



Project «LIFE GREEN VULCAN»

Layman's Report



With the contribution of the LIFE Programme of the European Union
LIFE19 ENV/IT/000213 - LIFE GREEN VULCAN

Project Information

Project identification number	LIFE19 ENV/IT/000213
Project Full Title	Hight performance devulcanized masterbatches for End-of-Life Tire reuse in high-volume technical compounding applications
Project Acronym	LIFEGREEN VULCAN
Funding scheme	LIFE Environmental and Resource Efficiency
Total eligible budget	2.115.607 €
EU Life Contribution	1.163.583 €
Start date of the project	September 2020
Duration	42 months
End date of the project	February 2024
Project Coordinator	INNOVANDO SRL
Project Website	https://www.lifegreenvulcan.eu/
LinkedIn page	https://www.linkedin.com/company/lifegreenvulcan/?viewAsMember=true

Project Partners



Summary

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1. Project in brief

Recognized as one of the added value projects that fits into the European environmental and climate agenda, the Life Green Vulcan project was selected for implementation in September 2020, in a series of other, very competitive ideas within the LIFE Programme. A technologically highly ready solution for industrialization unequivocally advances to the fulfilment of LIFE Programme objectives – and that is to contribute to the implementation, updating and development of EU environmental and climate policy and legislation, together with the transition towards a clean, circular, energy efficient and climate-resilient economy.

The LIFE Programme, moreover, seeks to develop, demonstrate, and promote innovative techniques, methods, and approaches to reach EU environmental and climate goals. One such technological innovation, developed and patented by one of the project partners Rubber Conversion, was demonstrated, tested and its superiority was confirmed within the project Life Green Vulcan. The result of powerful devulcanization technology has been translated into the industrialization of automotive components: new circular and sustainably developed **spring pads used by partner Stellantis – designed and produced with 20% of the devulcanized material by Rubber Conversion**, as well as automotive tires, precisely **PCR tyre treads, for whose new design partner Bridgestone used 10% of devulcanized material**.

To achieve a true circular process and recycle used tyres back into new tyre or any technical rubber component production, the devulcanization process is a necessary step, as underlined in the previous reports of the European Tyre and Rubber Manufacturers Association. Deployment of this technology at commercial scale, would open opportunities for a more circular business model for the tyre and GRG (General Rubber Goods) industry, allowing the ELTs to be recycled, used as components of new tyres and automotive technical components, and thereby helping to “close the loop” – exactly as demonstrated within the Life Green Vulcan project. The biggest concern when it comes to achieving this goal was related to technical limitations, which were overcome precisely during the realization of the project and the industrialization of the rubber substitute material in the production of new tyres and automotive components.

However, the status under the Waste Management regulation on the EU-wide EoW (End-of-Waste) criteria for the ELT-derived rubber is still under the definition within the Waste Framework Directive (WFD); different regulatory EoW regimes across the Member States are what leads still to difficulties in introducing the recycled material on the EU market. The only missing link for the infrastructure already in place to ensure a regular supply of high-quality material, i.e., the logistical issues of the collection of the End-of-Life Tyres (ELTs) solved through the set-up of the Extended Producer Responsibility (EPR) schemes; one of the project partners and the coordinator Innovando, has an EPR-compliance and logistics service that covers the treatment and traceability issues, which can

guarantee the highest treatment rate. Moreover, within the ELT report, produced on behalf of its clients', Innovando is communicating on an annual basis all the collection, treatment and consequent material and carbon footprint information, reporting it to the relevant Ministries.

The End-of-Life Vehicles Directive, on the other side, that emphasizes an inappropriate management and the environmental problems, on top of the European economy losses, is mainly focused on materials such as the steel, aluminium, copper and plastics. The automotive industry has placed significant focus on sustainable practices, for instance, by reinserting various recycled materials into cars. The rubber, however, despite being one of the major End-of-Life vehicle waste streams due to the complexity of recycling without compromising quality, hasn't been able to match the required automotive properties so far. This translates into the current inability of recycled rubber to meet the requirements of the automotive industry to be considered.

Nevertheless, **the breakthrough technology, developed and patented by Rubber Conversion, has managed to industrialize, and successfully implement a unique method for recovering rubber from both pre-and post-consumer recycled material and to provide an outstanding automotive-grade performance.** Closed-loop manufacturing of new rubber automotive products not only contributes to more efficient management of rubber waste with significantly less consumption of virgin material, but it also enables a considerable CO2 emission reduction, without sacrificing the performance.

2. The problem

Is it possible to replace virgin rubber with recycled one and use it for technical applications and production of new automotive components and tyres, without compromising their quality and performance?

Rubber is a unique material and difficult to replace in all applications in which it is used. The European Commission has included this material in its Critical Raw Materials (CRM) list two times so far, in the revision of the list that is done every three years, underlining the industry-wide and economic importance of this material, as well as the need for its supply diversification. Therefore, the importance of having a reliable access to this material within the EU and across the globe represents a growing concern, as well as the risk associated with the material supply.



Scrap tyres causing a waste problem

Without compromising its quality-related and some other properties, vulcanized rubber is very difficult to recycle, which is why **the End-of-Life Tyres (ELTs) are used at very low concentrations in tyre manufacturing (below 3%), and no recycled rubber is being used to produce automotive-grade technical articles.** Thus, a major part of the End-of-Life Tyres (ELT) and other rubber products are being landfilled (65%) or disposed through incineration (17.5%).

3. The solution

The Life Green Vulcan project has managed to increase the reuse rate of rubber waste with an innovative and environmentally friendly devulcanization technology.

With an extremely powerful method of rubber recycling, patented by Rubber Conersion, the project partners have managed to demonstrate that it is possible to develop a high-quality raw material from ELTs and post-production waste. The Life Green Vulcan project has demonstrated that the resulting material can be used at high loading, as a substitute of virgin rubber, into technical products such as in the production of new tyres (precisely for the production of the new PCR tyre tread), with a 10% weight concentration, as well as in the production of new technical components for the automotive sector (i.e., spring pads), with 20% weight concentration.

The material SRC 450 HP has been specifically developed from the ELTs and adjusted with the Nanofillers (contribution of project partner – University of Trento) and consequently industrialized to produce new spring pads (partner Stellantis) and PCR tyre treads (partner Bridgestone).

After performing a series of tests on materials and finished products to assess, performance, durability, and ageing, both partners Bridgestone and Stellantis have confirmed that the material developed by Rubber Conversion has successfully passed all the tests and procedures.



Material SRC 450 HP developed by Rubber Conversion

Rubber Conversion's technology and material patent is covering nearly 40 countries worldwide (21 in the EU, and 18+ outside of the EU).

Thanks to the development of an innovative mix of Natural Rubber/Styrene-Butadiene Rubber (NR/SBR) devulcanized masterbatch, a new sustainable spring pad for the Alfa Romeo Tonale has been designed and manufactured with 20% weight concentration of recycled ELTs, as well as a PCR tyre tread with 10% weight concentration of recycled ELTs.

Spring Pads

20%



PCR treads

10%

The contribution of each of the project partners is as follows:

- **Innovando** – apart from being the project coordinator, with the support of Ambiente Italia, the company was also responsible for carrying out the detailed environmental impact analysis based on the LCA (Life Cycle Assessment) method;
- **Rubber Conversion** engineered a filler enhanced masterbatch, the SRC Devucanised Masterbatch, from its commercial range SRC grade of ELT-derived devulcanized powders.

- **Bridgestone** ; within the project, Bridgestone has produced their PCR tyre treads by using 10% of the SRC 450 HP material, supplied by Rubber Conversion.
- **Stellantis** produced the new spring pads by using 20% of the Rubber Conversion's material and has implemented a full testing procedure for quality control purposes on rubber components containing recycled rubber.
- **Centro Ricerche Fiat** developed the compound recipe for volume production manufacturing of the spring pads from the SRC Devulcanised Masterbatch and the material and supplier qualification procedure to validate final performances of rubber spring pads containing recycled rubber from SRC Devulcanized Masterbatches. The compound was made with CRF's subcontractor, and the company took care of everything – from molding to the approval.
- **University of Trento** deployed a tailored version of its simulation-based optimization tool to support fine tuning of the SRC Devulcanized Masterbatch and of the compounds of both the CRF spring pads and Bridgestone PCR tyre thread, to reach the desired performance levels set forth by the Technical Data Sheets.

The new rubber compounds are not only contributing to an important raw material savings, but they also provide a significant CO₂ emissions reduction, with a cumulative long-term potential reduction estimated in the range of 500.000 to 1 million ton of equivalent CO₂. The technology developed by Rubber Conversion within the project Life Green Vulcan, significantly contributes to establishing a scalable supply of quality ELT derived sustainable materials for the European tyre and automotive industry, enabling them to achieve their decarbonization targets.

4. Results

The project partners have successfully demonstrated that both tyres and automotive components can be manufactured with high ELT recycled content.



An innovative mix of Natural Rubber/Styrene-Butadiene Rubber (NR/SBR) devulcanized masterbatch from ELT has been developed and upgraded with the Nanofillers, which helped the industrialization process of both spring pads for the Alfa Romeo Tonale, created with 20% weight concentration of recycled ELT and with a PCR tyre tread containing 10% weight concentration of recycled ELT.

After performing a series of tests on materials, the duration of the tyres and vehicles, abrasion, and several other important tests, both partners Bridgestone and Stellantis have confirmed that the material developed by Rubber Conversion has successfully passed all the tests and procedures. These tests assured that components made with a portion of devulcanized rubber ensure high performance in use and can be replaced with those produced entirely in natural rubber.

5. The impact

The European Commission's focus on the strategic nature protection projects related to the environment and climate within the Life Program intends to support the implementation of EU environmental and climate legislation and policies at regional, multi-regional, national, or transnational level. In this sense and on a regulatory side, the policy on the recovery of the End-of-Life rubber in the automotive and General Rubber Goods sectors would contribute to the facilitation of additional expansion of this disruptive solution in markets. The performance of the material is evidently equal to that of virgin rubber; therefore, the solution is strategically harmonized with the goals of the EU Commission related to the threat from a supply chain dependence on raw rubber materials. The missing factor that would accelerate the sustainability and introduce a circular sector approach is the regulatory one.

The technology developed significantly contributes to establishing a scalable supply of quality ELT derived sustainable materials for the European tyre and automotive industry, enabling them to achieve their decarbonization targets.

6. Prospects and applications in the future

Sustainability has become a crucial focus in all industries, especially in tyre and automotive ones, driving leading companies to adopt circular and eco-friendly practices and reduce their environmental footprint. By incorporating sustainable materials, on top of demonstrating a responsible waste management practice, both Bridgestone and Stellantis managed to pave the way for a greener and more environmentally conscious future. In concrete terms of the Life Green Vulcan project achievements, both companies have introduced the innovative materials developed into their industrial production for the two products tested, namely the spring pads in Stellantis case and PCR tyre treads in case of the company Bridgestone.

Moreover, the two companies have started a preliminary study to implement the use of these materials for other automotive components and for a wider range of vehicles, as well as for the tyre compounds for other parts in addition to the tread.

The technology is also being successfully tested for the manufacturing of other automotive components and rubber-based products like gaskets and shoe soles, extending the market application and the overall potential positive impact on decarbonization.

The developed product SRC 450 HP, has therefore a huge potential to be used to produce other rubber components for cars and commercial vehicles, in even higher percentages and in other sectors, such as the footwear one.

Within the project Life Re-Shoes, this has been already demonstrated with the technology of Rubber Conversion.

