technologies for the production of high purity raw materials ranging from 80 to 100% from complex CDW. Among other products, new cost-effective green concrete with more than 1,300 kg of recycled aggregates per cubic metre of new concrete; new cost-effective bricks made with a partial replacement (up to 10% by weight) of the inert sand fraction by CDW; reclaimed ceramic material ("brick by brick"); new absorbent plasterboards, fire-resistant plaster plasters and composite plasterboard panels made with a partial replacement (up to 50%) of natural gypsum and fibres by CDW; and other recycled materials.

IHOBE's participation in HISER has fostered the implementation of case studies in the Basque Country, which are relevant for their replicability, as well as implementing the project's technical developments in technical regulations in the Basque Country, thus contributing to the transfer of the results. IHOBE also supported the continuity of the project methodologies through its participation in the ICEBERG project.

DRIVING FACTOR



GREEN PUBLIC PROCUREMENT



REDUCTION OF GREENHOUSE GASES (GHGS)

The design of the ICEBERG project has been technically and financially supported by IHOBE within the framework of the “ECOINNOVATION PROJECT FACTORY” initiative. ICEBERG has been funded by the European HORIZON 2020 programme with IHOBE as a partner.



CIRCULAR ECONOMY OF CONSTRUCTION

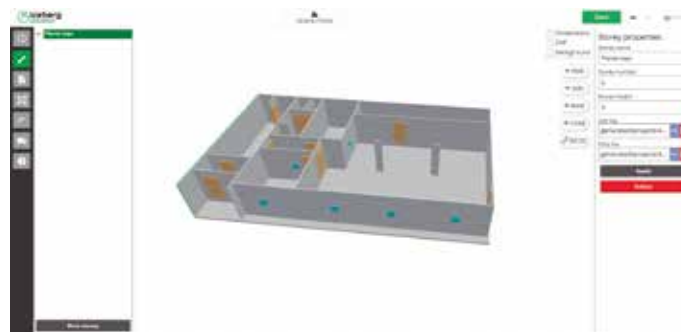
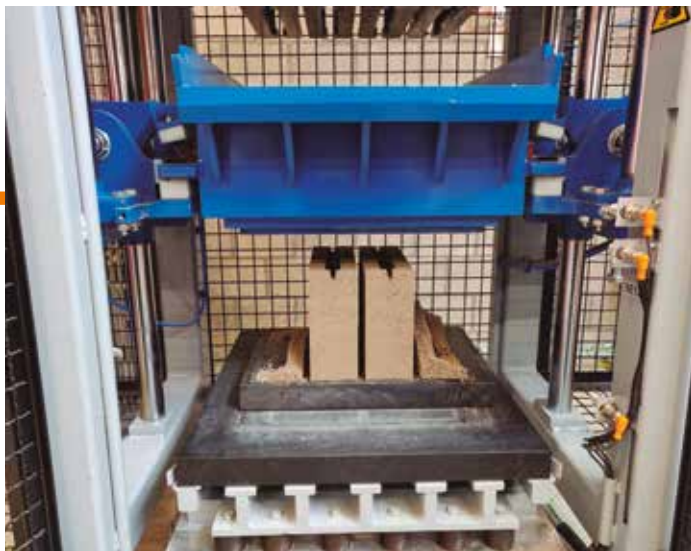
CONSTRUCTION, RENOVATION AND DEMOLITION WASTE (CDW)

is one of the heaviest and bulkiest waste streams generated in the EU and, as such, is a priority in the Circular Economy legal provisions of all administrations, as set out, for example, in the European Green Deal and in the 2030 Environmental Framework Programme for the Basque Country.

The succession of different projects in the field of CDW in recent years has enabled increasingly ambitious initiatives to be tackled and demonstrated, in which digitalisation plays a major role, with practical demonstration cases that enable technologies to be validated for their implementation on a larger scale. The relevance of the sector in the Basque Country is extensive, as is reflected in the continuous publication of guides and catalogues of good practices by IHOBE, such as the report on “Inclusion of secondary materials in works specifications” (2023), the “Guide to sustainable industrialised construction in the Basque Country” (2021), and the “Good practices in the use of recycled materials in civil works in the Basque Country” (2019).

COLLABORATORS





DESCRIPTION

ICEBERG, led by the TECNALIA Technology Centre, is a project with 35 participating entities from different European countries. The project implements advances in the circular economy in the construction sector through the development of innovative circular reverse logistics tools and high value secondary raw material production technologies, to gain market confidence and acceptability of recycled building materials at the end of their useful life.

The project aims to design, develop, demonstrate and validate advanced technologies for the production of high purity secondary raw materials (more than 92% in weight) through 6 circular case studies across Europe, covering the circularity of wood, concrete, mixed aggregates, gypsum boards, glass, polymeric insulating foams and inorganic super insulation materials. Three innovative reverse circular logistics solutions are being applied: an intelligent pre-demolition tool assisted by building information modelling (BIM) (with more than 80% accuracy in waste quantification); an innovative digital traceability platform for end-of-life building materials (EBM); and an identification system based on radio frequency and QR codes.

The development of innovative technologies for EBM recovery includes: hyper spectral (HSI) technology, machine learning software and robotic manipulators to increase the efficiency of mixed aggregate sorting; an optimised integrated crushing, sorting and cleaning system and fast pyrolysis and purification processes for wood fractions; mobile thermal attrition unit; hydrocyclone combined with acid sorting and purification to increase the purity of recycled gypsum boards; a combined purification and solvolysis process for polymeric insulating foams; and advanced hydrothermal processing of glass and silica that contain waste.

ICEBERG is a further development of the HISER project. IHOBE's participation has promoted the implementation of ICEBERG case studies in the Basque Country, which are relevant due to their replicability (in this case focusing on circular ceramic products, silica aerogel and polyurethane-based products), as well as implementing the technical developments of the project in technical regulations in the Basque Country, thus contributing to the transfer of the results.

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.

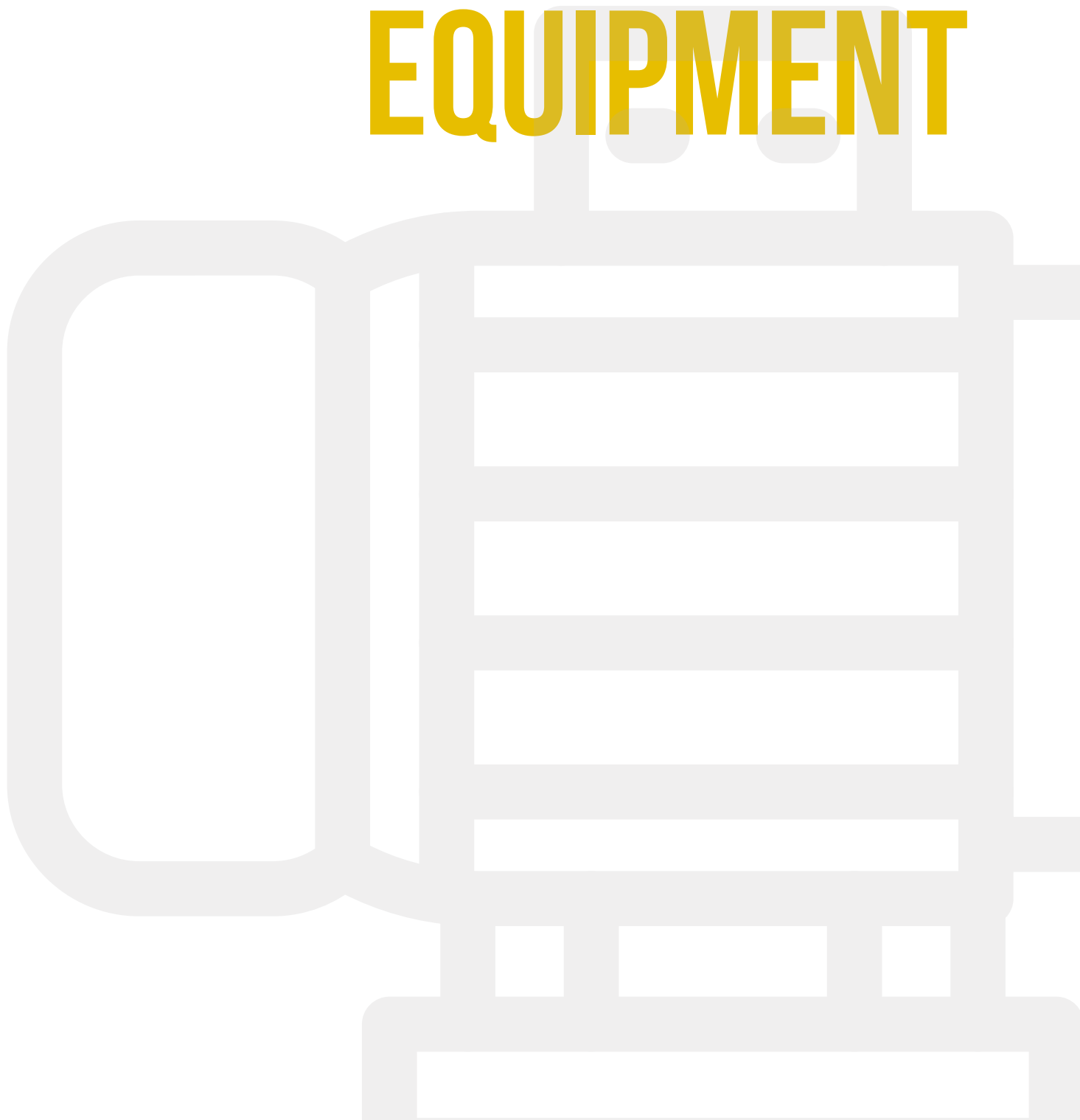


COMPETITIVE IMPROVEMENTS

- 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



EXTENDED PRODUCER RESPONSIBILITY (EPR)



LIFEPLUS

INCREASED LIFE CYCLE OF LI-ION BATTERIES

TODAY, BATTERIES ARE DESIGNED AND MANUFACTURED UNDER A DISPOSABLE CONCEPT. When a battery is installed in a light-duty vehicle, for example, it is expected to offer high functional requirements, such as autonomy. Given its intensive use, there comes a point when the battery no longer lasts long enough to carry out the minimum desired journeys so it is discarded and replaced with a new one. Functionally, the discarded battery still has 80% of its capacity and could be used, but is discarded after using only 20% of its lifetime. On the other hand, today's designs cannot be intervened as their components are welded and it is not possible to replace parts in order to extend their useful life or to facilitate their processing. The consequences are a high environmental impact and a high economic impact in operating costs due to the continuous replacement of batteries.

By 2025, some 3.5 million vehicle batteries are expected to have been accumulated as waste worldwide. Most of these still have at least 50% of their energy storage capacity, which is equivalent to throwing away enough energy to maintain 2 million homes. However, through the eco-design of lithium batteries it is possible to extend their useful life and postpone their disposal.

ALTERITY, a manufacturer of high-performance sustainable lithium batteries, has led LIFEPLUS.





OBJECTIVES

- Validate technically, economically and environmentally the life extension of Li-ion batteries in light mobility vehicles achieved by a Li-ion battery system which can be re-manufactured and be used in second life applications.
- - Produce high-performance batteries for mobile computer workstations to power a laptop and a small scanner or printer for 8 hours, i.e. a full day.



RESULTS

- Implementation of a stand-alone BMS (Battery Management System) instead of a central BMS, which allows cell information to be managed more effectively and quickly and does not require a variant to be implemented for each voltage and capacity variation.
- However, implementing a BMS for each battery significantly increases the cost of the system. This means that the difference between a stand-alone BMS and a central BMS system is not so great economically.
- The second life system for batteries requires knowledge of whether the cells are balanced, given that they pose a risk to the entire system if they are not balanced.
- Reduction of total environmental impact by 30-40% compared to the initial case without re-manufacturing, with an increase in impact in the raw material phase (due to lower consumption and transport), a higher but not significant impact in the manufacturing phase (due to the substitution of several components) and similar conditions with respect to the use phase.



CONCLUSIONS

- The results of LIFEPLUS show that second-life batteries have a lower economic cost than first-life batteries and a reduced environmental impact of up to 40%.
- LIFEPLUS has solved critical technical aspects of the Li-ion battery re-manufacturing process, such as state of charging measurement, fast and safe module removal and the existence of complex, weak and not very manufacturable wiring and electrical installation. All of this provides ALTERITY with the technologies and skills in printed circuit design that enable it to be more efficient and to scale products more easily.
- ALTERITY will develop the LIFEPLUS eco-designed battery in this project in external validation phases in a controlled environment in a potential client company.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



SILIVAL

PRODUCTION AND USE OF SECONDARY ALUMINIUM OXIDES FOR RUBBER FORMULATIONS

BEFESA, A LEADING COMPANY IN ALUMINIUM RECYCLING, HAS BEEN DEVELOPING A LINE OF RESEARCH FOR SEVERAL YEARS TO IMPLEMENT AN ALTERNATIVE RAW MATERIAL to the flame retardant additives used in the manufacture of plastic composite materials and rubbers. This material, commercially known as Paval®, is essentially a recycled aluminium oxide from the recovery of salt slag. Secondary aluminium oxide would constitute an alternative to primary Tri-Hydrated Aluminium (ATH), used as a flame retardant, of which the European manufacturing industry consumes more than 170,000 tonnes a year. Previous projects concluded with the challenge of optimising the amount of hydrated alumina in the oxide by studying the different variables that can affect its formation without altering the aluminium recycling process. The recycled origin of Paval® can hinder a constant supply of material, which is a constraint that prevents the immediate introduction of the product on the market.

BEFESA is leading the SILIVAL project, on which it has worked with the LEARTIKER Technology Centre.

COLLABORATORS





OBJECTIVES

- Demonstrate the ultimate technical and economic feasibility of Paval® as a raw material for new flame retardant polymeric fillers in silicone rubber formulations, focusing mainly on the electrical and electronic sectors.
- Study and enhance the formation of hydrated aluminium oxides versus other species in the oxide.
- Meet the requirements established for the formulation: without jeopardising the mechanical properties of the silicones.



RESULTS

- Obtain silicone rubber by replacing 40% of the commercial aluminium oxide product with the recycled alternative developed by SILIVAL
- Savings of 4,250 tonnes of raw materials (ATH), and the emission of 4,040 tonnes of CO₂ equivalent.
- Controlled study and optimisation of the formation of hydrated oxides within Paval® to enhance its ability to act as a flame retardant.
- Control of the entire process of obtaining secondary aluminium oxide: melting process, cooling and subsequent recovery of the salt slag via a wet process. The influence of the different variables in crystallographic phase formation was analysed: hydrated aluminium oxide versus corundum-type oxide formation, achieving a secondary aluminium oxide with a high hydrate content, which favours the flame retardant effect.
- Addition of the hydrate-rich Paval® from the previous stages as a flame retardant additive in the silicone rubber formulations developed in previous projects by LEARTIKER, and determination of the mechanical, rheological and flame retardant properties of the different mixtures prepared.



CONCLUSIONS

- It is important to note that the tests were carried out at the BEFESA ALUMINIO R&D&I test centre, which has equipment that enables the entire process of obtaining secondary aluminium oxide to be carried out.
- SILIVAL concluded that the developed Paval®-based filler does not constitute an alternative for the full substitution of ATH consumption in this sector, but it can be presented as a partial solution, reducing the consumption of materials of natural origin, adding value to products of recycled origin and reducing the cost of formulations.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



CIRCULAR BUSINESS MODELS



DIGITEEST

DIGITALISED DIAGNOSTICS AND TESTING FOR THE RECONDITIONING OF WASHING MACHINES

THE CURRENT RATE OF RECONDITIONING FOR THE SALE OF ELECTRICAL AND ELECTRONIC EQUIPMENT (EEE) is very low, both in the Basque Country and in Europe. In the case of large appliances, international studies show that only 4.9% of appliances collected for reuse pass the first stages of inspection, and only 1.5% of these appliances are finally reused (considering appliances recovered from green points and other collection points, sources with the lowest success rates in reconditioning).

Statistics show that only 191 tonnes of waste electrical and electronic equipment (WEEE) were reused in 2020, compared to the 20,360 tonnes collected and managed in the Basque Country.

The insertion company, EMAÚS, which collects, manages and recovers waste in order to give it a second life (second-hand sales or other alternatives) has led DIGITEEST, with the collaboration of the GAIKER Technology Centre, the new technology engineering firm, PURPLE BLOB, and the engineering firm for industrial assembly, handling and automation workshops, ROBOLAN.

COLLABORATORS





OBJECTIVES

- Reduce the emission of more than 2,000 tonnes of CO₂ equivalent by reconditioning washing machines and preventing the dumping of 86 tonnes of material.
- Achieve a 40% recovery rate for the collection of about 400 tonnes of washing machines per year.
- Invoice more than €300,000 per year 3 years after project closure thanks to SCRAP sales and fees.



RESULTS

- Reduced emissions by 301 tonnes of CO₂ equivalent from the reconditioning of washing machines, with 21 tonnes of material not being sent to landfill.
- Capacity of 620 tonnes per year (9,538 washing machines) has been achieved with a recovery rate of 20%.
- Estimated invoicing of €264,000 per year 3 years after project closure between sales and SCRAP fees.
- Increase in recovery volume by 124 tonnes per year, representing 1,908 units at €90 per unit.



CONCLUSIONS

- Process efficiency is key to the viability of a waste electrical and electronic equipment (WEEE) preparation line for reuse, and this efficiency depends on the application of technological solutions that help to systematise processes, such as sensorisation and process automation.
- Upgrading and capacity building through technology and process innovation is not enough in the face of a poorly functioning WEEE supply chain, which today prevents higher readiness for re-use rates due to the poor conditions in which equipment is stored.
- Lack of access to libraries to obtain software data required for reconditioning operations may result in a barrier to the execution of such operations.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



REDUCTION OF GREENHOUSE GASES (GHGS)



SOLFLOT

ECO-DESIGN OF AN EFFICIENT FLOATING SOLAR PUMP SYSTEM

The market for photovoltaic solar power is well developed, but not so much that of mounting the panels in a floating mode on preferably inland waters of reservoirs or storage ponds. The opportunity offered by such systems lies in the fact that they have several advantages over a conventional photovoltaic installation: non-occupation of land that could be used for other purposes; 20-40% higher generation thanks to the cooling of the panels, bifaciality and optimisation of the layout of the plants in terms of angle and orientation of the panels; reduction of up to 33% of evaporation; structures less exposed to the wind than on land; non-consumption of drinking water for cleaning the panels; and allowing for the industrial reconversion of irrigation and industrial cooling ponds, or the possibility of hybridisation with the turbine in the hydraulic jumps of reservoirs, which enables better generation management and therefore better energy storage. Reservoirs in Spain, which are affected by the general public domain regulations, require further development of the regulatory framework, which is currently slowing down the implementation of the system. In the meantime, many floating solar plants are being implemented on agricultural and industrial ponds as a self-consumption solution in these sectors, with significant energy consumption.

In Spain alone, excluding reservoirs, there are around 60,000 water reservoirs that could be used for photovoltaic installations. The Ministry for Ecological Transition and the Demographic Challenge has identified 106 state-owned reservoirs suitable for the installation of floating solar plants. In terms of generation, the potential market throughout Spain is estimated at around 8,600 megawatts (MW) in reservoirs and 10,000 in water reservoirs. There are irrigation and industrial ponds, old mining wells and several reservoirs in the Basque Country that could be used for floating solar photovoltaic installations. At present, the renewable generation park does not reach 3,000 MW of installed capacity in the Basque Country.

EMICA SOLAR designs and supplies floating solar solutions and has led SOLFLOT. The circular economy consultancy firm, GRUNVER SOSTENIBILIDAD, and the project management company, NORAY ADVISORY, have been involved in its implementation.

COLLABORATORS





OBJECTIVES

- Lead the development of floating photovoltaic energy in the Basque Country, and be a benchmark in the Spanish market with value-added floating solutions.
- Create an eco-design of an existing prototype to generate improvements based on a Life Cycle Analysis (LCA).
- Reduce the use of raw materials and improve energy production during the use phase, as well as simplify maintenance.
- Analyse the environmental impact that this type of application may have on the area where it is located (including the impact on flora and fauna).
- Create a system for monitoring variables to evaluate the impact in the production phase.



RESULTS

- Reduction in the weight of the structure thanks to the new design of floats with reduced thickness and 100% recycled material.
- High degree of inclination of the panels, which increases electrical output and reduces particle sedimentation, as well as the subsequent maintenance and cleaning tasks.
- The passage of light into the water is guaranteed thanks to minimal contact with the floats in the water, and the limited use of plastic.
- Reduction of all environmental impact indicators by 34%.
- 37% reduction in the product's impact on climate change.



CONCLUSIONS

- The interpretation of applicable regulations for the generation of environmental reports according to regulatory requirements has turned out to be one of the most time and effort consuming tasks, more than originally considered.
- There is no information in life cycle inventory databases on the impact on ecosystems associated with water occupation (such as degradation of materials, or light deprivation in the aquatic environment).

DRIVING FACTOR



ENVIRONMENTAL
POSITIONING AND
TRANSPARENCY



REEF

DEVELOPMENT OF ENVIRONMENTAL PRODUCT FOOTPRINT RULES FOR THE ELECTRICITY SECTOR

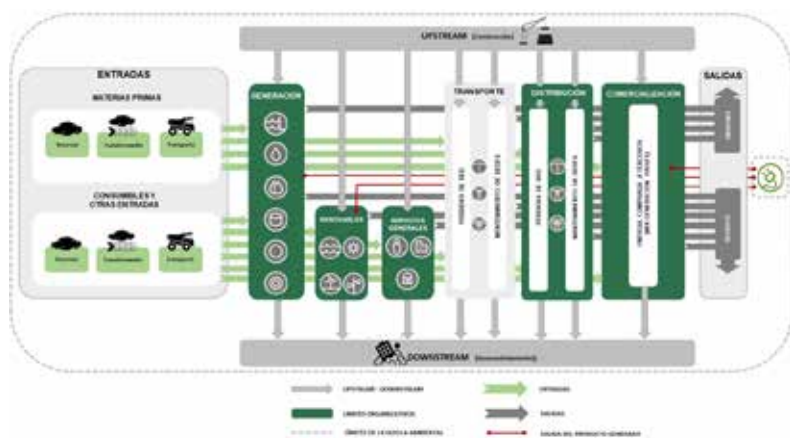
GIVEN THE WIDE DISPERSION OF SYSTEMS AND LABELS TO TRANSMIT INFORMATION on the environmental performance of products and/or services, the European Commission has been promoting common Environmental Footprint methods since 2013.

IBERDROLA and EDP have extensive experience in the development of organisational Environmental Footprints under international standard ISO/TS 14072:2014, but the non-existence of rules under the European Commission framework gives rise to discrepancies in the scope (system boundaries, estimates, assessment methodology, etc.) of the studies. The REEF project builds on this experience for the unification of criteria in the development of Environmental Footprints for electricity.

IBERDROLA has led REEF, with EDP as a project partner and with the collaboration of the LCA and environmental footprint expert consultancy firm, GRUNVER SOSTENIBILIDAD.

COLLABORATORS





OBJECTIVES

- Establish Environmental Footprint rules for the electricity sector under the framework of the European Commission, and disseminate them at a national and European level.
- Integrate the Environmental Footprint with environmental communication and reporting tools and internal management systems.
- Evaluate and drive supplier companies, involving them in the development of the project, and foster the development of Environmental Footprints in priority sectors, such as the manufacture of electrical equipment.
- Assess the potential of applying the Environmental Footprint for Green Private Procurement and Contracting (GPPrC).



RESULTS

- Definition of rules for calculating the Product and Organisational Environmental Footprint, under the regulatory framework of the European Commission.
- Integration with other tools: Carbon Footprint, Environmental Product Declaration (EPD), Environmental Management Systems, Sustainability Reporting Indices (GRI, DJSI) and with data reporting systems.
- Dissemination of common framework to stakeholders to standardise and share environmental information.
- Assessment of the potential of applying the Environmental Footprint for the CCPrV, including the establishment of recommendations for integrating environmental considerations into purchasing policy.



CONCLUSIONS

- The Organisational Environmental Footprint Sectoral Rules (OEFSR) lay the foundations for a framework for the development of Environmental Footprints in the national and European electricity sector.
- Integrating environmental communication and reporting instruments enables complete, truthful and focused CCPrV criteria to be established for a real circular transition, without burden shifting between environmental vectors and/or life cycle stages.
- Capacity building is essential in value chain traction. The training and tools developed in REEF enable participating companies to increase their competitiveness in the European market by providing accurate and transparent environmental information on their products.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



RAW MATERIALS COSTS AND SUPPLY



BatUA

MECHANICAL PrOCCESSING OF LITHIUM-ION BATTERIES AT THE OTUA GROUP

THE NEW EU BATTERY REGULATION (COM (2020) 798/3), WHICH SETS RECYCLING targets of 65% by average weight by 2025 and 70% by 2030, requires further efficiency improvements in the recycling processes for lithium-ion batteries (LIBs). Furthermore, the circular economy and the reduction in the consumption of raw materials can mean a significant improvement in competitiveness, profitability and sustainability for Basque companies.

The recovery of high-value materials contained in the so-called Black Mass (BM), which contains graphite, cobalt (Co), lithium (Li) or nickel (Ni), which can be reintroduced into the value chain, as well as other relevant materials for the Basque Country such as copper (Cu), aluminium (Al) and steels is key to the management of LIBs. There is no business line in the Basque Country that manages waste from LIBs. BatUA aims to do this with waste generated throughout the state.

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 BatUA, the company has worked with INATEC, the Otua Group's R&D Unit.

COLLABORATORS





OBJECTIVES

- Carry out an industrial test combining shredding in a controlled atmosphere with electrolyte evaporation to recover a processable material from which to extract a quality BM as well as other fractions with recoverable elements.
- Evaluate an industrial technology for the mechanical treatment of electric vehicle (EV) LIBs and waste electrical and electronic equipment (WEEE).
- Evaluate electrolyte removal methods in the recycled material stream.
- Obtain top quality BM (graphite, Co, Ni, Mn and Li)
- Obtain recoverable remaining fractions rich in Cu, Al or steel and polymers.
- Quantify and establish an initial estimate of the foreseeable environmental impact of the technologies and processes developed in the project by means of a Life Cycle Analysis (LCA).



RESULTS

- Industrial validation of an efficient method for mechanical treatment of EV LIBs.
- Obtain high quality BM (rich in graphite, Li, Co, Mn and Ni) corresponding to 16,8% of the input material.
- Obtain a heavy fraction (mostly metals such as Cu, steel, etc.) corresponding to 20% of the input material.
- Obtain a light fraction (mostly Al and polymers) corresponding to 49,1% of the input material.
- Savings of 394 kg of CO₂ equivalent emissions per tonne of cobalt oxide recovered compared to the conventional process of mining and production of virgin cobalt oxide.



CONCLUSIONS

- BatUA has achieved the industrial validation of an efficient method of mechanical processing of EV LIBs to obtain BM and recoverable fractions, making progress in completing the production and recycling cycle of lithium-ion batteries. BM production is key to strengthening Europe's battery supply chains.
- To complete the assessment of the recycling of LIBs, greater emphasis needs to be placed on the processing of graphite and its potential for recovery and re-incorporation into the value chain. Graphite is a valuable material with numerous applications, which in its natural variant, namely in its spherulitic form, is classified as CRM in Canada, Australia and the EU as a result of the supply risk for its production.
- It is necessary to optimise the consumption of reagents in the hydrometallurgical process and to look for strategies to reduce the impact from energy consumption for the production of activated carbon filters to improve the environmental impact of BatUA.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



KMALEBOX ECO-DESIGN OF ENCLOSURES FOR POWER STATIONS

OVER THE LAST FEW YEARS, THE INSTALLATION OF OUTDOOR POWER CONVERSION EQUIPMENT has been in high demand, mainly in the renewable energy sector. Energy storage systems (ESS) is a growing sector, driven mainly by the growth of renewable energies (which can exceed 40% of the total energy generated in the whole state),

as they are unable to guarantee a continuous power supply and therefore require outdoor power conversion equipment.

ZIGOR R&D offers power generation systems and solutions and is a specialist in solar photovoltaic grid-tie inverters capable of operating at full power in extreme temperature and altitude conditions. For the creation of KMALEBOX, ZIGOR R&D has been supported by the TECNALIA Technology Centre.

COLLABORATORS





OBJECTIVES

- Eco-design and develop an innovative concept of outdoor enclosure for power systems, including chassis and enclosure, for integration with new models of power converters.
- Meet the necessary quantitative requirements: weight, rigidity, vibrations, efficiency, sustainability and cost.
- Meet qualitative requirements, such as aesthetics or integration with the environment.
- Comply with functional and regulatory requirements, such as manufacturing, assembly, handling, transport, maintenance, and existing certifications and regulations.



RESULTS

- 65% reduction in environmental impact, especially on climate change indicators, compared to the inverter currently used.
- Approximately 50% reduction in the weight of the equipment, which makes it easier and cheaper to transport.



CONCLUSIONS

- KMALEBOX is a new box and enclosure design for outdoor electrical conversion that has a lower environmental impact (lower use of raw materials, higher percentage of recyclable material, less transport due to the weight of the product and the elimination of the container fitted to the company), and a lower cost.

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



CIRCULAR BUSINESS MODELS



CLADCUT RECOVERY OF RECYCLING SHREDDER BLADES



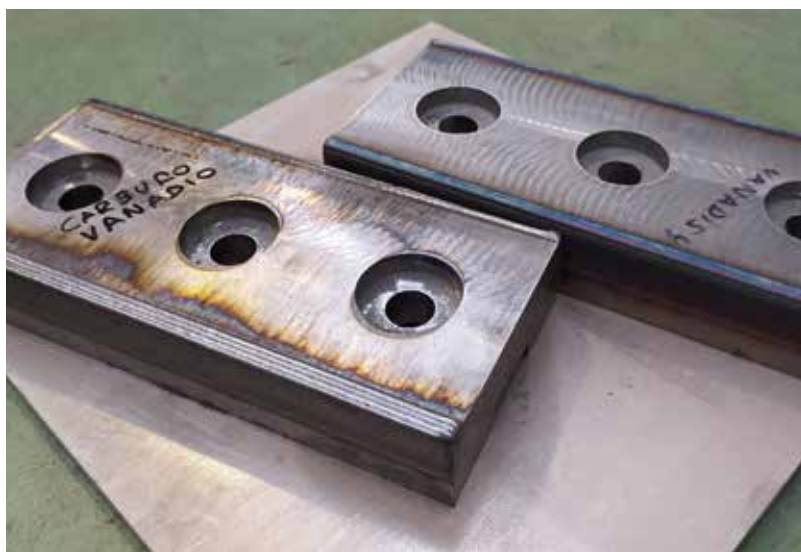
TYRE SHREDDER BLADES ARE SUBJECTED TO CONSTANT FATIGUE IN THEIR DAILY PROCESSES, which greatly reduces their effectiveness and service life. In addition to the technical and economic constraints that this entails, the emergence of misalignments may lead to rotor breakage. The blades are not recovered in existing processes. When they are worn, they are directly discarded and new blades are purchased. This way of working leads to an inefficient use of resources from a production and environmental point of view.

The laser cladding technique enables the specific use of wear resistant and high strength materials in complex geometries with a high degree of process control. The technique is not implemented in industry, but its advantages would offer a significant improvement in the process of cladding damaged parts or those that require preventive maintenance.

CLADCUT has been led by DELASER and has relied on the collaboration of ZORROTZ for the validation of the final demonstrators in real conditions.

COLLABORATORS





OBJECTIVES

- Apply laser cladding technology to the recovery of recycling shredder blades.
- Specifically addressing the problem of tyre shredding due to the significant challenge of shredding tyres, although the solution to be developed could be applicable to the shredding of different materials (plastics, metal packaging, etc.) and is one of the long-term objectives of this project.



RESULTS

- Manufacture of blades with laser cladded cutting edges, using high performance materials, such as Vanadis 4 and vanadium carbide X-90420-3. Claddings are free of pores and cracks. The manufacturing process of this blade has a lower environmental impact and greater durability in use due to the higher quality of the inputs.
- Development of a simple procedure for the recovery of new blades manufactured, consisting of machining the cutting area of the blades, laser cladding, and grinding the cutting edge.
- Reduction of waste material in the form of chips during machining and subsequent sharpening, by working with thicknesses of 0.3 mm on each side of the blade compared to thicknesses of more than a millimetre in conventional techniques.
- Reduction of energy, processes and input material compared to conventional techniques. It is estimated that the higher quality of the inputs will result in a 20% longer service life than existing blades, although this validation must be completed in real use tests of the blades at ZORROTZ.
- Laser cladding could not be applied to blades made of 1.2379 steel, one of the most commonly used materials in existing blades, so the possibility of repairing blades already on the market was abandoned.



CONCLUSIONS

- Investment in a laser cladding cell is considerably higher than that of conventional techniques, so the cost of the input is usually higher as well. However, in this case, the complexity of the geometry to be cladded (one edge) means that this equation does not apply, and the absence of pores and fissures in the new blades reduces the cost of materials and transport.
- The conclusions obtained from the application of laser cladding technology in the recovery and manufacture of shredding blades for recycling used tyres are applicable to the shredding of different waste materials (plastics, metal containers, etc.) and even other uses detected during the project, such as cutting steel coils.
- CLADCUT has led to a significant increase in in-house knowledge of materials, compositions and structures suitable for cutting applications, and in the environmental improvement of processes and procedures at DELASER, such as optimising efficiencies of consumed materials (gas and dust), for example.

DRIVING FACTOR



ECO-DESIGN OF EQUIPMENT



ARINBOX

SAFE AND EFFICIENT LOAD LIFTING AT WIND FARMS

THE OFFSHORE WIND POWER INDUSTRY INVOLVES A WIDE VARIETY OF SHIPS AND VESSELS, equipped with cranes of different types and sizes, to facilitate the handling of components and other loads. During the installation of the turbines, jack-up vessels play a key role. They are colossal vessels equipped with large capacity cranes to assemble the main components, which are the bulkiest and heaviest ones, in the middle of the ocean. Other types of vessels with a more limited capacity support offshore operations, not only in the installation phase, but also in operation, maintenance and decommissioning, and, like in the oil and gas industry, cargo handling from these vessels to the platforms (and vice-versa) is performed with cranes of smaller capacities, whereby 2.5 and 3 tonnes are the most common. Finally, there are the service cranes installed on the turbines themselves, which do not usually exceed a capacity of 5 tonnes.

Nowadays, loads are transferred by using either special bags or very heavy lifting boxes, which make transport, lifting and storage operations difficult in this type of industry, with the additional disadvantage that they are often not certified for use as hoisting equipment. On the other hand, in the onshore wind power sector, the pallet is the most commonly used means of transporting loads to the land where the wind towers are located. Once there, heavy bags or boxes are usually used to lift tools and other components to the turbine. Onshore turbine cranes usually have an even more limited capacity of 1 to 2 tonnes at most.

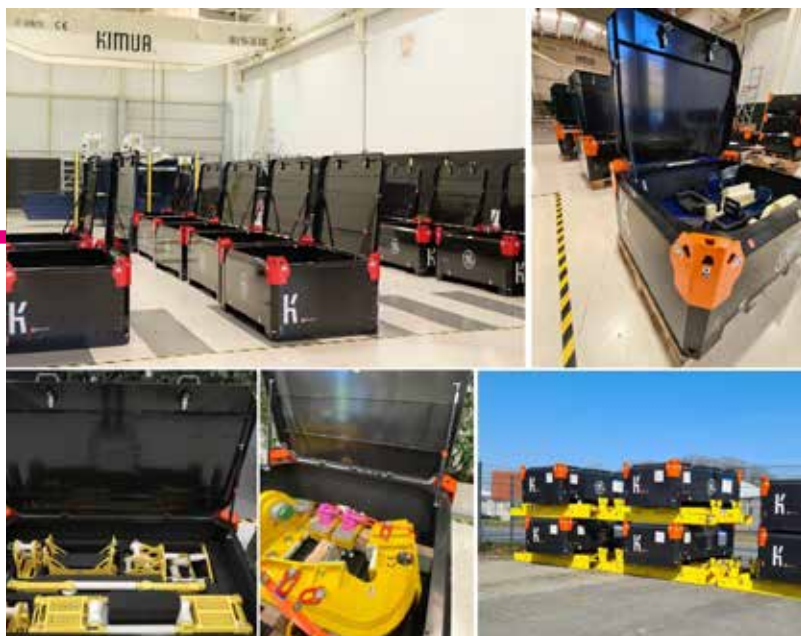
Facilitating these activities, guaranteeing a light and easy to handle system that is competitive and meets the requirements of the target market in technical-economic terms, as well as in terms of safety, agility and handling time is a need that has been expressed by companies in the wind power sector. Any modification to the existing hoisting system entails high costs for the installations. KIMUA, a leading company in the handling, lifting and transport of loads, promotes ARINBOX, a project in which IK INGENIERÍA, a company specialising in Life Cycle Analysis (LCA), has collaborated.

COLLABORATORS



IK / INGENIERIA





OBJECTIVES

- Develop a modular, light, resistant and easy to handle system for transporting, storing and lifting loads from 1 to 3 tonnes, that offers excellent safety conditions for the customer and is competitive in the onshore and offshore wind power market.
- Improve the stackability and collection method of existing systems.
- Facilitate the securing of loads transported on the decks of ships.
- Develop a system that is capable of being industrialised and is price competitive.
- Minimise energy consumption thanks to the agility and speed of use, by not having to use more than one system to carry out different handling and lifting tasks at wind farms.
- Reduce engineering design hours by 90% through the development and implementation of new representation methodologies for flat surfaces and spaces.
- Offer customers a lifting tool certified as such, with the aim of reusing it in different projects.



RESULTS

- Design and development of a multifunctional system in a "compact" format with a low specific weight for applications in the wind power sector with heavy loads.
- Reduction in environmental impact of 11% for semester 3 and 28% for semester 10 compared to the initial case, depending on the impact category considered.
- Invoicing of €768,000 associated with estimated sales of ARINBOX systems in 2026.



CONCLUSIONS

- Product parameterisation significantly reduces engineering design hours in the design of ARINBOX models.
- Customers demand lower environmental impact alternatives, so their interest in the implementation of ARINBOX reconditioning systems is high. It is therefore important to study the wear and tear of the gearbox, the reason for the wear and tear and potential improvements.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



ECO-DESIGN OF EQUIPMENT



BANCASIL

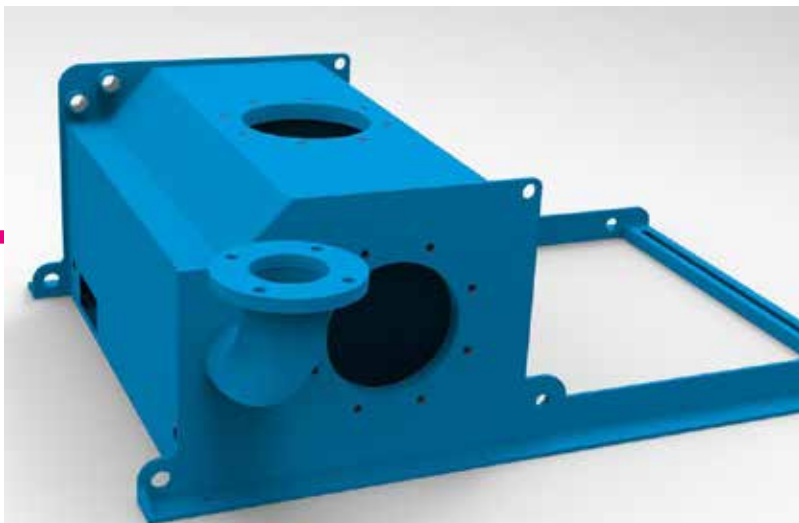
SILENT BEDPLATES TO REDUCE THE SOUND PRESSURE OF BLOWING MACHINES

THE EUROPEAN UNION ADOPTION OF DIRECTIVE 2002/49/EC

of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise has led to a new understanding of noise pollution, with special relevance being given to environmental noise, which shall mean unwanted or harmful outdoor sound created by human activities, including noise emitted from sites of industrial activity. This directive has been transposed into national law and, at the regional level, Decree 213/2012 regulates acoustic quality in relation to infrastructures that fall within its competence, among other aspects.

Maquinas Pneumaticas Rotativas XXI S.L.U. (MAPNER), the company behind the project, is a manufacturer of pneumatic rotary pumps with 85 years of experience. These machines provide solutions for various pressure and vacuum processes by means of different blower technologies and low pressure compressors. Blower technologies, however, generate noise in the workplace and present optimisable energy consumption.





OBJECTIVES

- Develop a technological solution to reduce the noise generated by the blowers manufactured at MAPNER, hence reducing noise pollution in the workplace.
- Create a prototype of a silent 10 mm steel bedplate to demonstrate the noise reduction and increased energy efficiency of the blowers.
- Create a prototype of a silent bedplate with 8 mm of steel to compare the results with the silent bedplate of 10 mm and try to reduce the consumption of raw material while bearing in mind the parameters of noise reduction and increased energy efficiency of the blowers.
- Carry out development and demonstration pilots of the planned improvements on MAPNER test benches and at a customer's plant.



RESULTS

- Fully developed prototypes of the new 10 mm and 8 mm silent bedplates.
- Reduction of the noise pollution of the blowers with both bedplates, whereby the noise pollution is slightly higher with the 10 mm silent bedplate.
- Reduction of 1.45 kWh in the electricity consumption of the new bedplates compared to the old ones during use, due to the reduction of the pressure drop of the blowers.
- Saving of 9.27 tonnes of CO2 equivalent emissions per year for products with an average life of 30 years.
- Installation of the 8 mm silent bedplate at a customer's plant, with highly satisfactory results in terms of noise reduction.



CONCLUSIONS

- Bedplates are currently made of cast iron. The use of steel instead of cast iron does not lead to an increased total environmental impact due to the offsetting of energy savings in the use phase of the blowers. Furthermore, the steel for the new bedplates is local (Hernani, Gipuzkoa). The use phase proves to be the key phase for reducing the environmental impact of MAPNER products.
- The reduction in noise pollution is similar for the 8 mm and 10 mm silent bedplates.
- MAPNER will manufacture and market the 8 mm bedplate as the most suitable for blowers, as they reduce noise pollution and increase energy efficiency in a similar way to 10 mm bedplates, but with lower consumption of raw materials.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



CIRCULAR BUSINESS MODELS



RESTYLING

EXTENDING THE SERVICE LIFE OF TICKETING MACHINES

TICKETING AND PAYMENT MANAGEMENT MACHINES HELP COMPANIES using them (public car parks, university or company canteens, sports centres, music events, hotels and restaurants, pharmacies and tobacconists, among others) to manage the access and/or payments by users of a specific service. SITECO, manufacturer of this type of machines, offers its customers renting services, maintenance and on-line guidance, and its products are manufactured with robustness and durability criteria. For SITECO, it is important to work with customers of its own machines that were installed 15 or 20 years ago, whose renewal is necessary, while the sector, in general, has seen the entry into the market of competitors with significant price reductions.

SITECO has led RESTYLING, in collaboration with the circular economy consultancy, ZICLA, and the specialist in Life Cycle Analysis(LCA), GRUNVER SOSTENIBILIDAD.

COLLABORATORS





OBJECTIVES

- Extend the life of SITECO machines and thus avoid the generation of electrical and electronic waste, whilst retaining the customers of its older machines by offering more environmentally friendly and more attractively priced machines.
- Diagnose the technical needs of the reconditioning process.
- Perform the reconditioning process on at least 6 real SITECO machines.
- Customer validation of the operation of the reconditioned machine in different applications.
- Know the costs of the process.
- Position itself in the market as a recognised direct supplier of reconditioning services.



RESULTS

- Savings of 94 kg of CO₂ equivalent emissions for each reconditioned machine compared to the manufacture and sale of a new machine.
- Reconditioning of 4 5RC machines and 2 mini RC machines. The 6 machines have been placed on the market after being adapted to the needs of a customer who has been offered the reconditioned product instead of a new machine.
- Reconditioning protocol for internal work in the company that has been implemented, where the dismantling processes and the destination of the parts (recycling, spare parts for other old machines at the customer's premises, or parts for reconditioned machines) are recorded.
- Results of the analysis of the reconditioning process of 1.75/5 for general factors, and 1.98/5 for factors related to reconditioning according to the REMANEX methodology provided by IHOBE. The best performance by category is resource management (2.75/5)
- Contribution of 14% to the company's turnover in collection management and ticketing machines.



CONCLUSIONS

- The reverse logistics of the process is key to its economic and environmental viability.
- The potential for improvement in reconditioning processes is wide-ranging, and this has been highlighted in RESTYLING by means of the REMANEX questionnaire prepared and provided by IHOBE, whose lower compliance factors are now part of in-plant improvement.
- The management of parts and components in stock is always a key factor, but it has become especially important because of the supply crisis.
- SITECO has participated in the two ZIRKULARRAK exhibitions organised by IHOBE in 2022 to disseminate and promote the value of circular products designed and manufactured in the Basque Country.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



LIFTLOOP

RECONDITIONING OF FORKLIFT TRUCK COMPONENTS

VIBACAR'S MAIN ACTIVITY IS THE SALE, RENTAL AND AFTER-SALES SERVICE OF LIFTING EQUIPMENT. In the after-sales service, a high number of changes in electromechanical elements have been detected, generating almost 22 tonnes of metal waste annually (according to figures for 2019). This fact and the high cost of spare parts have led to the need to test the feasibility of reconditioning these components through a specific project.

To carry out LIFTLOOP, VIBACAR has relied on the collaboration of the SAN VIATOR Vocational Training Centre, the circular economy consultancy firm, ECONIA, and the digital platform in Blockchain technology, CODE CONTRACT.

COLLABORATORS



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Pilot the industrial start-up process for the reconditioning of electromechanical systems and equipment in the forklift truck sector, with a systemic and iterative model, and certified through Blockchain technology.
- Generate a new business unit for VIBACAR, which not only supplies its own components, but can also offer reconditioned components to other companies in the sector, both in the Basque Country and at a national level, and therefore act as a driving force in the industrial sector.



RESULTS

- Transferability of the new reconditioning business model to 12 Basque companies.
- Estimated potential savings of 10.2 tonnes of CO2 equivalent per year.
- Potential savings of 1.5 tonnes of avoided waste per year, as well as original material purchased.
- Creation of a panel of economic, technical and environmental indicators.
- Generation of industrial process documentation.
- Digital certifications of process documentation.



CONCLUSIONS

- The industrial start-up process has been piloted, with a systemic and iterative model (up to 3 pilots), which has given way to the opportunity of reconditioning 8 components, certified through Blockchain technology, where the economic and environmental viability has been analysed.
- Knowledge has been generated for a new business unit for the company, aligned with the Circular Economy.
- The project has generated interest in reconditioned products in the forklift truck sector, in terms of small distributors and importers of this type of machinery.

DRIVING FACTOR



CIRCULAR BUSINESS MODELS



RAW MATERIALS COSTS AND SUPPLY

ZAYER

R²P²

REPAIRABILITY AND REDUCTION WITH PREDICTIVE AND PREVENTIVE SYSTEMS

ZAYER CURRENTLY HAS A 4.0 SOLUTION BASED ON CLOUD AND BIG DATA TECHNOLOGY for IIOT (Industrial Internet of Things) environments, as a result of different research and development projects carried out in the past. This solution, under the commercial name of "HORUS NX", enables the operational status of the machines to be controlled, the production of the machines to be monitored and the forensic analysis of the machining process and quality to be carried out. However, this platform depends fundamentally on a proactive attitude by the customer company, as it must carry out the analysis to draw conclusions and opportunities for improvement based on its particular machining processes, which allows for improvements in the tool's operability and efficiency. An opportunity has therefore been identified to improve the business model in order to reduce costs and environmental impact associated with the existing equipment maintenance system, through profound refocusing by implementing appropriate digital solutions.

ZAYER develops state-of-the-art milling machines and machining centres. To carry out R2P2, the company has worked with the industrial digitalisation expert, VIXION, and with GRUNVER SOSTENIBILIDAD, specialists in Life Cycle Analysis (LCA).

COLLABORATORS



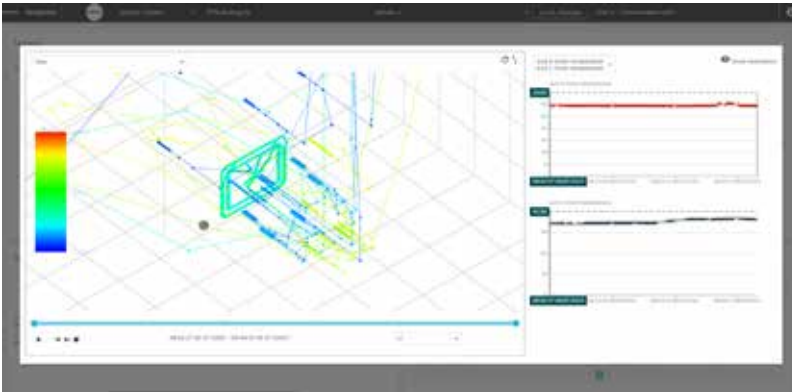
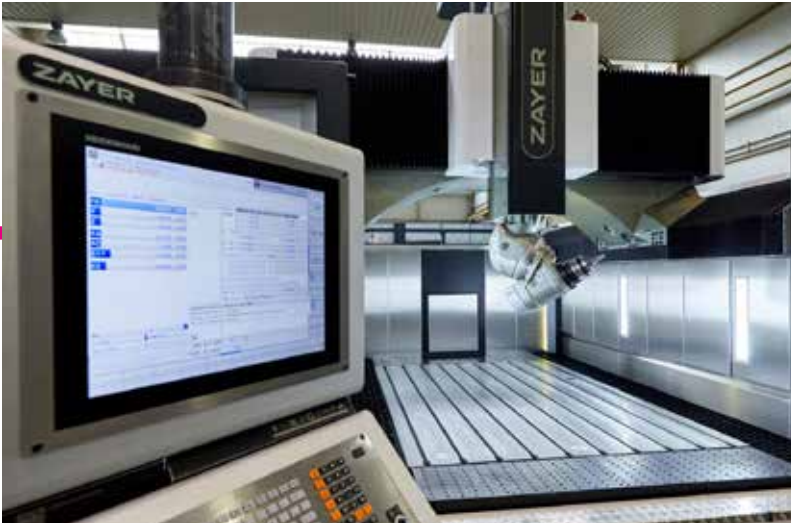
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Develop a new remote, automatic and decentralised diagnostic system for ZAYER equipment and implement a 4.0 predictive maintenance solution
- Reduce the number of repairs and replacements to be carried out by early identification of potential breakdowns in customer equipment, thereby reducing costs and environmental impact.



RESULTS

- Reduction of between 15% and 20% of the maintenance activities carried out by the ZAYER SAT team: travel of the technical department to the destination country for assistance, as well as the production and shipment of spare parts.
- Extend the service life of machines by 2 years until their first general maintenance overhaul (from 10 to 12 years).
- Estimated 6-year savings of 15 tonnes of CO₂ equivalent emissions per year.
- Estimated 6-year increase of 5% in market share, with 4% of overall turnover dependent on R²P² results.



CONCLUSIONS

- R²P² has demonstrated that the proactive use of digital technologies enables environmental improvements to the product profile and makes the company competitive.
- Reducing the number of breakdowns not only brings value to the customer by increasing productivity and reducing maintenance costs, but also avoids a large number of human trips and the shipment of materials. On the other hand, it allows for the transformation of the traditional SAT model into a new hybrid model, where the active monitoring of the machines provides value that is tangibly perceived by the customer.

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



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY



ECO-START

ADDITIVE MANUFACTURING TO REDUCE THE ENVIRONMENTAL IMPACT OF MACHINED PRODUCTS

THE BUY TO FLY INDEX QUANTIFIES THE MATERIAL WASTE

that is converted into scrap in the form of chips when machining metal parts to obtain a final geometry. In the aerospace industry, this averages 12:1 for structural parts and up to 20:1 for engine parts, or in other words, 20 kg of starting material as a block or preform is required for every kilogram of final part. The process also requires energy consumption and machining consumables (cutting fluids and tools) that leads to this process having a high environmental impact.

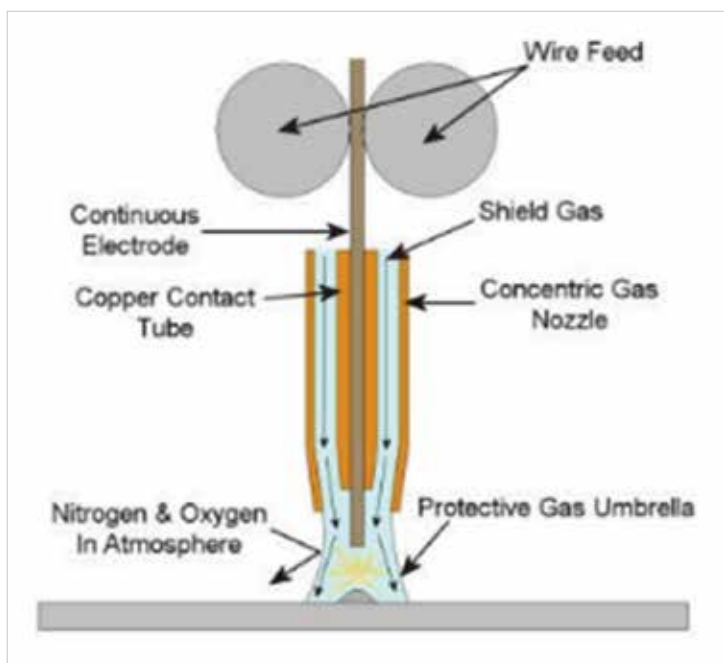
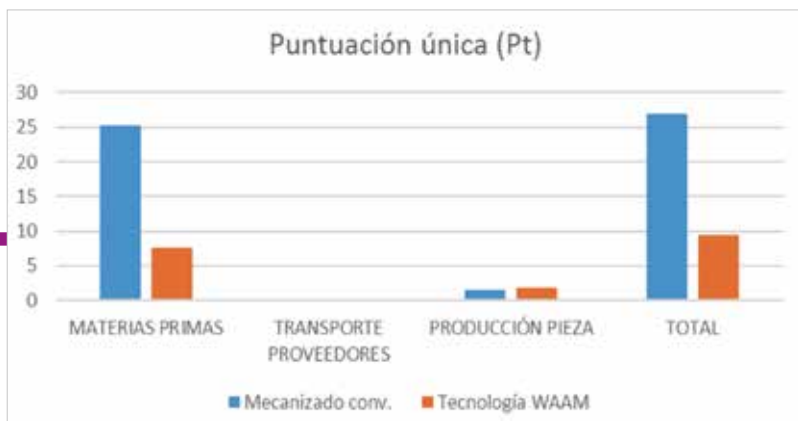
ADDILAN, manufacturer of high added value and medium-large components for sectors such as aeronautics and aerospace, has led ECO-START, with the collaboration of the specialist eco-design consultancy firm, IK-INGENIERIA, the TECNALIA Technology Centre and ACITURRI, one of the leading companies in the aeronautics sector in Spain.

COLLABORATORS



IK / INGENIERIA





OBJECTIVES

- Provide an alternative to metal part manufacturing industrial sectors, by replacing the current stages of obtaining preforms (billets, castings or forgings) with their manufacture by means of additive manufacturing with a high input rate.
- Implement wire and arc additive manufacturing (WAAM) technology, which combines arc welding and wire material processes, to obtain high quality preforms with Buy to Fly ratios below 4:1.



RESULTS

- The comparative Life Cycle Analysis (LCA) on a titanium alloy part shows that the use of the preform manufactured by WAAM reduces the environmental impact of the manufacturing of the part by 60%, also detecting room for improvement in critical environmental aspects of the WAAM technology in the final environmental impact.
- Development of three different alternatives by varying the geometry and manufacturing strategy, resulting in an average reduction in environmental impact of 15% compared to the original WAAM design, and 70% compared to manufacturing the part using the existing block machining process. Savings in CO₂ equivalent emissions could reach 1,700 tonnes each year.
- Reduction of cost and manufacturing time by an average of 22% and 14%, respectively.
- Manufacture of a mechanically characterised prototype part: the properties of the part obtained are superior to those set by the standard for Titanium Blocks (AMS-4911) and are close to the values required for Forgings (AMS-4928).



CONCLUSIONS

- ECO-START has demonstrated that WAAM technology can be an alternative to the manufacture of machined titanium components from blocks, castings and forgings, reducing environmental impact, manufacturing costs and production times, while meeting the required mechanical requirements.
- The ECO-START results have been included in a dossier added to the commercial catalogues used in the company's sales actions.

DRIVING FACTOR

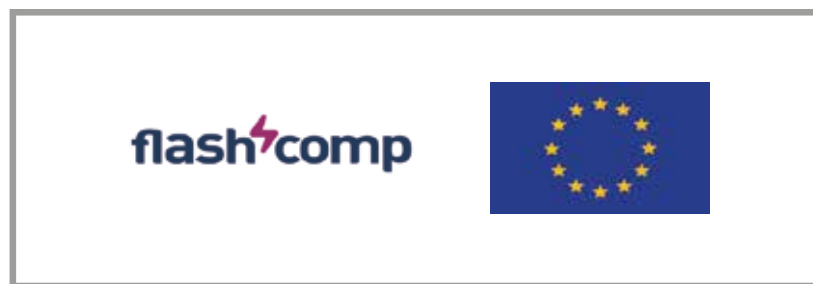


**WASTE DISPOSAL
REDUCTION**



**RAW MATERIALS COSTS
AND SUPPLY**

The design of the FLASHCOMP project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative. FLASHCOMP has been funded by the European HORIZON EUROPE programme.



COMPOSITE MANUFACTURING? FIRST TIME!

MOBILISING INDUSTRY TOWARDS A CLEAN AND CIRCULAR ECONOMY

is one of the main strategies set out in the European Green Deal, which stated in 2019 that any circular economy action plan must prioritise the reduction and reuse of materials prior to their recycling. Reducing manufacturing waste is therefore a priority in Europe's transition to climate neutrality.

According to the Basque Waste Prevention and Management Plan 2030, composites represent one of the greatest revolutions in the world of materials in recent decades. They are gradually conquering more and more production segments. The industrial sectors that consume the most composites are construction, transport (automotive, aeronautics, rail and marine), energy, and sports, accounting for 75% of the total market, with automotive (22%) and aeronautics (21% of sales value) being the main players. Packaging, textiles and household appliances are another growing application scenario. From the perspective of the Basque Country, composites deserve special consideration as an emerging waste stream



COLLABORATORS





DESCRIPTION

FLASH-COMP, a project led by the LORTEK Technology Centre with the participation of 15 entities, develops a fast and reliable quality control solution that uses artificial intelligence to help identify and eliminate defects during the manufacturing processes of composites (composite materials). This defect-free manufacturing approach will help reduce the volume of waste in manufacturing by more than 30%. The decision-making support system is based on an intelligent tool to estimate the severity of defects, which enables their early detection by means of innovative inspection and control devices.

The industrial feasibility of FLASH-COMP solutions will be demonstrated and validated in

two key industrial environments, representing different industrial sectors and covering different materials, part sizes and monitoring and inspection challenges. An overall performance assessment will be carried out for each use case to validate the environmental impact reduction capability of FLASH-COMP solutions when implemented in industrial configurations: yachts whose composite structures, like ship hulls, can range from 14 to 50 metres in length, and manufacturing of composites for wings in airborne and astronomical systems.

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



RAW MATERIALS COSTS AND SUPPLY



ALTXOR OPTIMISATION AND ROBOTISATION TO INCREASE THE QUALITY OF STEEL SCRAP

THE INCREASE IN SCRAP CONSUMPTION AND ITS LOW

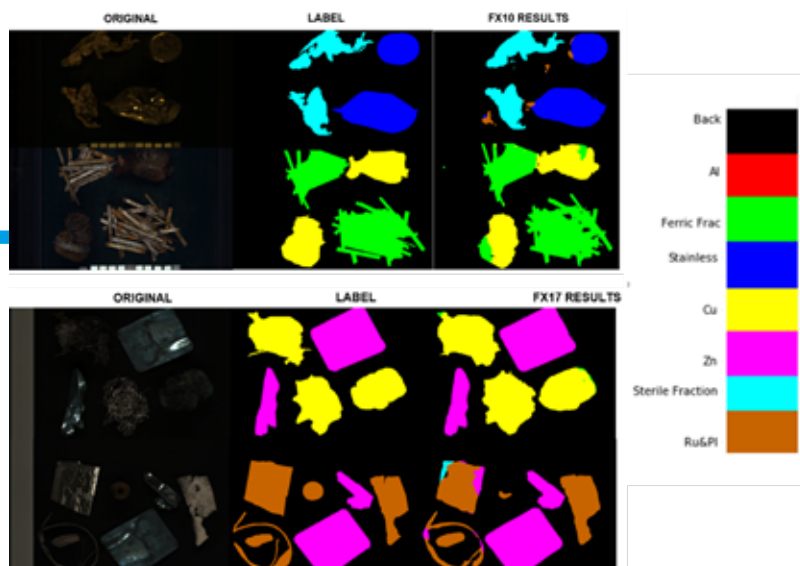
AVAILABILITY means that tools must be available to improve and control the quality of lower quality scrap for steel production. Steel scrap contains a series of residual elements that are harmful to steel, such as copper (Cu), tin (Sn), chromium (Cr), nickel (Ni), etc., which cannot be removed in the manufacturing process and must be diluted to guarantee the final quality of the steel to be produced.

ARCELOR MITTAL BASQUE COUNTRY RESEARCH CENTRE is a Research Centre specialised in the steel sector, which is currently working on optimising the electric arc furnace (EAF) process, continuous casting and the treatment of scrap through new characterisation technologies. ARCELOR MITTAL (AM) SESTAO manufactures high quality flat steel products from recycled scrap in an electric arc furnace, and is aiming to consume 100% local scrap, so the installation of a scrap treatment plant could be of interest to improve the plant's operating results.

ARCELOR MITTAL leads ALTXOR and has relied on the TEKNIKER Technology Centre and its experience in the development of artificial vision solutions.

COLLABORATORS





OBJECTIVES

- Provide ARCELOR MITTAL plants with advanced tools for the characterisation of ferrous scrap, enabling them to optimise purchasing strategies for obsolete scrap as the main raw material.
- Drive the AM Sestao plant in its pilot decarbonisation process.
- Increase knowledge of existing technologies, capabilities and limitations 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

- Improve and control the quality of scrap using the magnetic separator for the separation of fragmented scrap, with a decrease in non-ferrous and non-metallic materials (Cu reduction by 0.20% and increase in Fe content).
- 10% reduction in environmental impact in all impact categories assessed by a comparative Life Cycle Analysis (LCA) with and without scrap sorting.
- Development and optimisation of a pilot sorting facility for ferrous materials capable of detecting the percentage of Cu, Ni, Zn, Al and sterile materials in pixel format in captures by hyperspectral cameras.
- Proposal for a continuous processing scheme with a bin-picking system for the recovery of non-metallic ferrous waste.
- Proposal for a model to measure the efficiency of cleaning machines (ferrous fraction measurement) for real-time optimisation of parameters.



CONCLUSIONS

- The technical, economic and environmental potential of scrap cleaning techniques is high. Given the results obtained, new lines of work have been opened up in terms of improving the quality of ferrous scrap. A new module is being designed for scrap preparation and adaptation.
- The development of a pilot sorting plant for ferrous materials enables harmful materials to be detected, which improves the iron and steel process and also enables the material separated by this sorting plant to be recovered, reducing its environmental impact on electric arc furnace processing, reducing fluxes and the waste generated (slag and emissions).
- The development of a sensor to measure the efficiency of cleaning machines is applicable to the outflows of a magnetic separator.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



BEST PRODUCTION
TECHNIQUES

The design of the LIFE BAUXAL II project has been supported technically and financially by IHOBE within the framework of the "ECO-INNOVATION PROJECT FACTORY" initiative.

LIFE BAUXAL-II has been funded by the European LIFE programme (LIFE17ENV/ES/00160)



COLLABORATORS



RECOVERY OF ALUMINIUM BY-PRODUCTS IN THE REFRACTORY SECTOR

ENERGY-INTENSIVE ACTIVITIES, SUCH AS STEEL AND ALUMINIUM PRODUCTION, use refractory or heat-resistant products as protective linings in furnaces. Refractory products are made from minerals, such as magnesite, graphite, dolomite and bauxite. To produce cast aluminium, bauxite-based refractory castables - or bauxite cast in bricks or other forms - are essential. The EU is highly dependent on imports of these natural resources, including bauxite. The EU imports around half a million tonnes of refractory bauxite each year, mainly from China. EU importers are therefore at the mercy of China's restrictive export policies.

Bauxite could be replaced by an alternative raw material which is obtained from the recycling of salt slag, secondary aluminium oxide. The European aluminium sector produces one million tonnes of salt slag each year from the secondary smelting of scrap and other aluminium waste. Salt slag contains salts, aluminium oxide, aluminium metal and impurities and is classified as hazardous waste in the EU. The recycling process allows for the recovery of different products, including metal oxides, with an aluminium content of 60-70% in weight, which becomes an alternative to bauxite after undergoing a transformation process.



DESCRIPTION

The LIFE BAUXAL-II project, led by BEFESA, has built a prototype demonstrator with the capacity to treat 650 t/year to carry out an innovative process to transform secondary aluminium oxide, obtained as a by-product of the recycling of aluminium salt slag, into a refractory aggregate, known as BAUXAL, which can be used as the basis for INSERTEC's development of new refractory masses. It will be an appropriate substitute for refractory grade bauxites and its production will therefore reduce the EU's dependence on bauxite imports. The project will demonstrate resource efficiency and contribute to the implementation of the circular economy policy by replacing natural minerals with a secondary material derived from a recycling process.

The expected results include recovering 1,000 tonnes of salt slag, producing at least

650 tonnes of refined secondary aluminium oxide, REFINAL, which will subsequently be demonstrated in different aluminium, steel and iron applications in the form of 200 tonnes of BAUXAL refractory aggregate.

The aim is also to create a defined European target market and a business plan for BAUXAL. BEFESA manages 600,000 tonnes of salt slag each year, so the success of this project and its transformation into BAUXAL refractory aggregate would reduce EU imports of refractory-grade bauxite by 43%.

IHOBE has contributed to the design of LIFE BAUXAL-II in the integration of the life cycle approach in the project, as well as in the promotion and transfer of results.

DRIVING FACTOR



WASTE DISPOSAL
REDUCTION



BEST PRODUCTION
TECHNIQUES



AREZIKLA REUSE OF FOUNDRY SANDS IN THE CORE-MANUFACTURING PROCESS

THE PROBLEM OF FOUNDRY WASTE SAND IN THE BASQUE COUNTRY IS ONE OF THE SECTOR'S PRIORITIES, as there are no sustainable or viable solutions for managing all the volumes of this waste stream. Around 154,000 tonnes of foundry sands and fines are generated annually in the Basque Country, and the recovery rate is around 35%. Landfill disposal is the predominant management method but estimates for 2030 show a significant shortfall in the capacity to accept such sand. Meanwhile, the new Basque Waste Plan has established a ban on landfill for green moulding sands in December 2023 and for chemical moulding sands in December 2025.

BETSAIDE is an iron foundry located in Elorrio (Bizkaia) with annual production in excess of 70,000 tonnes of liquid metal for which the management of foundry sand represents a major environmental challenge. AREZIKLA has been carried out in collaboration with the AZTERLAN Technology Centre.

COLLABORATORS



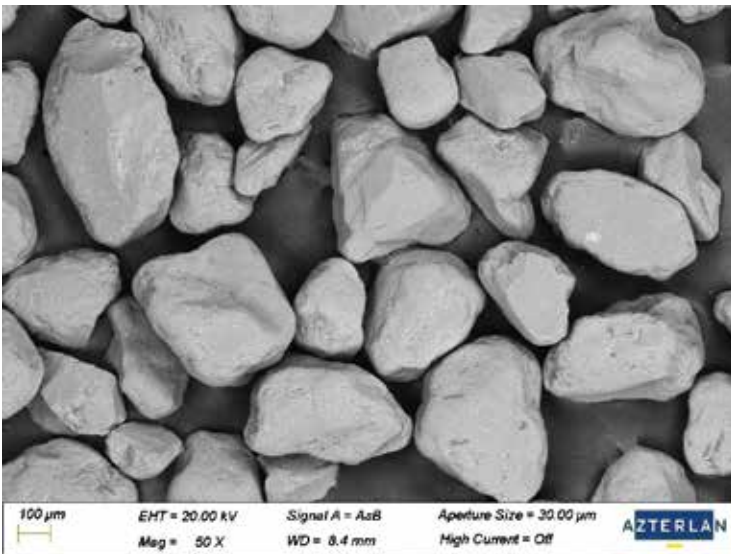
ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Regenerate green sand waste for internal use in the crushing plant as a replacement for new sand.
- Carry out tests on prototypes that demonstrate the viability of green moulding sand regeneration systems, guaranteeing the requirements of the sand for use in BETSAIDE's core-manufacturing process, under the same production conditions and without varying the consumption of binding resins.



RESULTS

- Regeneration of foundry sand by means of a mechanical attrition process that achieves a high degree of sand cleanliness and suitable mechanical strength in core mixes based on 100% reclaimed sand.
- However, these characteristics are not enough for BETSAIDE core specifications and can be improved by adapting a reclaimed sand/new sand mixture.
- Reduction in CO₂ emissions for scenarios using 100% or 60% reclaimed sand of 16% and 28%, respectively.
- Reduction in the fraction of PM2.5 particulate matter attributed to the use of reclaimed sand in both scenarios of 69% and 45%, respectively.
- The impact of the use of 100% reclaimed sand is slightly more than 60% as electricity consumption is higher in sand recovery.



CONCLUSIONS

- It is estimated that the BETSAIDE specifications can be achieved by designing mixtures of new and reclaimed sand and evaluating a mechanical-thermal process to improve the quality of the reclaimed sand and maximise the proportion of reclaimed sand in the mixture.
- The results of the project are of high value to continue advancing in the development of the green sand regeneration process and the adaptation of core manufacturing technology.
- Energy consumption and the waste fines generated may question the economic profitability of the solution.
- As a result of AREZIKLA, a new project, HAZITEK 2022, has been launched which seeks to progress in the mechanical and mechanical-thermal regeneration of green sand and the performance of validation tests on a pilot scale.

DRIVING FACTOR

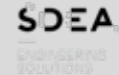


**BEST PRODUCTION
TECHNIQUES**

The design of the LIFE HI4S project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative. LIFE HI4S has been funded by the European LIFE programme under Grant n. LIFE20 CCM/EN/001733



COLLABORATORS



HEAT IT YOURSELF FOR SUSTAINABILITY. CIRCULARITY IN ENERGY-INTENSIVE INDUSTRIES

GENERATING NEW KNOWLEDGE AND INNOVATION ABOUT THE USE AND LIFE CYCLE of materials and energy, identifying specific areas of action to increase material productivity, adopting innovative solutions and promoting resource savings and waste reduction are direct objectives of the transformative project on "Circularity in value chains" included in the 2030 Environmental Framework Programme for the Basque Country.

Most energy-intensive industries use energy in the form of heat and, once the process heat has been applied, the exhaust gases are discharged into the atmosphere via chimneys. The waste heat contained in these exhaust gases is the largest heat loss at manufacturing plants. Most industries using the Electric Arc Furnace lower the temperature and remove the contamination from the large amount of hot gases produced before releasing them into the atmosphere. Therefore, not only is the heat of the gases wasted, but also energy is consumed to treat them and lower their temperature before releasing them.

Waste heat recovery in industrial processes is a well-known topic, but only low/medium temperature solutions under "clean" conditions can be considered mature for widespread implementation. Hot streams containing harmful chemicals or condensable particles require more costly equipment and present fouling, degradation or contamination problems, and therefore require further research and implementation efforts to extract their full energy potential and to be cost-effective.



DESCRIPTION

CIC ENERGIGUNE leads the LIFE HI4S project, which has 8 participating entities (CIC ENERGIGUNE, ARCELORMITTAL SESTAO, ARCELOR MITTAL R&D, SDEA, ENERBASQUE, FIVEMASA, AZTERLAN and LCE). It aims to build a pilot plant to demonstrate a technology for combined heat and power production from the waste heat contained in the exhaust gases of an electric arc furnace (EAF). This innovative and cost-effective technology also seeks to increase the efficiency of the technology by incorporating an innovative thermal energy storage solution using steel mill slag as a thermal storage material.

LIFE HI4S will use high-temperature ceramic filtering systems to avoid the usual fouling problems of traditional technology, and thermal energy storage systems to convert the intermittent and inhomogeneous nature of the exhaust gases from the EAF into a continuous and homogeneous source of useful energy to be managed on demand. The recovered heat is preferably used for the preheating of scrap

metal, with the remaining heat being used for the production of electricity through an ORC cycle, mainly for the self-supply of the pilot plant. Furthermore, LIFE HI4S will develop a digital twin of the heat and energy recovery plant, so that the best operating modes can be determined and scaling and replicability are facilitated.

The prototype for a heat recovery and electricity production plant that will enable waste heat from furnaces to be reused will be installed at the ARCELOR MITTAL plant in Sestao (Bizkaia), with the aim of measuring its environmental benefits "in situ" and demonstrating its economic viability.

IHOBE has contributed to the design of LIFE HI4S by requesting the development of a specific chapter on the BREF documents (European reference documents on best available techniques) on heat recovery from industrial processes, and the inclusion of a life cycle approach and business model.

DRIVING FACTOR



WASTE DISPOSAL REDUCTION



BEST PRODUCTION TECHNIQUES



RESAND ALTERNATIVE MOULDING MATERIALS TO SILICA FOUNDRY SAND

SILICA SAND IS THE MOST WIDELY USED IN THE MOULDING OF CASTINGS DUE to its interesting characteristics, such as high compaction power and large availability of sizes and/or distributions. However, crystalline silica dust in the breathable fraction poses certain problems to be combated in the foundry process: the risk of developing an occupational disease known as “silicosis” caused by exposure to sand dust in mould and core manufacturing and de-moulding operations; the recent classification as a carcinogenic agent (Royal Decree 1154/2000) with a binding occupational exposure limit value of 0.05mg/m³; or the imminent ban on landfill for foundry sands (in accordance with the Basque Waste Plan 2030). Finally, the cost of purchasing silica sand for foundry use has risen to around €40 per tonne, which is a significant expense in many foundries.

EUSKATFUND is an auxiliary company and supplier of foundry products and has led RESAND, in which the FUCHOSA foundry has participated as a partner and in which the AZTERLAN Technology Centre has collaborated.

COLLABORATORS





OBJECTIVES

- Develop an alternative moulding sand to silica sand for the manufacture of moulds and foundry cores from the recovery of black steel slag, which meets the technical properties required for moulds and has a lower impact on the environment and on the health of workers.
- Foster industrial symbiosis between the steel and foundry industries, through new opportunities for the use of the most relevant waste in the Basque Country: steel slag.
- Describe good mouldability, compactability, refractoriness and cooling and de-sanding capacity of steel sand after the part as cooled.
- Obtain the recyclability and reusability of steel sand in several production cycles, in order to minimise the quantities.



RESULTS

- Development of the process of transforming slag into moulding sands of a size and grain distribution in the range of silica sands used in moulding applications. The process combines mechanical grinding, sorting and washing systems.
- Minimisation of crystalline silica emissions: steel sand does not generate them.
- The differentiating characteristics compared to silica sand are: basic pH, higher density, angular grain morphology.
- Significant improvement in the compressive and cracking strengths of steel mixes. The other mechanical properties have also been improved.
- 20% additional demand for water in moulding.
- Reduction in environmental impact in all categories, particularly reductions in climate change (30% reduction in CO₂ emissions), use of fossil resources (32% reduction in energy consumption) and use of mineral resources (36% reduction).



CONCLUSIONS

- Electric arc furnace slag has proven to be a potential and harmless material from the point of view of crystalline silica generation, representing a material of interest to replace silica sand in foundry moulding processes, specifically in green moulding processes.
- The recovery of black slag is an important economic and environmental improvement, but sand formulation needs to be optimised to reduce raw material consumption.
- The impact of this material on the quality of parts, equipment and production resources, possibilities for recycling and reuse still need to be studied further. It should be addressed in a forthcoming demonstration project at an industrial level.
- RESAND results were presented at the 74th World Foundry Congress in Korea in October 2022.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY



ECOFUNNOD SELECTED SCRAP FOR THE MANUFACTURE OF NODULAR CAST IRON PARTS

THE PRODUCTION OF NODULAR CASTINGS CURRENTLY USES AROUND 40% OF PRIMARY INGOT, in addition to the return of castings and a low percentage of scrap (5%), with the addition of alloying elements (manganese (Mn), nickel (Ni), copper (Cu)...). The ingot used is produced from iron ore (Fe), which has a very high impact on CO₂ emissions and the energy required to manufacture it, as well as a higher price (around 25-35% higher than scrap). It is well known that the replacement of ingot with scrap is not an easy process due to the variability of scrap, its composition and the need to increase the percentage of inoculant required, whereby previous experiences show up to about 15% of scrap being used but only in some types of alloys.

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





OBJECTIVES

- Develop a new process for the manufacture of nodular cast iron parts from selected scrap.
- Reduce the percentage of primary ingot used in the furnace charge from the current 40% to 15% or lower.
- Reduce the addition of alloying elements (Mn, Ni, Cu...) by about 25%.
- Reduce carbon footprint and emissions by approximately 85%.
- Improve competitiveness by reducing the cost of raw materials and energy consumption.
- Increase FURESA's market share by 5%.



RESULTS

- Process using a maximum of 10% primary ingot compared to the previous 40%, with an average percentage of 7%, in order to meet the specifications for railway parts.
- Approximate reduction of 31% in energy consumption, 80% in ingot consumption and 28% in slag generation.
- Reduction in the environmental impact of around 85% for categories such as acidification, eutrophication, climate change and ozone depletion.
- 2% reduction in part weight.
- €680,000 reduction in total annual manufacturing costs by using 10% ingot and €1,460,000 annual reduction by using 5% ingot.



CONCLUSIONS

- The study of the effect of the use of scrap for the production of nodular iron, the control of process variability (raw materials and their composition) and the improvement of the working methodology with the incorporation of historical casting data (composition of fillers, chemical analysis, results of mechanical tests) has been key to reducing the rejection of parts and reducing the costs of raw materials, as well as the uncertainties inherent in the process.
- -Thanks to the study of the results of the Life Cycle Analysis in conjunction with IHOBE, an environmental improvement in the manufacturing process of lightened moulds has been identified and will be proposed as a new development project, based on the reduction of the weight of the moulds and their direct manufacture as joined cores.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY



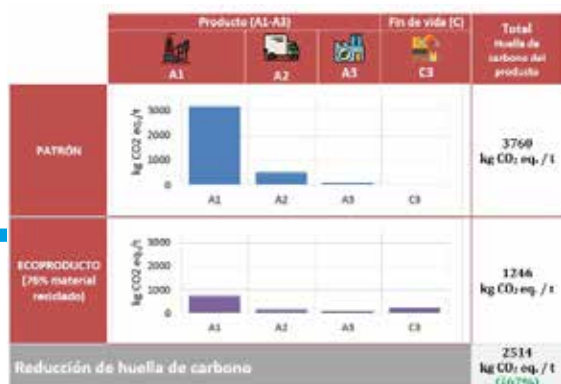
ERIC NEW RANGE OF REFRACTORY ECO-PRODUCTS

DESPITE THE LOW GEOGRAPHICAL AVAILABILITY OF HIGH PURITY RAW MATERIALS for the production of refractory materials, and their associated environmental and economic issues, use of recycled material in their manufacture remains low at 10-15% in the refractory materials sector. Increasing this percentage is a priority for the sector's entire value chain, due to the scarcity of virgin materials, their high cost, and their production in far-off locations.

ERIC is a project led by KROSAKI, one of the largest producers of refractory products in the world. The TECNALIA Technology Centre has also collaborated in the project.

COLLABORATORS





OBJECTIVES

- Reincorporate 50-75% of recovered refractory waste minerals from cement plants.
- Eco-design and develop a new range of refractory eco-products for this purpose.
- Minimise the environmental impact of the final product due to less ore extraction and less transportation.
- Increase productivity in the manufacture of the material by 30%.
- Offer KROSAKI's customer a sustainable product as well as a transferability solution at the end of the life of the waste material in the cement plant, by launching a new eco-product with low environmental impact.



RESULTS

- Inclusion of up to 75% of refractory waste from cement kilns recovered by thermal treatment in the development of new refractory eco-products, with successful characterisation and technical feasibility.
- 67% reduction in the carbon footprint of the production of new refractory eco-products.
- Savings of up to 2.5 tonnes of CO₂ equivalent emissions per tonne of new eco-product.



CONCLUSIONS

- Ecoproducts made from recovered refractory material have the physical-chemical properties required for their reincorporation in certain areas of cement kilns, thus promoting the circular economy of refractory materials.
- Once the first ecoproducts have been successfully obtained from a technical, environmental, economic and commercial perspective, the validation of the products in a cement kiln and their final approval is planned for the near future.



ECO-DESIGN OF EQUIPMENT



INERGAZKI CONTINUOUS PARTICLE SEPARATION FOR EDM MACHINES

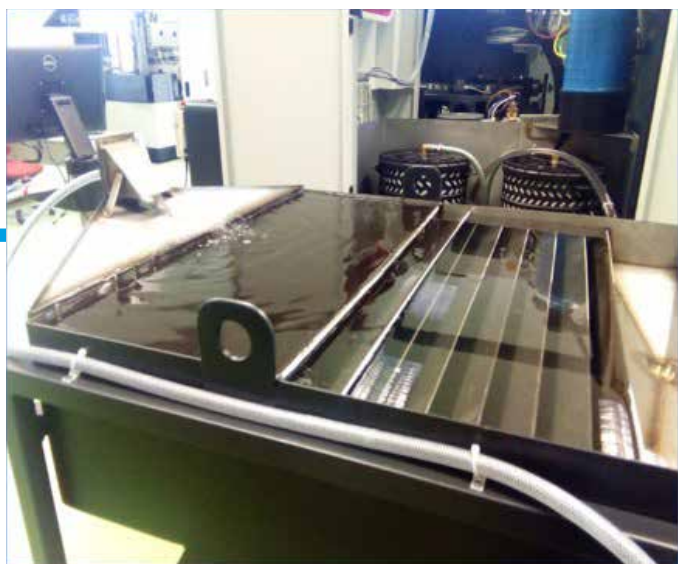


EDM IS A NON-CONTACT MATERIAL REMOVAL PROCESS USING ELECTRICAL DISCHARGES in a dielectric medium between the part and an electrode. The dielectric fluid cools the work area, contains the metal particles generated in the starting process, and must have a low content of these particles to maintain process efficiency, repeatability and quality of results. For this purpose, two types of filters are used in wire EDM (WEDM), which uses deionised water as a dielectric: those based on cartridges with paper filters and self-cleaning filters (mineral filter based on granules of different calibre) of which ONA is the only manufacturer. Today's new machine requirements in the premium sector (ONA AV series) require a higher separation capacity, which has been achieved by means of an additional stage based on conventional disposable cartridges. This solution, although feasible as it increases the lifetime of the disposable filters, requires management of the filter elements after they have been exhausted. The higher plant occupancy of the self-cleaning filters is also a customer concern.

ONA ELECTROEROSION is the world's most specialised manufacturer of EDM machines. INERGAZKI is being developed with the support of the AZTERLAN Technology Centre.

COLLABORATORS





OBJECTIVES

- Eco-design a new, continuous, ecological filtering system based on the principle of separation by inertial forces that guarantees filtration down to 2 microns for any type of particle and material, comparable to disposable paper cartridge filters.
- Minimise the space occupied by the machinery of the new filtering system at the plant.



RESULTS

- Design and manufacture of a full-scale prototype to be coupled to an ONA Premium series machine, with a separation system by centrifugal forces and a decanter with lamella.
- Consideration of flocculant and cartridge filter consumption and waste generation during the use phase, as well as material and energy consumption and emissions during the manufacture of filter systems, as aspects with the highest environmental impact and therefore a priority.
- Increased filtration quality compared to the mineral filter and prolongation of the service life of the paper cartridges or even the possibility of doing without them.
- The much more compact design of the new filter system improves the critical aspect of industrial plant occupancy.



CONCLUSIONS

- The new filtration system has two distinct phases: the first is based on the separation of particles from the WEDM process using centrifugal forces, and the second focuses on a settling system with a geometry based on lamella to favour settling, in a continuous process without self-cleaning or stoppages.
- INERGAZKI's next steps include carrying out industrial tests under conditions not addressed in the project and overcoming the technical problems to be expected in an initial prototype, which have not yet made it possible to visualise industrialisation, although feasibility has been demonstrated under laboratory conditions.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



EXTENDED PRODUCER RESPONSIBILITY (EPR)



ALE SEGREGATION OF SECONDARY ALUMINIUM ALLOY STREAMS

A SO-CALLED DOWNGRADING EFFECT OCCURS IN SECONDARY ALUMINIUM (AL), which enables it to be used as a raw material for references with high technical requirements, to which only primary Al has access. There are only a few production lines for recycled Al wrought alloys in Europe. These lines require a significant input of material from scrap plate and other sources of highly controlled composition, but there is currently no European company capable of obtaining wrought alloys when using aluminium scrap from mixed waste of different origins.

REYDESA, part of the OTUA GROUP, has the best sensorised techniques for extracting the greatest possible amount of secondary Al of homogeneous composition from end-of-life vehicles (ELVs), is leading ALE, on which it has worked with INATEC, the Group's R&D unit, and the GAIKER Technology Centre.

COLLABORATORS



Gaiker

MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Carry out a pre-industrial test with LIBS technology to complete the Al alloy segregation process, improving the current X-Ray separation technique in two qualities (wrought and cast) that is carried out at REYDESA.
- Research, develop and optimise innovative technologies capable of segregating Al alloys of compatible composition by means of XRF (X-ray fluorescence spectrometry) and LIBS (laser induced plasma spectroscopy) sensing, or a combination of XRF sensing, hydrometallurgical process, colour separation, and LIBS.
- Assess the technical and economic feasibility of applying automatic and continuous sorting technologies in order to define an Al scrap by-product of compatible composition capable of competing with primary Al in the Al processing industry.
- Evaluate the sustainability and circularity of the technologies and processes developed in the project by means of a Life Cycle Analysis (LCA).



RESULTS

- The most technically and economically feasible scenario is the application of XRF separation methods for the segregation of alloys according to their heavy alloys (copper and zinc) and LIBS for the separation of alloys according to their light alloys (magnesium and silicon).
- 59% separation is achieved by aluminium alloy families (6xxx, 5xxx and Al-Si).
- A rich remainder fraction of the 1xxx family of aluminium alloys is obtained.
- State-of-the-art clean separation system (FRX + LIBS) with minimal waste generation.
- Savings of 4.7 tonnes of CO₂ equivalent emissions per tonne of aluminium produced, as well as 9,015m³ of water equivalent compared to the production of primary aluminium.



CONCLUSIONS

- XRF and LIBS sensory separation of a post-consumer Al stream (ELV and WEEE), enables the segregation of alloys of compatible composition, obtaining high separation ratios and purities in the alloys studied: Al-Mg-Si, Al-Mg and Al-Si, and product quality is increased by minimising waste generation.
- In LIBS separation, it is necessary to apply the laser ablation technique and/or spectra processing by numerical methods to remove surface interferences (dirt, coating...) from the Al fragments.
- The morphology of the parts for LIBS analysis is problematic in cases in which the parts are not flat.
- On an industrial scale, the analytical production capacity of the combined XRF + LIBS equipment has to be assessed.

DRIVING FACTOR



EXTENDED PRODUCER RESPONSIBILITY (EPR)



RAW MATERIALS COSTS AND SUPPLY



BIOFIL RECOVERY OF METALS BY BIOLEACHING OF SUCTION FILTER WASTE

THE WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

recovery and recycling sector has been called upon to investigate and update its recovery processes in order to increase recovery rates and decrease landfill rates. OTUA GROUP companies managed 6% of the total WEEE in the Basque Country in 2018, with a clearly upward trend to reach 10% in 2020 (1,942 tonnes of WEEE). During its management, WEEE generates various waste streams that are difficult to treat, some of which have sufficient metal content to represent a source of strategic metals of high economic value. This is the case of filter dust collected in the suction system at crushing and separation plants of the separated metal streams. However, this waste is difficult to treat due to its fine granulometry and content of organic matter (25%) and inerts (35%). Its significant economic interest comes from its high copper content (10-30%). Different technological options for its treatment have been tried, but no technically satisfactory results have been obtained to date.

There are no known European-scale processes capable of treating fines from the suction systems of the WEEE shredding and separation process, beyond their treatment in large furnaces of waste management refineries, provided that the metal content is high.

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 BIOFIL project implementation, the company worked with INATEC, the Otua Group's R&D Unit.

COLLABORATORS





OBJECTIVES

- Seek a local solution for suction filter waste at the OTUA GROUP's own facilities, recovering the metal content of these materials, avoiding dumping or the outflow of critical metals from the Basque Country (mainly copper).
- Find the most suitable pre-treatment to optimise the recovery of metals by bioleaching the waste studied.
- Analyse the laboratory and semi-industrial performance of this technology and optimise the conditions to increase the recovery of target metals.
- Study the technical and economic feasibility of the biotechnological process applied to such waste at an industrial level, defining the best conditions to carry it out.
- Assess the sustainability and circularity of the technologies and processes developed in the project by means of a Life Cycle Analysis (LCA).



RESULTS

- 80% effective copper bioleaching in 11 days from suction dust, using bacteria on a semi-industrial scale.
- Effective regeneration of the medium on a laboratory scale for re-use at least once, bioleaching 14% less copper.
- 82% of the copper contained in the sample recovered, with a purity greater than 95%, by the proposed bioleaching process and copper recovery by means of iron cementation
- Savings of 1.55 tonnes of CO₂ equivalent emissions per tonne of filter dust treated, compared to its usual treatment by pyrometallurgical method. However, the technology has major impact due to high water consumption and high use of reagents, resulting in worse impacts such as water consumption, ecotoxicity in fresh water or scarcity of mineral resources.



CONCLUSIONS

- It is difficult to define the economic viability of BIOFIL in the absence of several tests that would shed light on the need for increased production capacity and reagent savings. Without validation of these tests, the BIOFIL process, which is strongly dependent on the potentially recoverable copper content and requires a high investment in assets, is presented as a non-viable process.
- To reduce the environmental impact of BIOFIL, it is necessary to reduce the consumption of water and reagents, which means optimising reuse and improving operating efficiency.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



WASTE DISPOSAL REDUCTION

The design of the LIFE RefrACT project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative. LIFE 5RefrACT has been funded by the European LIFE programme (ENV/ES/000228.).



COLLABORATORS



SYSTEMATIC AND INTEGRATED RECOVERY OF REFRACTORY WASTE USING THE "5R" ENVIRONMENTAL MODEL

REFRACTORY OR HEAT-RESISTANT MATERIALS ARE USED

to protect equipment in industries working at high temperatures (e.g. steel, glass and cement production). Refractories are made from a wide range of mineral compounds, such as aluminosilicates, magnesite, dolomite, chromite, zirconia, carbides, nitrides and oxides. The recycling of refractory materials is complex due to differences in composition depending on their application. Furthermore, it is common to use more than one type of refractory in the lining of furnaces or other equipment, and even in the refractory parts themselves, which further complicates their recycling. Some refractories - for example, those containing zirconia and other more specialised materials - were not considered recoverable prior to this project and were therefore disposed of in landfills.

The availability of refractories is essential for steel production in the EU. The EU produces 177 million tonnes of steel per year (11% of world production), making it the world's second largest steel producer after China. The EU refractory industry has an annual turnover of around €4 billion, but is dependent on the availability of raw materials, which may be affected by strict conditions imposed by exporting countries, such as China. Refractory waste is one of the priority streams in the Basque Waste Prevention and Management Plan 2030.



DESCRIPTION

LIFE 5RefrACT is a project led by SIDENOR with the participation of 5 other entities. The project has applied the 5R environmental model (Reduce-Reuse-Remanufacture-Recycle-Reduce) to the iron and steel sector and the refractory market, mainly in the Basque Country. A series of reuse and remanufacturing practices have been validated and routinely integrated into the operating procedures at the SIDENOR plant in Basauri. A recovery rate of 74% has been achieved, reducing refractory waste disposal by 1,848 tonnes per year. A sorting algorithm has also been developed for the use of LIBS technology in the detection and segregation of refractory waste. The algorithm achieved a 75% success rate in a blind sample test. The results were shared with several recovery firms and future actions are currently being studied. A life cycle analysis quantified the reduction of CO₂ emissions of around 3,900 tonnes, as well as the reduction of energy consumption, thanks to the actions developed within the framework of this project.

Furthermore, several batches of a range of recycled refractory products incorporating

between 30% and 70% refractory waste have been designed, developed and industrially tested. In this way, several magnesia-based and alumina-based products with different market prospects have been technically validated. In both cases, the transition of the regulatory framework is key to the successful implementation of these products, as well as harmonising the interpretation of legal measures at a European level.

IHOBE has contributed to the LIFE 5RefrACT project supporting the inclusion of these solutions by classifying them as emerging techniques in the BREF documents (European reference documents on best available techniques) on steel production, for which the project has already initiated contacts with stakeholders. It has also supported actions related to the communication and promotion of the project. The introduction of stricter regional regulations and use of the new products in other sectors are other areas where work has also been carried out.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



WASTE DISPOSAL REDUCTION



ISOVAL INTEGRATED MANAGEMENT OF STEEL REFRACTORIES

TO DATE, BASQUE STEEL MILLS HAVE CONSUMED MORE THAN 40,000 TONNES of magnesite in refractories each year. Half of it is lost in the production process and the other half becomes waste. By means of an internal improvement team, SIDENOR has managed to recover 60% of the annual 5,000 tonnes of used magnesite refractories through the reuse of refractory bricks, the production of new raw materials and external recycling. This has led to significant financial savings and international recognition, winning the award for the best process at the European Business Awards for the Environment, Spanish section. The expert team has detected additional possibilities for improvement that could increase the level of refractory recovery and transfer this knowledge to other Basque steel mills.

SIDENOR has led ISOVAL, a project in which REYMA, as a refractory manufacturer, and MARUGAN, as an external recovery firm, have also collaborated.

COLLABORATORS



ENVIRONMENTAL

TECHNICAL

ECONOMIC

COMMERCIAL

ON THE MARKET



OBJECTIVES

- Increase the internal refractory recovery rate from 60 to 75%.
- Analyse the direct use of used refractories with the appropriate geometry in new thermally demanding applications, such as false walls or repairs, but with less criticality than in their original applications.
- Develop new refractory products incorporating isostatic waste, e.g. the crowning of ladles or repairs to shower chambers. There is currently no international solution and it is therefore a major technological challenge.
- Evaluate recycling alternatives for lower quality magnesites from the troughs.



RESULTS

- Significant progress in the systematic recovery of waste from MgO-C and High Alumina refractories
- Increase in the average life of the refractory used in steel ladles (MgO-C), reaching almost optimum levels of remaining brick thickness.
- Increased recovery of magnesia-carbon based refractory waste by 81%.
- Systematisation of the practice of recovering 2 rows of bricks from the ladles during the repair of the slag line.
- Production of banquette stone and other refractory products containing high percentages of such residue.
- Increased quantities of clean brick on MgO-C basis, with production of bulk recycled refractory remaining stable.
- 50% increase in the amount of High Alumina refractory destined for external recovery after the generation of new recovery points.



CONCLUSIONS

- The recovery of isostatic refractory waste has been technically demonstrated. Although the characterisation of the concrete resulted in sub-standard values in terms of resistance (RCF), subsequent industrial tests have shown the applicability of the concrete developed in different operations.
- ISOVAL's environmental viability has benefited from the collaboration with external agents for high alumina-based refractory waste.
- The recovery route demonstrated with isostatic waste makes it possible to dispose of waste previously destined for landfill.
- All materials made from refractory waste have been used in non-critical applications, so that the safety of people and processes is ensured above all, as well as the quality of the steel products.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



REDUCTION OF GREENHOUSE GASES (GHGS)



ZEROCARBONHEA
USE OF CARBON-NEUTRAL MATERIALS IN THE ELECTRIC ARC FURNACE

THE APPLICATION OF BIOCHAR IN STEEL PROCESSES HAS

BEEN THE SUBJECT of a large number of studies for many years, as coal fuels can be used a priori to replace fossil energy carriers in the steel sector. In particular, biochar, or charcoal, is currently used as a reducing agent in blast furnaces (BOF process) but not in Electric Arc Furnace steel mills (which represent all the facilities in the Basque Country), where coke and anthracite are used as a fuel source, slag foaming agent and steel recarburant. There is a high potential to replace it with biochar and hence reduce the carbon footprint of the steel industry. In Europe, the contribution of biochar to the decarbonisation of the steel sector is well known, and recent publications have shown that the use of biomaterials seems to be ready for implementation, although these studies also highlight the need for further research, such as that proposed in ZEROCARBONHEA.

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





OBJECTIVES

- Replace the materials used in the melting stage in the EAF (Electric Arc Furnace) with those with a reduced carbon footprint.
- Reduce the Greenhouse Gas (GHG) emissions associated with the use of coal in the Electric Arc Furnace.
- Validate new materials as substitutes for anthracite and foaming agent, enabling their replacement by a neutral/low carbon material.
- Reduce dependence on foreign supplies of anthracite and foaming agent by switching to a local and highly available material.



RESULTS

- Validation of a material with partial plant biomass content as a substitute for anthracite for steel melting, with no technical issues observed.
- Calculated reduction of 20% in emissions compared to anthracite in the production of the material and 30% in its subsequent combustion.
- The full replacement of anthracite with plant biomass offers savings of approximately 450 tonnes of CO₂ equivalent each year.
- Demonstration of technical and environmental feasibility in more than 100 steel castings on an industrial scale.



CONCLUSIONS

- It has been shown that anthracite could be replaced with a material of plant origin, at least partly, without affecting the quality of the steel produced and without incurring additional production costs. The reduction of the carbon footprint would, however, be limited for two reasons: because of the low content of plant material and because anthracite makes a limited contribution to the total carbon footprint of steel.
- However, biochar and biomass prices are currently high and there is a need to develop the biomass management and processing industry to allow for economies of scale so that these products can compete with their mineral counterparts.

DRIVING FACTOR



BEST PRODUCTION
TECHNIQUES



RAW MATERIALS COSTS
AND SUPPLY



KRITEUS II IMPROVED SCRAP AND WASTE MANAGEMENT

BY-PRODUCTS OF THE TUBACEX PRODUCTION PROCESS ARE SCRAP AND WASTE (steel dust and slag), which should be reused as far as possible in order to reduce stock and therefore the financial cost. However, typical work does not involve proper sorting of scrap as the processes are designed to facilitate the evacuation of scrap in large volumes rather than sorting.





OBJECTIVES

- Identify and analyse the volumes of scrap generated from production, stock and sales data at each point in the manufacturing process to identify the generation of scrap and economic potential for savings.
- Internalise the recovery process to control the slag management process and obtain recovered scrap at a lower cost than at present, implementing the process and making the necessary investment in facilities, resources and training.



RESULTS

- Identification of scrap generation in as much detail as possible at each generation point: most steel grades require smaller containers and more frequent scrap collection. The potential savings range from €1.7M to €3.7M.
- Investment (€0.25m) in a new scrap evacuation/transport system, including smaller baskets for scrap collection and sorting, forklifts, personnel, management systems, inter-plant truck flows. Clean points have been set up in designated areas around the plant.
- Preparation of a general scrap sorting guide for Tubacex and a specific guide for each work station, documenting the new scrap management procedures and defining the evacuation, sorting and collection model that preserves the value of the scrap at the authorised clean points.
- Investment (€0.85m) in the modification of the debarking machine and the evacuation of scrap metal in the sawmill area.
- Recovery of some of the waste generated may have a high economic impact if managed correctly. Tests carried out with DIGIMET technology for steel mill dusts (in the KRITEUS project) have recovered between 74% and 80% of chromium and between 69% and 84% of nickel in preliminary tests.



CONCLUSIONS

- Although the value of the metallic material in the slag is high, the analysis and management carried out does not appear to be profitable enough for the investment. However, this is an area to be analysed in greater depth and in which niches can be identified for the use of this slag.
- The next investment phase plans to use and manage all of the scrap generated by the TUBACEX GROUP in Europe.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY



VERTICERO ZERO REFRACTORY LANDFILL IN THE STEEL INDUSTRY

THE GENERATION OF REFRACTORY WASTE IN THE TUBOS REUNIDOS GROUP

(TRG) steelmaking process amounts to 3 kg of magnesite, 3.04 kg of dolomite and 0.6 kg of alumina per tonne of steel. The refractory is changed every 6 casts, although this factor depends on the type of steel processed, and the quantities could vary considerably with different types of carbon and/or processes in other steelworks in the Basque Country. According to the Basque Country's non-hazardous waste statistics, 18,865 tonnes of carbon-based metallurgical refractories, 16,140 tonnes of metallurgical refractories and 3,168 tonnes of non-metallurgical refractories are generated each year.

TRG is a pipe manufacturing company that leads VERTICERO, a project on which it has worked with INTOCAST, a manufacturer of refractory ceramic products, REDENA, a refractory material waste management company, and the CTME Technology Centre.

COLLABORATORS





OBJECTIVES

- Recycle all the metallurgical refractory waste generated at TRG's Amurrio plant, or in other words, 660 tonnes per year of magnesite, 669 tonnes per year of dolomite and 132 tonnes per year of alumina.
- Reduce CO₂ emissions by 2,300 tonnes each year due to the minimisation of the extraction, treatment and transport processes of virgin refractory.
- Replace fluorspar as an acid additive in the process with an alumina-based component, in anticipation of European regulations calling for the elimination of fluorides from the composition of the waste.
- Savings of more than €300,000 each year in raw material and landfill costs.



RESULTS

- Development in the laboratory, verification tests at the TRG plant, and implementation of different pretreatment processes for TRG refractory waste (extraction, gunning, grinding, etc.), with different uses of the secondary materials obtained, and demonstration of their technical feasibility.
- Recovery of dolomite from the ladle for direct reuse, and use of the surplus for refractory mortar.
- Reuse of magnesia plus carbon as a basic additive. It has been reformulated to obtain the required quality.
- Reuse of dolomite as a substitute material for dolomitic lime as a slagging agent.
- Development of the corresponding formula to reconvert alumina into acid additive for refining.
- Savings of more than 1,400 tonnes of different raw materials each year.
- Reduction of waste sent to landfill by more than 2,500 tonnes each year.
- 34% reduction of CO₂ equivalent emissions, achieving savings of 1,900 tonnes per year.



CONCLUSIONS

- The results of VERTICERO are transferable to 10 Basque companies in the iron and steel sector, and its adoption by the sector as a whole would mean savings of 8,000 tonnes of refractory bricks per year, 9,000 tonnes of refractory mortar, 2,000 tonnes of basic additives, and 14,000 tonnes of dolomitic lime, if a significant part of the Basque steel sector were to implement the initiative. Savings in CO₂ equivalent emissions could reach 28,000 tonnes each year.
- TRG is participating in the ReStoRe project, led by the Italian company DEREf, as part of the European Union's Horizon 2020 programme, which shares the same objectives as the VERTICERO project.
- The next major step to be taken is the implementation of grinding at TRG, given the volume of material that can be recovered using the technology developed by VERTICERO.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY



ATOMCESS REPAIR OF COMPONENTS BY ADDITIVE MANUFACTURING FROM POWDER STEEL

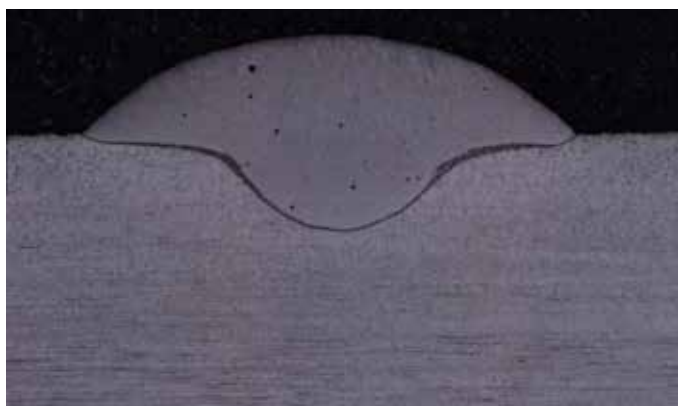
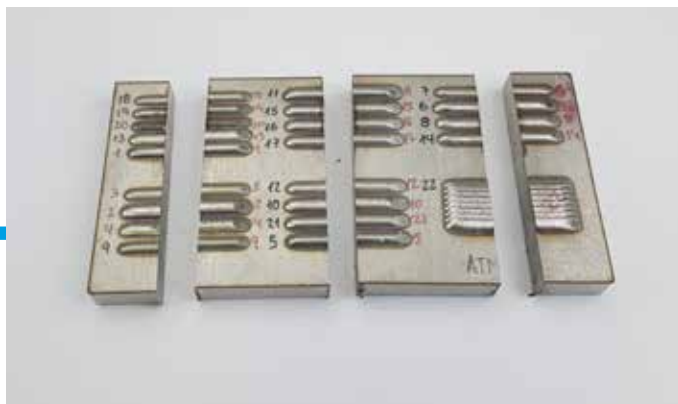
WINOA'S CURRENT PRODUCT IS CARBON STEEL SHOT BETWEEN 100 MM AND 2 MM. The production of special steel shot enables the use of applications with significant economic and environmental added value, working with granulometries similar to the nano scale. For this, it is necessary to use other technologies, such as atomisation by centrifugation (new in the Basque Country), in which WINOA also has a practical advantage due to its size and accessibility of installations.

Repair of defective parts from large castings by additive manufacturing could be beneficial for some 450 tonnes of special steels in high-value parts that are remelted annually in their manufacturing facilities due to minor non-repairable defects, with a consequent energy impact (consumption of 700 kWh per tonne). Although additive manufacturing may have great potential for the repair of these parts, it is still far from being applicable to mass production. However, in the case of ATOMCESS, the application is interesting as it involves the repair of extremely high-value units.

WINOA, world leader in the production of steel abrasives, is the promoter of ATOMCESS, with the participation of the CEIT Technology Centre, the circular economy consultancy firm, ZICLA, and the collaboration of the AMPO and TUBACEX steel companies.

COLLABORATORS





OBJECTIVES

- Atomise new steel powders with the necessary characteristics to be used in the advanced repair of high value-added components using additive manufacturing techniques.
- Determine the optimum composition compatible for the manufacture of processable stainless steel powders by laser metal deposition (LMD).
- Design, build, implement and optimise centrifugal atomisation equipment (ATC) that enables stainless steel powder to be produced with sizes below 700 microns.
- Determine the conditions required by atomised powders for the repair of defects in flat demonstrators obtained from stainless steel parts supplied by AMPO and TUBACEX.
- Analyse the repaired materials and validate the process by means of the standardised tests applied to them.



RESULTS

- Determination of optimal compositional ranges compatible with the manufacture of stainless steel powders processable by LMD.
- Specific scrap selection with volumes available locally, adjustable content in composition and an affordable price.
- Design, installation and optimisation of the parameters of an ATC plant at the WINOA plant in Balmaseda (Bizkaia).
- Obtaining shot powder of a suitable composition, particle size and morphology for use in additive manufacturing.
- Optimisation of repair parameters on stainless steel plate demonstrators including deposition rates.
- Generation and validation of specific process software for the stainless steel powder generated in the atomisation studies.
- Validation of ATOMCESS repair powder on cylindrical geometry for AMPO and TUBACEX materials and parts.
- Improvement of the environmental profile of the repair of steel parts by 99%. For each tonne of steel repaired, the emission of 523 kg of CO₂, consumption of 281 m³ equivalent of water, consumption of 7.35 GJ of energy or the emission of 1.38 kg equivalent of volatile organic compounds are avoided.



CONCLUSIONS

- Certain technical aspects of the installation require extreme precision in order to obtain the desired materials under the right industrial and commercial conditions. The optimisation of the parameters is therefore of high added value and has involved significant effort in the implementation of ATOMCESS.
- Although the process is considered validated, large potential customers of ATOMCESS need to repair parts with complex geometry and in areas that may be difficult to access, which involves developing prototype robots to complete the commercialisation of the project, as well as defining the final business model.

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



WASTE DISPOSAL
REDUCTION



VALOMPLUS

RECOVERY OF MANGANESE
SLUDGE TO ACTIVATE
SECONDARY USES

AUTLAN IS THE SECOND EUROPEAN PRODUCER OF ELECTROLYTIC MANGANESE DIOXIDE (MnO₂ or EMD), a compound necessary for the manufacture of commercial and industrial batteries, whereby it has highly efficient facilities that enable high purity MnO₂ to be obtained, which generates waste of varied composition and in the form of sludge that usually accumulates in landfills and may amount to more than 12,500 tonnes each year.

Results from previous projects showed that the waste could not be used without prior treatment. VALOMPLUS aims to use this knowledge on the waste generated in the preceding project to define the final application for the waste, enabling circular economy principles to be followed and waste recovery to be improved.

AUTLAN has led VALOMPLUS and has relied on the collaboration of OVIEDO UNIVERSITY for its implementation.

COLLABORATORS



Universidad de Oviedo





OBJECTIVES

- Develop procedures to recover the waste sludge generated in the electrolytic manganese dioxide production process, for which no recovery option currently exists worldwide.
- Reduce the amount of waste sludge generated that needs to be landfilled.
- Transform or adapt this waste so that it can be converted into one or more of the raw materials in the production process of AUTLAN or other companies.



RESULTS

- 8% saving in the consumption of raw materials through a new way of reusing waste in the EMD production process developed in collaboration with OVIEDO UNIVERSITY, although it does involve the generation of new waste.
- Identification of particle separation by cyclones as the most suitable separation method among those studied (magnetic separation, filters, etc).
- Difficulties in recovery and the need for large quantities of water and energy for the removal of sulphur contained in the waste.



CONCLUSIONS

- A recovery methodology has been developed that involves the generation of two new types of waste. The implementation of the method developed therefore requires recovery pathways for the two new types of waste.
- This method requires a substantial increase (about 200%) in sulphuric acid consumption.
- The resulting electrolyte cannot be used by AUTLAN EMD or other companies due to impurities. Its purification is being studied.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



CORAL

USE OF PAVAL TO OBTAIN CORUNDUM FOR THE MANUFACTURE OF ABRASIVES

ABRASIVE MATERIALS ARE ESSENTIAL FOR SHAPING AND FINISHING

a wide range of materials. They can be of synthetic or natural origin. Synthetics, such as corundum, require significant and costly processing of raw materials, reagents and energy. Its origin lies in areas such as the Alps or Norway in Europe, Niagara Falls in the USA or Ukraine.

The raw material in the production of abrasive grains is calcined bauxite, which produces solid alumina with a purity varying between 95 and 99% through electro-fusion. The technologies available on the market for the use of recycled abrasives focus on reusing the abrasive grains at the end of their useful life. There are some procedures that cover the use of ceramic materials from the construction sector as a source of alumina for the manufacture of recycled corundum, but they do not constitute a sufficient alternative raw material.

BEFESA, a leading European company in hazardous waste recycling services for the aluminium industry, produces around 100,000 tonnes of secondary aluminium oxide each year, and has led CORAL. This secondary aluminium oxide (known as Paval®) has an Al₂O₃ content of around 70%.





OBJECTIVES

- Demonstrate the technical-economic and environmental viability of a secondary aluminium oxide as a raw material for obtaining recycled corundum for use as a raw material in the manufacture of abrasives.
- Add value to the secondary aluminium oxide obtained from the recovery of salt slag, a hazardous waste from aluminium recycling.
- Comprehensively study the ability of secondary aluminium oxide as a candidate for all applications requiring significant alumina content.



RESULTS

- Definition of a roadmap with chemical treatment, calcination and electric arc furnace melting stages.
- Obtain a fused oxide, CORAL, with a chemical composition of mostly corundum (Al_2O_3) and 30% spinel.
- CORAL contains iron in its structure, which would require additional friability testing, and approximately 8% feldspar. Chemical and crystallographic analyses are consistent. However, in order to compete with brown aluminium oxide, an increase in the percentage of aluminium oxide to at least 90% is required.



CONCLUSIONS

- The CORAL product could be used in other markets, such as refractories, as its spinel and feldspar content provides it with specific characteristics in terms of hardness, corrosion resistance and thermal performance, but further analysis, especially the friability test, is recommended to determine its real abrasive potential. The aim is to obtain a higher purity product in future tests.
- The results obtained indicate that there is the possibility of developing a product as a substitute for abrasive materials obtained from the melting of bauxite in electric arc furnaces. However, its abrasive power needs to be confirmed and the materials with which it would compete need to be studied in detail. To do so, there are plans to collaborate with WASHINGTON MILLS, a leading abrasives company.

DRIVING FACTOR



BEST PRODUCTION
TECHNIQUES

The design of the VALZINC project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative. VALZINC has been funded by the Innovation and Development Programme (PID) at the Centre for the Development of Industrial Technology (CDTI).



COLLABORATORS



VALZINC 

OPTIMISATION OF THE PRODUCTION OF HIGH PURITY Zn COMPOUNDS FROM WASTE

ZINC OXIDE IS THE MAIN INORGANIC CHEMICAL IN THE ZINC FAMILY and approximately 8% of the world's zinc is used annually to produce it, amounting to 1,000,000 tonnes. It is produced mainly by pyrometallurgical methods (in furnaces that evaporate the zinc ingots) or by hydrometallurgical methods, using non-renewable resources as raw materials, mainly from mines located in South America and Australia. In addition to the impact and consumption of natural resources involved, they are electro-intensive methods that require an electrolysis stage to deoxidise the mineral and produce the metal, and a subsequent oxidation of that metal. This inefficient production route is due to processes designed simply for the production of the metal, which is the main market for zinc (60% zinc metal vs 8% zinc oxide).

According to data from the European Green Deal, global annual extraction of materials tripled between 1970 and 2017 and continues to grow. Approximately half of total greenhouse gas (GHG) emissions and more than 90% of biodiversity loss and water stress are due to resource extraction and the processing of materials, fuels and food. Only 12% of the materials used by industry come from recycling. Energy-intensive industries are vital to the EU economy as they supply several key value chains. It is crucial to decarbonise and modernise this sector. The Basque Waste Prevention and Management Plan 2030 is committed to better management of metal waste as it reduces dependence on imports of these metals in the Basque Country, producing significant savings in the purchase of raw materials, employment and added value in their recycling.



DESCRIPTION

VALZINC is a project led by BOSTLAN, and addresses the production of commercial zinc compounds from different waste containing this metal by means of a process that avoids the generation of brine. The waste to be treated includes foundry ashes, galvanising sludge and mattes, brass foundry fines, and other possible compatible waste, all of which is generated in the Basque Country, in some cases in significant volumes. The new process allows the production of zinc carbonate and zinc oxide with sufficient quality and chemical purity to access the rubber or ceramics markets, with high chemical specifications and high added value.

VALZINC involves the construction and commissioning of a pilot plant to test batches of 100 kg of waste under semi-industrial conditions for the production of zinc oxide. The pilot plant defines the process applicable to

each type of waste to be treated in detail and enables the necessary data to be obtained for an industrial plant. In addition, the project has designed and initiated a project market plan to ensure the stockpiling of Zn waste and initiate approval processes for the zinc oxide products to be obtained.

IHOBE has supported the design of VALZINC by helping to resolve critical aspects, such as the potential sustainable management of the brine generated, which is acceptable to the administration, and the location of feasible industrial sites for the implementation of the project. It also provided support in the business plan and the sourcing of secondary materials and product destinations. VALZINC has led to the search for funding for the industrial implementation of the process, as well as new development initiatives for the recovery of zinc from other waste sources.

DRIVING FACTOR



POLLUTION MINIMISATION



BIORECIGAS

ELIMINATION OF NO_x AND CO₂ GASES FROM INDUSTRIAL SOURCES THROUGH AN ALGAE BIOFILTER

A mere 17 companies in the Basque Autonomous Community generate 7,500 tonnes of nitrogen oxides (NO_x) annually. European Union generation exceeds 250,000 tonnes each year in certain activities alone.

BROMALGAE is a technological company that designs and develops chemical and biological solutions aimed at the abatement of Greenhouse Gases (GHG), mainly CO₂ and NO_x, generated and emitted by companies that use combustion in their production process, such as steel mills, paper mills, cement factories, glassworks, electricity generators, etc. and by urban traffic pollution. It has adapted and expanded a microalgae-based technology from the work of California Polytechnic State University (CAL POLY).





OBJECTIVES

- Reduce the effects of industrial activity and improve human health by reducing pollutant gases using microalgae.
- Reduce traffic pollution in cities through "artificial urban trees".
- Reduce industrial pollution.
- Produce (harvest) microalgae independently at its own facilities and without relying on polluting companies, with the aim of it being commissioned in October 2022.
- Extend the project internationally, starting with France (Aquitaine Region).
- Consolidate internal organisation.



RESULTS

- Verification and extension of the conclusions obtained by CAL POLY in its day, at a laboratory level, through collaboration with the UNIVERSITY OF THE BASQUE COUNTRY (UPV/EHU).
- Pilot plant designed, built and monitored at the ZABALGARBI solid urban waste energy recovery plant (Bizkaia).
- Verification of the feasibility of the plant in a difficult industrial environment.
- Capture of 15% of CO_2 , and observed captures of NO_x , HCl , H_2F_2 , y H_2SO_4 .
- Finalisation of a new design of closed photobioreactor and the design of the new vertical and modular plant.
- Completion of the "artificial urban tree" prototype.



CONCLUSIONS

- Awareness of the possibilities of BIORECIGAS, in its two versions (industrial abatement and "artificial urban tree") has been extended, starting in the Basque Autonomous Community and extending to Spain and Europe, initially in the south of France.
- BIORECIGAS has led to an increase in staff to cover certain aspects that the initial size of the company did not take into account.
- Collaboration with companies and institutions, such as TECNALIA, GAIKER and the UPV/EHU has increased.
- BIORECIGAS has been the entry project for other projects to continue its results, such as Garbiar and Garbinox, financed by the Basque Government and Bizkaia Provincial Council.

DRIVING FACTOR



RAW MATERIALS COSTS AND SUPPLY



ENVIRONMENTAL POSITIONING AND TRANSPARENCY



VITRINET

DEVELOPMENT OF A NEW GENERATION ECO-DESIGNED DISPLAY CABINET

FUME CUPBOARDS ARE VENTILATION ELEMENTS WITH AN ELECTRONIC CONTROL SYSTEM

that enables the ventilation of the fume cupboard to be activated for the extraction of gases that are dangerous and harmful to the user. It is a rudimentary control and limited in its functions, as the existing design for fume cupboards has remained largely unchanged for the last 15 years, ignoring the technological advantages and functionalities that have occurred over this period: improvement in materials, advances in electronic systems, improvements in the performance and precision of the manufacturing machinery, etc. The entire fume cupboard manufacturing sector follows the same line. Therefore, the development of competitive equipment that improves the working conditions of the users at these facilities is a key opportunity.

BURDINOLA is a cooperative that focuses on the development of laboratory projects, including the manufacture of its own furniture and safety equipment. BURDINOLA has led VITRINET, on which it has worked with ULMA EMBEDDED, a company specialising in electronic manufacturing and design, and the MUKA design studio.

COLLABORATORS



Muka Design Lab





OBJECTIVES

- Develop a new range of state-of-the-art fume cupboards marketed by BURDINOLA.
- Reduce material, manufacturing and transport costs by 40%.
- Monitor the energy consumption of the display cabinet and obtain data for subsequent analysis and proposal of energy improvements, in order to reduce the energy consumption of the display cabinet by up to 15%.
- Improve the user experience by moving from a membrane keyboard to a TFT touch screen (HMI).
- Implement remote commissioning without the need to travel to the site.
- Monitor faults and incidents remotely using IoT (Internet of Things) technologies, without having to travel to the customer's premises, and reducing support time from days to minutes.
- Improve fume cupboard safety by including new sensors.
- Improve the overall safety of the laboratory by using sensors for the remote detection of VOCs (Volatile Organic Compounds) and hazardous compounds.
- Take over as technological leaders in the fume cupboard field and transfer it to the laboratory environment by focusing on efficiency, user experience and, above all, safety.



RESULTS

- Fully developed and finished fume cupboard. It is industrially efficient and technologically advanced in terms of manufacturing, assembly, transport, commissioning and regular maintenance, and clearly improved in relation to the competition.
- Information and documentation has been obtained for the Environmental Product Declaration (EPD).
- 7.5% reduction in material consumption.
- 30% reduction in the assembly process thanks to the system's remote management.



CONCLUSIONS

- VITRINET has been relevant in gaining experience in collaboration with local industrial partners, such as ULMA EMBEDDED as a technology solutions provider.
- Substantial operational improvements in productivity, manufacturability, installation and maintenance have been achieved, as well as a technologically advanced and differential product in the laboratory market.
- The eco-design applied in VITRINET has given rise to a highly efficient, profitable and differential product, which is marketed immediately after the industrialisation phase.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



RAW MATERIALS COSTS AND SUPPLY

The design of the BIOFURFURAL project has been supported technically and financially by IHOBE within the framework of the "ECOINNOVATION PROJECT FACTORY" initiative.



BIOFURFURAL

LOCAL BIOMASS FOR RESINS INTENDED FOR THE FOUNDRY INDUSTRY

FURFURYL ALCOHOL IS USED AS A MONOMER TO SYNTHESISE FURANIC RESINS, which are essential in the foundry industry. This alcohol is manufactured through the hydrogenation of furfural, which in turn is produced from waste biomass, mainly from maize crops or sugar cane bagasse. At present, 100% of the furfuryl alcohol consumed in the Basque Country comes from imports from China. Although alternatives exist, such as producers in South Africa and the Caribbean linked to the sugar cane industry, they are not economically competitive. This means that alcohol-consuming companies are highly dependent on the Asian market, which is notoriously volatile and dependent on the seasonality of harvests and their use as fuel.

The challenge of this project lies in clarifying the technical and economic feasibility of producing furanic resins from furfuryl alcohol using the biomass sources available in the Basque Country: mainly pruning or forestry crop residues, or by-products from the paper industry. The goal is to reduce dependence on imports and strengthen sustainability and the local economy by using the biomass resources already available in the Basque Country".

COLLABORATORS

ASKCHEMICALS
We advance your setting



FOSECO





DESCRIPTION

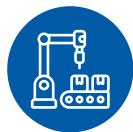
BIOFURFURAL seeks to study the feasibility of setting up a plant for the production of furfuryl alcohol from biomass in the Basque Country, which will enable local and/or surrounding forest waste to be recovered and furfuryl alcohol to be produced. This is an initial analysis step from a competitive environmental monitoring point of view.

The furfuryl alcohol market has developed considerably due to the growing demand for furan resins and in the formulation of thermoset polymer matrix composites, cement, adhesives, coatings and casting resins. There is constant and high demand in Europe, and the production of its own furfuryl alcohol will enable the chemical industry and other Basque sectors to be more competitive, complying with the REACH

regulation, the strategies of the European Green Deal and the New Chemicals Strategy. In order to reduce risks and diversify the plant's capacity, the potential production of other compounds from furfural, which may be more profitable and offset Asian competition from furfuryl alcohol, has also been studied.

The technical feasibility verified in the literature depends on the nature of the vegetable waste used in the first transformation and the processes in order to extract them, which could affect the economic feasibility. Preliminary results on technical and economic feasibility have been positive. The next step is to apply for an R&D&I project through the Basque Government's Bioeconomy Innovation Projects line.

DRIVING FACTOR



**BEST PRODUCTION
TECHNIQUES**



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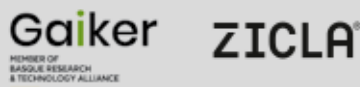
LEHORTUTA DRY INDUSTRIAL SEPARATION OF COMPLEX PLASTIC SCRAP

MASER'S MAIN ACTIVITY FOCUSES ON THE TREATMENT OF THE PLASTIC MIXTURE FROM THE RECYCLING OF ELECTRICAL CABLE WASTE, using a wet separation process that results in recovered fractions of PVC, PE and copper. In order to reduce energy consumption and the water footprint of the process, MASER has implemented a new dry process line which has improved the environmental and production objectives compared to the wet process for the production of recycled PVC: reducing water use and increasing production capacity.

The unique characteristics of this new industrial plant allow for the treatment and recycling of other complex streams of plastics and metals generated in the Basque Country, fractions that are currently not recoverable due to a lack of suitable processes and which are therefore sent to landfill. Some examples of these complex mixtures, most of which are generated by waste management companies based in the Basque Country, are small particle size streams from the management of waste electrical and electronic equipment (WEEE), cables and others, streams generated in the shredding processes of end-of-life vehicles and other scrap, plastics with metal inserts, plastics from window waste, and plastic fractions of different origins.

MASER is a company specialising in the treatment of waste flows with a high plastic content, and has led LEHORTUTA, a project on which it has worked with the GAIKER Technology Centre and the circular economy consultancy firm, ZICLA.

COLLABORATORS





OBJECTIVES

- Demonstrate the technical, economic, environmental and commercial feasibility of MASER's new dry separation process for treating complex plastic fractions.
- Avoid landfill disposal of complex streams with plastic and metal fractions.
- Recover metal concentrates (copper, steel and aluminium) included in these plastic streams
- Recover plastic concentrates for the secondary plastic market.
- Industrial scale demonstration of the new process to treat a complex stream of plastics and metals, selected from the possible ones according to characteristics, accessibility and volume.
- Identify commercial outlets for new fractions of recovered plastics, thus diversifying MASER's commercial portfolio.
- Environmentally assess the treatment process from a Life Cycle Analysis (LCA) perspective.
- Establish MASER as an industrial benchmark for the mechanical recovery of complex plastic and metal streams, laying the foundations for a valid supply for the waste management sector.



RESULTS

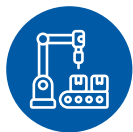
- Characterisation and study of 15 waste fractions received from 7 companies.
- Selection of 4 fractions according to analytical, morphology and experience, for which processes combining different technologies were designed, carrying out a semi-industrial test (approximately 200 Kg) on them in order to select 1 material for a complete industrial test.
- Industrial test production of 92% purified rPET from material at 50% concentration of a reject fraction received from EKOREC, a leading PET recycler in the Basque Country, at a competitive price for all parties.
- 45% reduction of environmental footprint in the process compared to landfilling the fraction.
- Laboratory production of BHET monomer by solvolysis test (chemical recycling) with the rPET obtained.



CONCLUSIONS

- The heterogeneity of waste remains a circumstance in the management of plastic waste of these characteristics. It is necessary that the company supplying the waste produces and stores it under stable conditions
- MASER's combination of mechanical pre-treatment technologies is unique in the Basque Country and can be offered for different waste fractions currently on the market
- The facility is also interesting for the supply of purified materials to the emerging chemical recycling industry, as demonstrated in laboratory tests within the framework of LEHORTUTA.

DRIVING FACTOR



BEST PRODUCTION TECHNIQUES



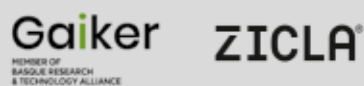
RELOPA

FULL REUSE OF WASTE SLUDGE FROM THE PAPER INDUSTRY

FROM AN ENVIRONMENTAL POINT OF VIEW, THE TREATMENT AND RECOVERY of sludge and paper waste is one of the major drawbacks of the paper industry. Currently 5% of the fibres are lost during the paper manufacturing process. This percentage represents thousands of tonnes of lost raw material, in addition to the generation of waste disposed of in landfills. Pulp and paper waste is the fourth largest waste stream in the Basque Country (182,000 tonnes generated in 2018) and is therefore one of the specific priority waste streams within the Basque Waste Prevention and Management Plan 2030.

ORLOGA is an engineering firm specialised in industrial scaling projects and is behind RELOPA, on which it has worked with ARALAR, a paper manufacturing company.

COLLABORATORS





OBJECTIVES

- Research, design and develop a new solution to obtain high quality nanocellulose from the recovery of waste sludge generated in the paper manufacturing process.
- Obtain and make high-performance nanocellulose available at a low production cost from the treatment of sludge from the paper industry.
- Treat and recover sludge from the ARALAR plant with a km 0 approach by using nanocellulose locally.



RESULTS

- Design and research two different processes at a pilot plant: (1) acid hydrolysis for the recovery of paper sludge (coloured and uncoloured) from the treatment plant; and (2) recovery of waste fibres by disintegration of the line prior to blending and sending to treatment
- Design of a flexible modular plant to produce nanocellulose by acid hydrolysis of waste and virgin cellulose fibres, pending economic and environmental validation in a real environment
- Creation of the B2B (Biomass to Biorefinery) start-up with the aim of developing, validating and launching the solution obtained on the market. Design of the B2B Roadmap, and presentation of an initial pilot plant project through HAZI in Enkarterri.



CONCLUSIONS

- The local approach to the use of nanocellulose in the plant where it is manufactured from its waste is a priority for a viable implementation from the economic, environmental, legal and market point of view.
- It is necessary to validate the results obtained in a real environment through the implementation of a flexible modular plant that enables us to carry out the necessary verifications and validations in order to implement the system in different types of customers.
- This validation will enable industrial applications of nanocellulose to be scaled up in different sectors by carrying out demonstration R&D&I projects with companies and technology centres.



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