Towards a new circular economy through the valorization of plastic and newspaper waste

CEPLAFIB

TOWARDS A NEW CIRCULAR ECONOMY THROUGH THE VALORIZATION OF PLASTIC AND NEWSPAPER WASTE

Could you imagine a world where an integral part of your cars, your house or the packaging of your ordered products are made from recycled newspaper and plastic? That world is far from imaginary, but a reality. After years of research, the European LIFE CEPLAFIB project has managed to implement a revolutionary approach to raise the European recycling rates, promoting a new circular economy in which post-consumer recycled plastic has been reinforced with pulp fibres obtained from wasted newspaper, developing thus a new high-quality material with the potential to be used for mass production in multiple sectors (packaging and automotive, especially).

Project Motivation

CEPLAFIB demonstrates the viability of an economy in which post-consumer plastic is revalued through low-consumption processing technologies. In addition, to obtain the improved products, CEPLAFIB allows sustainable and innovative mechanisms and solutions to be extended to all production processes and methodologies, facilitating thus its transformation into an industry of the future low in carbon, and sensitized with the reduction of the consumption of primary resources and the revaluation of waste in the production lines.

The project also tries to appeal to companies, institutions, and society in general, raising awareness about the need to curb climate change and the real benefits that would accrue from adopting a sustainable socio-economic model.

Background

29.1 M t

Collected plastic post-consumer waste

32,5%
Recycling
81% Inside EU
19% Outside EU

42,6%
Energy recovery

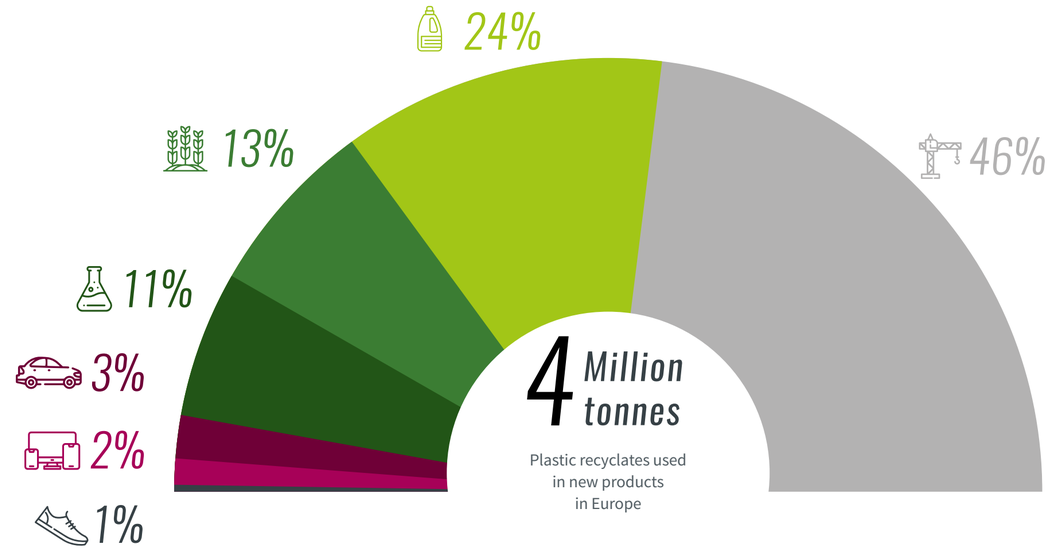
24,9%
Landfill

In 2018, around 29.1 million tonnes of post-consumer plastic waste were collected in Europe to be treated further. Of this, only 32.5% was recycled. 42.6% of this plastic waste stream was recovered energetically, while 24.9% still ended up in landfills.

Plastic Recyclates: *where are they used*

BUILDING & CONSTRUCTION PACKAGING AGRICULTURE OTHERS
AUTOMOTIVE ELECTRICAL & ELECTRONIC HOUSEWARE, LEISURE, SPORTS

In 2018, from the 5 million tonnes of plastic recyclates produced in Europe, 80% re-entered the European economy in orden to manufacture new products. The rest was exported outside Europe to re-enter other regions of the world's economies.



Post-consumer newsprint:
Fibre recicling process

The global paper recycling rate stands for about 58%, while recycling quotes in Europe reaches 72,3%.

OLD NEWSPRINT PAPER

1 COLLECTION
End-of-life newsprint paper collected from homes, waste management, business and recycling sites.

2 SORTING AND BALING
Paper is pre-sorted and graded depending on its type. It is then compressed in bales and stored.

3 PULPING & SCREENING
The newsprint is mixed with water into slurry mixture, called pulp. This mixture is then screened to remove any plastic or glue.

4 DE-INKING
Air is passed through pulp to produce foam which removes at least half of ink. Chemical are also used to separate the ink form paper which is then washed out.

5 DRYING
The wet pulp is dried and passed to hammer milling and refining processes.

6 MILLING & REFINING
Raw newsprint material is refined into medium short fibres by the refiner and then stored in the fibre surge bin.

RECYCLED POLYMER RESINS

Post-consumer plastics:
Mechanical recycling process

In 2018, close to 5 million tonnes of plastic recyclates were produced in European recycling facilities.

END-OF-LIFE PRODUCTS

1 COLLECTION
Collection of end-of-life plastic products from separate and mix waste streams.

2 FIRST SORTING
Separation of waste by type of material (plastic, aluminium, tinplate, cardboard, paper, etc.) and then by type of polymers.

3 SHREDDING
Plastics are grounded into smaller pieces.

4 WASHING
Shredded plastics are washed to remove dust and dirt.

5 SECOND SORTING & CONTROL
Plastics are sorted again and controlled before sent to extrusion.

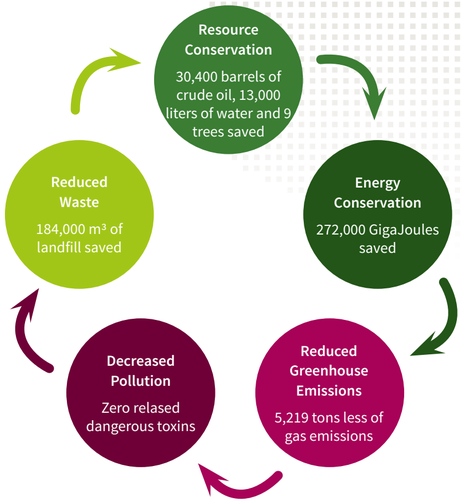
6 EXTRUSION
Plastic flakes are finally converted into high quality of recycled pellets, ready to use in the manufacture of new products.

RECYCLED POLYMER RESINS

Background

Solution to the Environmental problem

CEPLAFIB itself offers a sustainable alternative to the climate change approach with five great purely environmental goals.



Waste Reduction:

The US EPA identified landfills as the main source of methane emissions, and the breakdown of paper is the largest contributor to methane generation. In addition, the current EU fibre recycling yield could increase by 10 million tonnes of paper and cardboard if diverted from landfill and incineration. For every ton of plastic that is recycled, reports estimates that 23 cubic meters of landfill space can be saved. This means that only our project will save 92,000 m3 of landfill space when additional 4,000 tonnes of post-consumer plastic waste will be converted into novel primary raw materials. Within three years after the project completion, we will continue to save the landfill space by same cubic values with the same enthusiasm for recycling, which will be further intensified by newly joint stakeholders.

Conservation of Primary Abiotic Resources:

The US EPA estimates that recycling one ton of plastic conserves approximately 3.8 barrels of crude oil. CEPLAFIB estimates that by the end of the project 15,200 barrels of crude oil will be conserved, and an additional 15,200 barrels a few years after the project ends.

Conservation of Primary Abiotic Resources:

Creating new materials from existing resource streams consumes much less energy than using raw materials. The recycling process uses up to half less energy than traditional manufacturing, significantly reducing the strain on the traditional electrical grid, which relies on incineration of fossil fuels. CEPLAFIB will retain 136,000 GJ over the course of the project, and an additional amount of saved energy GJ units through the replication and transfer actions.

Greenhouse Gas Reduction:

The plastics recycling process requires less energy and fossil fuels; it also results in fewer greenhouse gas emissions. Thus, about 2,609.4 tons of greenhouse effect emissions will be saved through the course of our project.

Global Pollution Reduction:

The plastic resin that is used to make plastic parts also contains potentially harmful chemicals that can leach into the soil or groundwater if they can decompose in the landfill.

Background

Towards a Circular and Sustainable Society

There are materials that even in the final phase of their useful life can be very valuable. Aiming at the transition from a linear to a circular economy, CEPLAFIB uses a global approach to stimulate a paradigm shift, from an economic, social, and environmental point of view.

CEPLAFIB combines the most advanced manufacturing technologies and applications, while transforming two post-consumer waste (plastic + newsprint) into recycled reinforced composite, called CEPLAFIB material. To this end, technologies for sorting and treating of waste, as well as upcycling optimization methodologies, are embedded in a cost-effective manufacturing processes, enabling recycling companies to supply constant streams of high-quality recycled materials.

Main Objectives:

Project Core

The integration of fibres recovered from rejected newsprint paper into recycled post-consumer PP and PE matrices will improve the tensile modulus and yield stress up to 300% of their initial value.

The feasibility of recycled fibre reinforced material processing through the most widespread manufacturing technologies (thermoforming and injection moulding)

The viability of using new recycled materials in three massive applications (packaging, automotive and construction)

The replicability of the project results with other recycled streams (LDPE), transformation processes (blown film extrusion) and applications (films - flexible packaging).

The transferability of the project results to other regions (Poland, Germany, Italy) and sectors (fast moving consumer goods, household appliances, toys, building).

CEPLAFIB will increase public and industrial awareness about the implementation of the circular economy among the different sectors, by demonstrating that the recycling rate can be increased by 40% and greenhouse emissions can be reduced by 40%, by comparing the current recycling activities.

The CEPLAFIB Approach:

Raw materials

Optimization of the production of materials reinforced with recycled fibre and validation of their higher performance.

URBAN PLASTIC WASTE RECYCLING

The effective collection and sorting, the control over the physical and mechanical properties (e.g., dark spotting, elasticity, etc.) and the identification and treatment of additives during the recycling processes at OMAPLAST allows that only a very sophisticated raw materials enters in further transforming chain for producing the high-quality recycled products.

CEPLAFIB project is about to develop a fully-fledged substitute for virgin polyolefin materials (i.e., PP or PE) consisting of 100% post-consumer waste plastics, fulfilling all technical requirements for fibre reinforced plastic composites, and being considered as an aesthetically appealing product. The later are intended to be in full compliance with the technical requirements of final products, covering the mechanical, color and physical properties, by respecting and following all the necessary quality standards defined by the respective industrial application.

PAPER RECYCLING

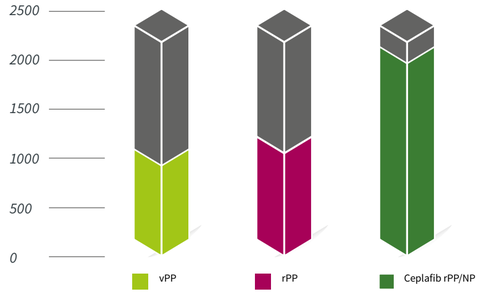
Pre-sorted, deinked, and refined recycled newsprint fibers, used as reinforcing agents in CEPLAFIB composite materials, are collected by vacuum process from the processing line of ECOPULP and then pressed to a briquette form. These briquettes are further sent to extrusion compounding line to be bonded with a recycled polymer matrix under the high temperature and shear compounding conditions into a homogeneous composite melt.

By applying the post-chemically oxidation treatments to the fibre surface at the end of the recovering process, the retention between the fibers and binder-material (plastic) is assured and implemented in high-strength composite materials.

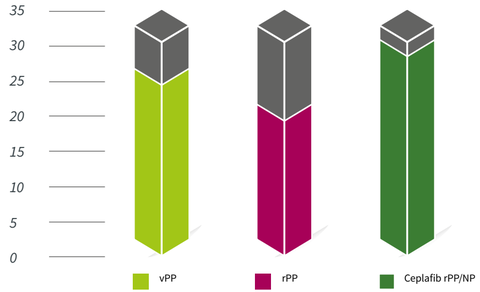
Research Results and Demonstrator:

Extrusion compounding

Through challenging and complex selection of suitable composite components, such as polymer matrix, fibre reinforcements and various modifiers or additives, and along the coordination of the final product requirements, designed for at least three different industrial sectors (packaging, automotive and construction) CEPLAFIB Consortium at final managed to develop two new grades of recycled composite materials that are based on post-consumer plastic resins of PE and PP type and technical recycled fibres obtained from old newsprint paper.



Modulus of elasticity [MPa]



Tensile Strength [MPa]

The first material grade, entitled as Ceplafib® rPP/NP, contains 30% of reinforcing fibres and is intended for high-strength products made by injection moulding. Second grade of CEPLAFIB composite materials, called Ceplafib® rPE/NP is based on recycled polyethylene and 15% of newsprint fibres and is envisioned for thermoforming application processing.

Both types of materials exhibit excellent mechanical properties with up to 210% higher modulus of elasticity and up to 40% higher strength under the applied tensile loads. Their processability can be paralleled with virgin polymers, and their selling price is just below the value of 1€, which represents a significant competitive advantage or unique selling point given to the current situation of rising prices for virgin polymer materials.

Research Results and Demonstrators

Ceplafib materials processing

INJECTION MOULDING

When selecting the appropriate input materials and their ratio compositions for the injection moulding type of composite, we paid a special attention on achieving a sufficient MFI value (> 6 g / 10-min) which acts as a key parameter for the industrial processability. Through the optimization of injection moulding parameters, appropriately designed tool, and knowledge in processing of such materials, CEPLAFIB consortium can say with great enthusiasm that they have managed to layout this process to the optimum state where it can be easily transferred to other areas of injection moulded products.

CASTING & THERMOFORMING

Demonstration in packaging sector

ECOPULP designed two different packaging concepts. The first one is intended for wide production use in the form of packaging protective trays for sensitive instruments, and the second as a protective cover for pvc, metal or concrete pipes against dust contamination during the transportation. For both demonstrators, a specially constructed tools were fabricated, and the hot compression technology was optimized to the individual prototype processability. Sheets from Ceplafib® rPE/NP material grade have been designed and produced by AITIIP with a special appraisal to the pre-forming ability under the applied temperature profiles during the compression moulding process.

Demonstration in automotive sector

The introduction of recycled materials in automotive sector is not an easy task, as they must show a sufficient mechanical resistance and aesthetic quality that can compete with virgin plastic materials. This is especially true when new construction elements are envisaged on which the load capacities and safety of end-users depends. For this reason, a bottom-up approach was followed along CEPLAFIB project by developing a special grade of materials that corresponds to final product application. These were verified through simulation analyses for mechanical durability and successful processability, and finally with standardized quality tests in ADRIA Mobil's prototype vehicles.

The consortium set the design, development, manufacture, production and validation of the two different installation elements for interior and exterior equipment of ADRIA Mobil' motorhomes. The first demonstrator developed is a load-bearing distance holder made with injection moulding technology to raise the double floor in motorhomes.

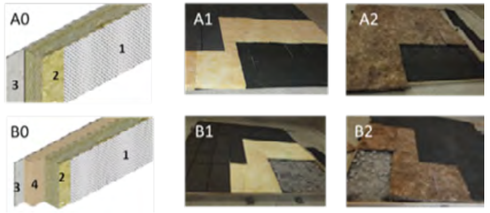
Demonstration in automotive sector

The second element is a thermoformed panel to protect the ventilated slots from the ingress of dust or dirt on the bottom body floor of Adria's motorhome. In both cases, CEPLAFIB can confirm a successful implementation of the two mass production prototypes for recreational vehicles, and confidently claim that CEPLAFIB materials are useful for many other applications or end products in the automotive sector.

Ceplafib materials in construction sector

CEPLAFIB ACOUSTIC BARRIERS AND ELEVATION PANELS

ITB developed two options of acoustic barriers (1 - perforated rPE sheet (HD: LD - 70:30) + NP; 2 - mineral wool type X / type Y; 3 - rPE sheet (HD: LD - 50:50) + NP.; 4 - NP (briquettes)) intended to be mounted to the wall or roof or celling depending on the acoustics requirements. Also, they achieved a successful implementation of the elevation panels made of rPP/NP composite material coated with metallic layers in 3-step process (primer, metallic coating, top-coat).



Ceplafib demo products developed with newly joint stakeholders

1. CEPLAFIB ULLA - SMART HYDRATION REMINDER

A cooperation with Slovenian company - Ulla Labs, a brand owner of smart and engaging contemporary wellness tool, entitled as simple as Ulla. Ulla employs hydration detection, ambient and proximity technologies, and reminds, even motivates people to drink regularly with a subtle yet effective visual alert. Ulla is originally made of virgin plastics, but with a common vision to introduce more environmentally friendly materials a new alliance was born between Ulla Labs and CEPLAFIB Consortium. We jointly created the first Ulla, that is 100% made of recycled post-consumer plastic and wastepaper.

2. CEPLAFIB CONCRETE CUBE MOULDS

Our research partner - ITB and our newly joint stakeholder – company Alkaz Plastics form Poland, successfully introduced CEPLAFIB recycled materials to unique product appliances, now offered as a testing equipment for concrete strength determination, complying the standard EN 12390-1:2012.

3. PROTECTIVE GRASP ELEMENTS IN TAM EUROPE BUSES MADE OF CEPLAFIB MATERIALS

A limited-edition series of protective grasps for handrails in airport bus shuttles were developed with TAM Europe Company with headquarters located in Slovenia. TECOS, CEPLAFIB coordinator, initiated this campaign with an aim to raise the awareness over the prospect potential of CEPLAFIB materials and strong foreground mindset: “Act local, think global”

4. CEPLAFIB RECYCLED TOYS: FROM WASTED PLASTIC YOGURT JARS TO KIDS’ PLAYROOM

CEPLAFIB transferable products reveals that recycling of post-consumer plastic waste can result in something tangible and meaningful. Through our project we manage to demonstrate that cups and jars from yogurt, ice cream, butter, just like the ones in your refrigerator and recycling bins, can ultimately end up back in your children playroom.

5. CEPLAFIB “STRESS-FREE” STORAGE BOXES

CEPLAFIB storage boxes represents another successful replication idea that helps you to become more organized, efficient and stress-free, while helping to protect the planet by incorporating recycled materials and green designs into your home.

6. CEPLAFIB SHOEHORNS

Shoehorns come in all shapes, sizes and materials and while finding the right one is a matter of personal taste, using one is absolutely essential. Meet our CEPLAFIB shoehorns, made of post-consumer recycled plastic, of just the right size for every woman’s handbag or men’s jacket pocket in your preferred colour.

7. CEPLAFIB AIR GRANTING COVERS

ITB – Building Research Institute – a partner of LIFE CEPLAFIB project – leaded already second successfully transferable action with Alkaz Plastics Ltd., a Polish company for injection moulding solutions, and Aereco Ltd., a Poland producer of ventilation systems, for AIR GRATING covers that ensures the uninterrupted air flow and guarantees a proper functioning of the overall ventilation systems.

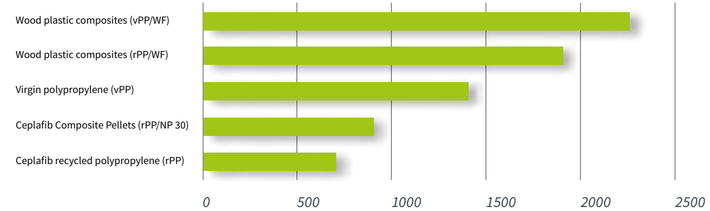
Environmental impact & socioeconomic analysis:

A new value chain

The very latest trends in plastics and polymer resins industry reveals that the most widely represented types of technical plastic grades have experienced a rapid price increase over the past three months, which favourably affects the market penetration of recycled plastic resins. Polyethylene and polypropylene prices, the most used plastic resins, have risen 25 per cent since December to €1,500 per tonne, the highest level since 2015, according to market information service ICIS.

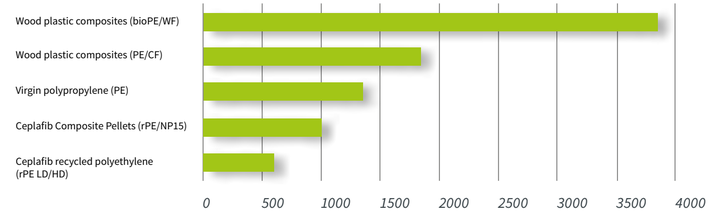
Plastics prices in Europe were among the lowest in the world for much of 2020 but have shot up in recent months on the back of shortages and strong demand. A rebound in crude oil, which the plastic resins are derived from, also added to the upward pressure on prices. Despite the latest trends for jeopardized supply of virgin polymer resins the use of plastics diverted or recovered from the waste streams (recyclates) could be considered as a golden opportunity of advantages to society or in commerce, either environmentally or economically.

Since CEPLAFIB materials are generated from two diverse waste flows with secured supply streams and are far ahead of the competition in terms of their final characteristics and selling price, can be as such marketed under the unique value proposition (UVP).



Comparative cost analysis of CEPLAFIB and competing materials intended for Injection Moulding Applications

Selling price of compounds/resins per unit [€/ton]



Comparative cost analysis of CEPLAFIB and competing materials intended for Extrusion & Thermoforming

Selling price of compounds/resins per unit

ENVIRONMENTAL BENEFITS

The recycling industry has grown quickly in recent decades, and this boom has translated into social, environmental, and economic benefits for society.

Specifically, for plastics the new recycling targets, recently adopted by the "European Strategy for Plastics in a Circular Economy" is now expected to be increased from 22.5% to 55% by 2025. This achievement means that **more than twice the amount of the total recycled material in 2014 and to about one third of the plastic used need to be absorbed by the different end-markets.**

For the absorption of additional tonnages of recycled plastics, the identification of new markets is now more than ever required. The highest potential for absorbing the recycled plastic flows and transforming those into new products are packaging, construction, and automotive sectors. In this sense **CEPLAFIB is addressing the recovery targets by involving the entire recycling chain.**

To current OMAPLAST's recycling rate of 20,000 tonnes/year, additional 4,000 tonnes of post-consumer plastic waste is going to be collected, separated, processed, and put back into the industrial processes to close the recycle-loop with new higher-added value products, specifically adapted to automotive, packaging and construction sectors demands. The short-term plan after the project completion envisages an additional 4,000 tons of recycled waste plastics, which means that by 2024 CEPLAFIB alliance triggers to recycle overall 8,000 additional tons of post-consumer wastes.

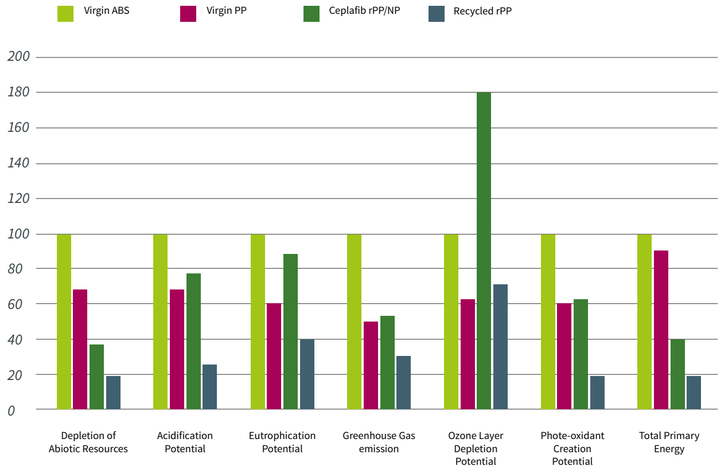
LIFE CYCLE ASSESSMENT

Life cycle assessment or LCA, also known as life cycle analysis, is a methodology for assessing environmental impacts associated with all the stages of a product's life, which is from raw material extraction through materials processing, manufacture, distribution, and use. LCA serve not only as a tool to improve the environment, but also an instrument for industry implying cost-savings and competitive advantages. And this last fact was the main trigger to perform a cradle-to-grave analyses on three final demonstration prototypes of CEPLAFIB project, namely injection moulded distance holder, thermoformed protective panel and hot-pressed pipe covers. In all studied cases the products made of virgin polymers, recycled polyolefins and improved CEPLAFIB composites have been compared and evaluated for environmental indicators: primary energy demand, global warming potential, eutrophication, acidification, depletion of abiotic resources elements, ozone layer depletion and photo-oxidant creation.

For all assessed products, the main environmental impacts are related to the production of used raw materials. The production and transport processes are also rather important contributors, even more in the case of some CEPLAFIB demonstrators because additional production step – compounding – is needed and longer transport routes are expected.

Life Cycle Assesment

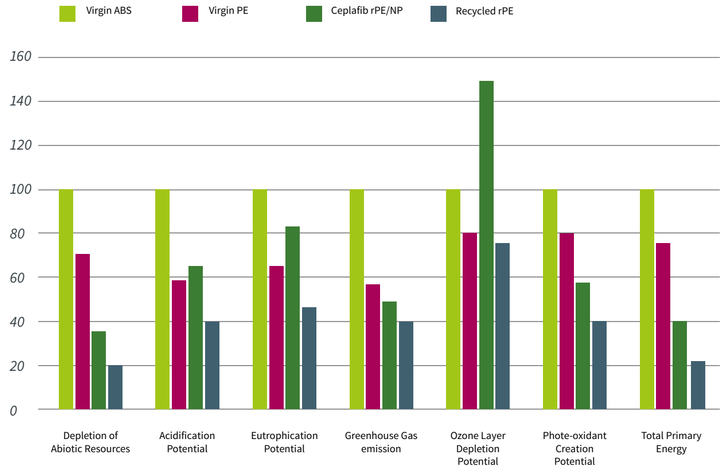
Injection molded distance holders



The comparison of LCA results for injected distance holders revealed that products made of CEPLAFIB composites has a lower environmental impact as traditional one made of virgin ABS or PP apart from the ozone layer depletion potential and primary energy from renewable resources. However, it shows a higher environmental impact compared to distance holder produced from pure recycled post-consumer plastics. The main reasons for the unexpectedly slightly higher primary energy from renewable resources of CEPLAFIB distance holder are the following: (1) impacts, caused by the additional production step (compounding) and recycling process to produce rPP, (2) considerably longer transport routes and (3) impacts, caused by the production of impact modifier and coupling agent.

Life Cycle Assesment

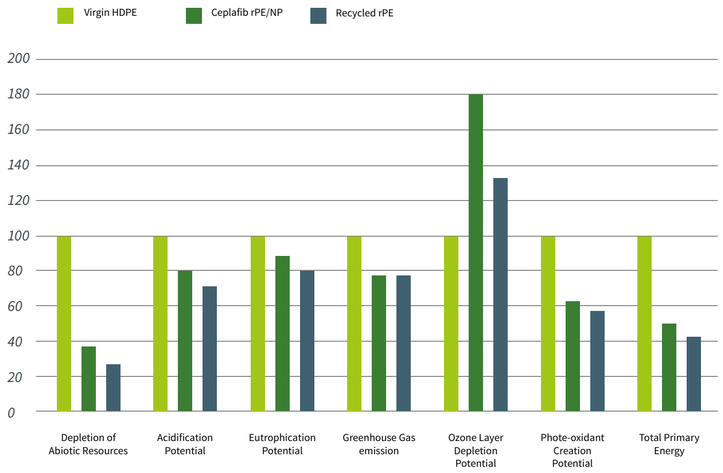
Thermoformed Protective Panels



For CEPLAFIB protective panels it was realized that possesses lower environmental impact as traditional one made of virgin PE with one exception of primary energy from renewable resources. However, it shows higher environmental impacts compared to protective panels produced form pure recycled PE. The main reasons for the higher ozone layer depletion and primary energy from renewable resources can result by the fact that additional production step (compounding) and recycling process to produce pure rPE is needed in the case of CEPLAFIB products, besides the longer transporting routes envisaged and impacts that are caused by the production of impact modifier and coupling agent.

Life Cycle Assesment

Hot-pressed Protective Cover for Pipes



CEPLAFIB protective cover for pipes signalled a lower environmental impact than the traditional one made of virgin HDPE with an exception of the Ozone layer depletion. However, it shows similar results to the covers if produced from pure recycled PE. The main reasons for higher Ozone layer depletion potential of the protective covers made of CEPLAFIB material or recycled PE are linked to the additional production step (compounding) and recycling process to produce rPE, longer transport routes and impacts, caused by the production of impact modifier and coupling agent

ECONOMIC BENEFITS

Both industrial buyers of recycled plastic granules (re-granulates) and end-consumers of plastic products are increasingly conscious of the environmental impact of their actions.

Recycled plastics trade at a 20-40 percent discount to 'virgin' (oil-based) plastics, making it financially attractive to plastic converters. The higher the price of oil, the more attractive recycled plastics become. Given the long-term scarcity of oil, the financial benefit might increase over time. By giving the fact that 30 wt. % in final CEPLAFIB composites represents the cheap newsprint paper fibres with price of 50 €/ton, the resulting materials are even more attractive and market absorbable.

Also, the creation of jobs in the recycling industry, as well as recycling self-employment opportunities. Typically, a plant producing about 50,000 metric tons of recycled plastic will employ around 30 people. This is significantly more jobs than those generated by sending an equivalent amount of waste to landfill or incinerating it, or by the petrochemical industry synthesizing an equivalent quantity of virgin resins – and these jobs are local.

SOCIAL BENEFITS

Key social benefit of CEPLAFIB recycling lays in decreased amount of pollution in our surrounding environments. Many landfill facilities will incinerate plastic to save waste, but on the other hand this can emit toxic pollutants or irritants into the air or soil. Many of these chemicals are known to be persistent (very resistant to degradation in the environment), bio accumulative (builds up in tissues of living organisms) and toxic to all the living population. More and more end-consumers for these reasons appreciate the use of recycled plastic in new products and can better sort their plastic waste. In addition to the social concerns for a better health environment, these combined efforts go in line with the trend that consumers are increasingly concerned at their role in contributing to the plastic crisis. Fifty years after the introduction of the recycling symbol, they expect manufacturers to act and help them consume in a more responsible manner by providing them more eco-friendly products.

From this perspective, products with recycled packaging, as are introduced by CEPLAFIB, are considered in line with the consumer expectations and part of the mainstream market rather than "green" niche. Sustainable packaging is no longer a choice for brands, but a corporate necessity.

SWOT Analysis

STRENGTHS:

- High quality recycled composites
- Low probability of contamination and high repeatability of recyclate properties
- Less GHG emissions and lower consumption of total primary energy
- Excellent mechanical performances allowing extended usage in various application fields (interior/exterior & visible parts)
- Consistency in recyclate features as well as product quality.
- Lower market prices than virgin plastics (type PP, PE) and competitive WPC (wood plastic composites)
- Integrity and sustainability of locally available waste resources
- Color sorted recycling possibilities.

WEAKNESS:

- New infrastructure investments needed.
- Image of the recycled products may be perceived as inferior.
- Post-recycling possible for limited number of times
- Recycling of CEPLAFIB end-of-life products can be circulated limited number of times.
- Inconsistent quality of supplied raw materials (post-consumer plastic and/or paper waste streams)
- Higher processing costs vs. industrial plastic recycling due to more stringent and complex separation and purification steps.

SWOT

OPPORTUNITIES:

- New market niches facing the circular economy.
- Cooperant EU network of plastic composite producers, plastic parts manufacturers, OEMs and recycler in conjunction
- Proximity and customization ability to the specific consumer requirements
- Venturing of new customized CEPLAFIB material formulations
- Improved brand image of the end-user organisation with CEPLAFIB materials
- EU directives and National Government support for the market up-take of recycled plastic products

THREATS:

- The up-coming unknown regulations & national legislations
- Material specifications and demands same as for virgin plastics.
- EOL regulation of CEPLAFIB products
- Ending up in mixed waste stream can jeopardize secondary recycling.
- Price fluctuation dictated by virgin polymers, crude oil and demanding trends in plastic industry.

Industrialization

During the project, the CEPLAFIB compounds were produced on pilot extrusion compounding machine (Coperion ZSK 26) with a processing capacity of 60 kg/h (500 Kg/year) in which all the possible problems that might arise at industrial level were detected and successfully resolved. TECNOPACKAGING, a Spanish SME and one of the VIP stakeholders of the CEPLAFIB project, possess much higher production capacity for the preparation of CEPLAFIB compounds (Coperion ZSK 58), namely by up to 2,000 tones/year.

OMAPLAST on the other hand intends to increase their production of recycled high-grade materials by 20% (4.000 tonnes) at the end of the project, and further 20% shall be reached in 3 years after, totally amounting the 40% increase in recycling rate, specifically from 20,000 to 28,000 tonnes.

The recycling performance of end products is related to the quality of the input flows received, in particular to the nature of pollutants found in the sorting output in relation to the final end-use (i.e., product functionality) and the quality required. The effective collection & sorting, the control over physical and mechanical properties (e.g., dark spotting, elasticity etc.) and the identification and treatment of additives during the recycling processes at the production facilities of OMAPLAST and ECOPULP will allow that **only very sophisticated output materials enters further transforming process chain.**

BUILDING/CONSTRUCTION SECTOR:

To further boost the integration of recycled plastics and recovered fibre materials on the markets, the CEPLAFIB Consortium also explored a certain application in the construction sector. They showed a good potential for uptake of recycled content (e.g., insulation materials, construction elements, outdoor furniture, or dashboards).

In the context of ongoing and upcoming evaluations of EU rules on Construction & Demolition Waste Protocol, the CEPLAFIB project took a special appraisal for specific replicability and transferability ways of promoting this.

AUTOMOTIVE SECTOR:

Today, an average vehicle consists of 12-15 % of plastic parts. If an average car weighs 1,300 kg this amounts to 150-200 kg of plastic per vehicle. The potential to replace this amount of plastic parts with recycled plastic materials is estimated to around 40%.

According to ADRIA's expectations at least 600 tonnes of recycled plastics after the project span could be returned into new product assemblies on annual basis. During the project course the absorption of recycled materials have been demonstrated for the production of two new products:

- Distance holder for double RV's floor with production series of 150,000 pcs/year
- Protective element for hidden venting installations with production capacities of 2,000 pcs/year.

Besides, other potential assortments in automotive interior design, namely extruded plastic profiles, bumper covers, interior furniture, dashboard elements, cup-holders, arm rests and further decorative elements, could replicate the usage of CEPLAFIB materials.

The successful results of CEPLAFIB demo line in the RV sector (ADRIA) will be continued along its chain of suppliers for other final products in automotive or another sectors, which will be also made from recycled plastic composites.

PACKAGING SECTOR:

For packaging demonstrators (ECOPULP) it has been provisioned that extra 30 tons of recycled materials (recycled fibres as raw-material) shall be consumed on annual basis after the end of the project, implemented in new branded functional packages, made of 100% recycled materials.

Current annual capacity of 100 tonnes of recycled fibres now shifted to 25% raise of used recycled materials in new products.

Outreach Activities

- It is estimated that at 25.000 of citizens in the EU have been somehow aware about the LIFE CEPLAFIB project through different dissemination and cooperation actions. At the international level, the partners have interacted with various experts and stakeholders from more than 10 countries. One of the most significant milestones was TECOS as the recipient of the Slovenian National Energy Globe Award for year 2020, which is the world's most prestigious award for sustainability, for their innovative post-consumer waste recycling innovations leaded through LIFE CEPLAFIB Project.
- In terms of visibility, LIFE CEPLAFIB has carried out important communication and branded content campaigns, with their corresponding repercussion in the local and national press, as well as in the general public. The most outstanding, without a doubt, the presence of the ADRIA motorhome in the 2021 edition of one of the most popular sporting events in the world: Le Tour de France. The caravan, with its built-in CEPLAFIB demonstrators, also accompanied the cyclists during the Tour of Slovenia.

- Over time, CEPLAFIB has organized or participated in numerous meetings with the scientific-technical community (such as Virtual Workshop with ADRIA tier-suppliers/dealers) reaching at least 170 people. CEPLAFIB has also had constantly contacts with companies through seminars or B2B visits, gathering more than 200 attendees (for example, 50 people from industry could learn about the project during AITIIP's and Aragonese Automotive Cluster jointed workshop).
- CEPLAFIB organizad a total of 7 meetings with educational community, accumulating almost 200 attendees (such as the OMAPLAST presentation plant to 50 students). Likewise, the project has actively participated in national and international fairs (two examples are the presence of ITB at the International Fair BUDMA or ECOPULP at PacTEc in Hensilki).
- CEPLAFIB has the opportunity to generate synergistic collaboration with policymakers, starting contacts with about ten different institutional representatives (TECOS established contact with the Ministry of Development and Technology, and OMAPLAST did so with the Prime Minister's office).
- LIFE CEPLAFIB was recognized by both the national and international press, being mentioned in more than dozens of publications through blogs, specialized magazines (also with banners), newspapers and radiophonic programs, and has been approached also to the scientific and industrial community throughout numerous scientific papers.
- Several videos were made about the project and its effect on cooperation with other projects and the transfer of knowledge to improve the sustainability practices in industry. This audio-visual content got a great impact especially in social media channels, reaching more than 3.000 people.

Project Partners

TECOS (SI)

Slovenian technological centre for plastic transforming technologies, responsible for development of the injection distance holders. Project Coordinator. Replication / transferability.

OMAPLAST (SI)

Implementing a comprehensive economic on recycled plastic materials from post-consumers waste resources. Industrial partner in charge for post-consumer plastic matrices selection, optimisation, and end-user validation protocols.

AITIIP (ES)

Technological centre involved in the extrusion compounding and the development of the casting sheets for thermoforming. Dissemination leaders.

ADRIA (SI)

One of the leading companies in the EU caravanning branch. Technical expertise in RV's equipment and end-user validation protocols.

ECOPULP (FI)

Developing designs and producing shaped moulded pulps and pressed fibre pieces. Technical expertise in fibre recycling and end-user validation protocols.

ITB (PL)

Scientific research and development in the field of building - construction sectoral applications. Technical expertise in material characterization, replication and transferability exploitation.

LIFE Program: LIFE17 ENV/SI/000119

The LIFE program is the EU funding instrument for environment and climate action created in 1992. The current 2014-2020 funding period has a budget of 3.4 billion euros. http://ec.europa.eu/environment/life/

Project co-financed by the European Union through the LIFE program.
Budget: € 1,832,020
EU contribution: € 1,099,211 Euro
Duration: 36 months
Contact: Vesna Žepič Bogataj vesna.zepic.bogataj@tecos.si

CEPLAFIB

ceplafib.eu