

Layman's Report of the LIFE project

"Demonstration of separation and closed loop recycling of carpet waste into polymers for reuse in carpet production"



Project reference: LIFE12 ENV/NL/000269 LIFE

Project location Netherlands

Project start date: 01/07/2013 Project end date: 31/12/2018

Total budget: € 2.238.845 EU contribution: € 1.119.422



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Introduction: from linear to circular carpet production

Carpet manufacture has traditionally followed a linear model, where products are made from components derived from virgin raw materials and disposed of at the end of their use. This linear economy model contributes to the depletion of resources. Nylon yarn, for example, relies on finite fossil fuels. It also increases pressure on the climate and the environment. After use, the majority of carpets are sent to landfill, municipal waste incinerators (to produce electricity) or cement kilns, increasing pressure on the climate and environment.

When carpets become waste in a linear economy model, the value of their materials is lost. The manufacturer has no choice but to start the same process again with new virgin materials.

With climate change and resource scarcity posing significant business risks, including raw material price volatility and supply chain disruption, it is vital that the carpet industry adopts a more regenerative, circular approach to manufacturing, installing and using carpet. This means designing products with healthy materials, producing sustainably, and collecting post-use carpets to upcycle into raw materials for new carpets.

Circular carpet manufacturing is central to Tarkett's sustainability vision to create healthier spaces by making sustainable

flooring that is good for people and good for the environment. In order to achieve this ambition, Tarkett has developed a take-back program called ReStart® which is already operational for other flooring types and will now be gradually rolled out for post-consumer carpet tiles in EMEA.

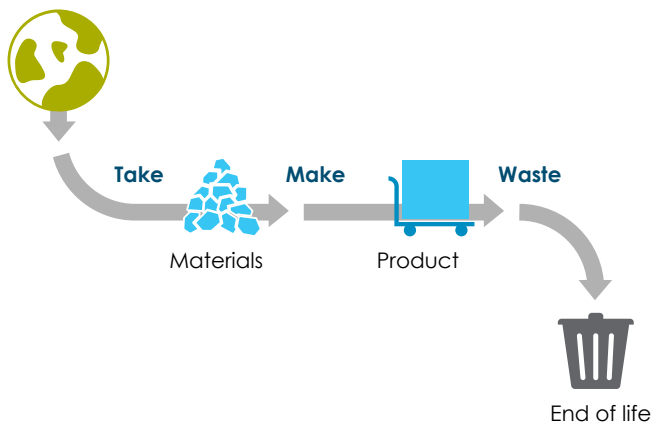
Through its LIFE ClosedLoopCarpet project, Tarkett has made an important step towards 'closing the loop' on its commercial carpet tiles.

At Tarkett's (Formerly Desso) manufacturing plant in Waalwijk, the Netherlands, the company has proven, through the installation of an innovative pilot line, the capability to separate carpet into its key components of yarn and backing which can go to different recycling routes:

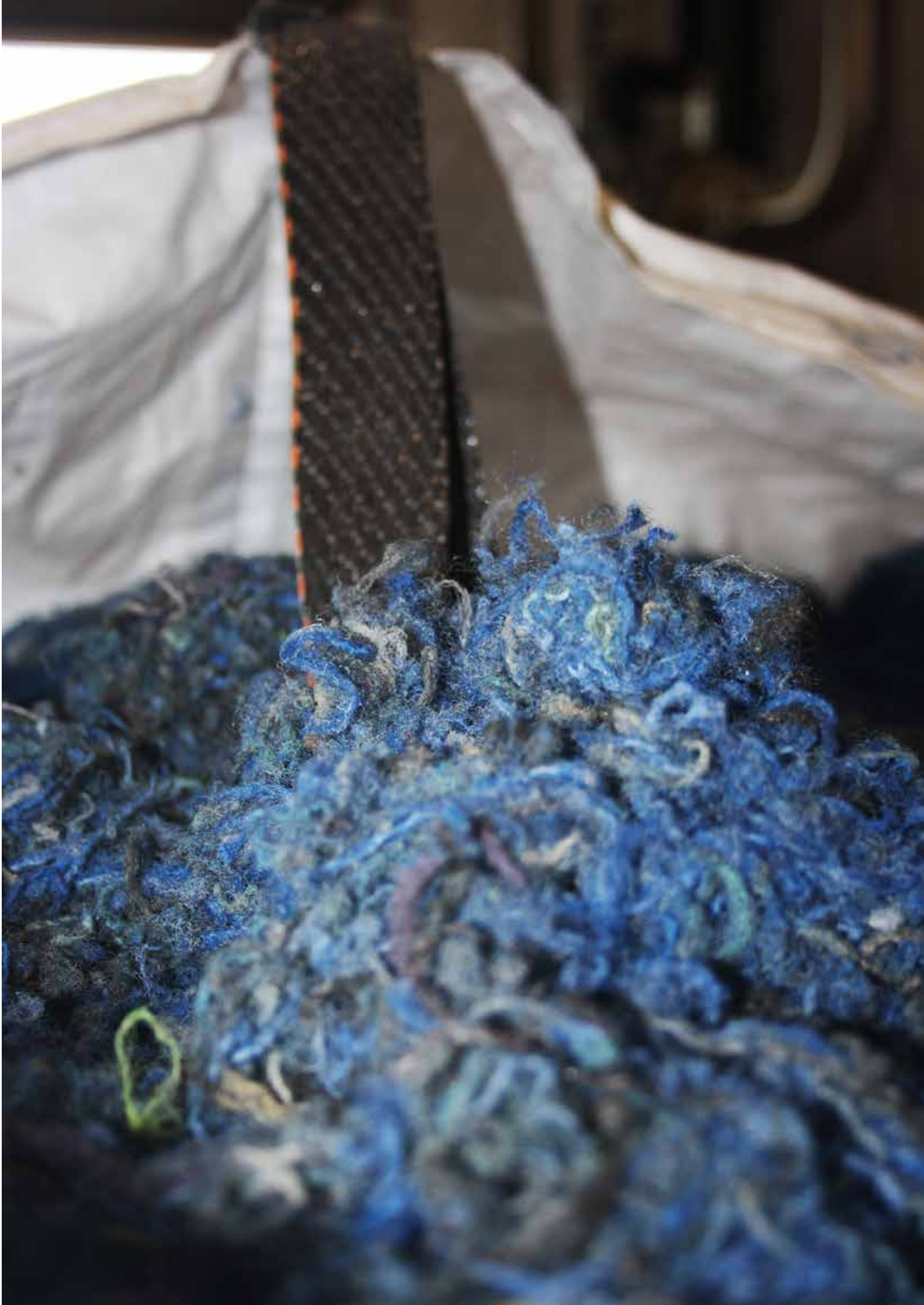
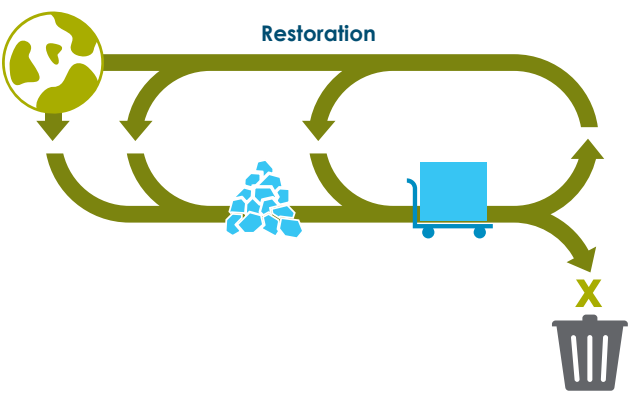
- Nylon 6 yarn can be recovered and upcycled into new yarn, in collaboration with Italian yarn specialist Aquafil. Nylon 6.6 yarn will go to another outlet.
- The company's EcoBase backing material can be transformed into new backing for Ecobase carpet tiles at the same location. For carpet tiles with a bitumen-based backing, this backing will be recycled in the cement industry.

Figure 1 Transition from linear to circular carpet production

THE LINEAR ECONOMY



THE CIRCULAR ECONOMY



Project overview: objective and work plan

The overall objective of the project is:

“To demonstrate the technical and economic feasibility of a separation line based on innovative separation and purification technology, capable of separating discarded carpet material into its primary resources, which can directly be used in the production of new carpets.”

Separation is vital to safe, efficient recycling. Tarkett’s pioneering approach separates used carpet tiles into the main components, ready for transformation into upcycled yarn and Ecobase backing for new tiles. With a strong focus on healthy materials that can be safely recycled and used again, Tarkett has demonstrated the ability to reach an average yarn purity level of >95% , as well as the ability to separate the backing layer for recycling.

The project followed a clear structure:

- A. Preparation - researching the development of the pilot installation and contracting a supplier.
- B. Implementation - engineering, building and starting up the operation of the pilot separation line.
- C. Monitoring and evaluation - tracking the project’s progress towards its goals and assessing environmental and socio-economic impacts.
- D. Communication and reporting – maintaining dialogue with stakeholders, networking with other LIFE projects, reporting progress and developing future plans.

The pilot installation consists of several steps, whereby the backing is separated from the pile material (the soft material on the top of the tile) and the yarn is then cleaned in further steps. For Nylon yarn, an average purity of >95% can be achieved through this process. Nylon 6 yarn can then be reprocessed into new yarn by Aquafil.

In the course of the LIFE project, Tarkett has designed and optimized the process to separate the materials in the most energy and material-efficient manner.

Step 1: Separation

- The sorted carpet material is fed into an installation that separates the backing from the pile. The process is designed to be as simple as possible, in order to separate the yarn from the backing with minimal losses.

Step 2: Purification

- The yarn is processed further, with any remaining backing material removed from the pile material in order to ensure it is as clean as possible, ready for recycling.

Throughout the project, Tarkett continuously sought to optimise the process, exploring a variety of technologies, including a cryogenic process, processes using supercritical CO₂, as well as physical and chemical separation processes. It opted for a highly innovative mechanical separation and purification process, which has yielded the best results in terms of the quality of the recovered materials and of scalability into an industrial operation.

Upcycling carpet yarn into yarn for new tiles

To upcycle Nylon 6 yarn, Tarkett forged a collaboration with Italian yarn specialist Aquafil. At its waste regeneration plant in Ljubljana, Slovenia, Aquafil processes the separated Nylon yarn into new ECONYL® yarn, which is made from 100% regenerated Nylon. By using ECONYL® for the manufacture of new carpet tiles, Tarkett is contributing to closing the loop on Nylon 6 yarn, conserving natural resources and protecting the environment.



Results and future goals

As part of this project, Tarkett has established a pilot separation and purification line and has committed to process 100 tonnes of carpet waste for the duration of the project. In particular, it sought to demonstrate the technical and economic feasibility of separating carpet waste, deepen its understanding of carpet separation and recycling, and pave the way to optimising the separation process. During the project, the line has processed sufficient material in order to establish proof of concept.

Following comprehensive tests of the final pilot line, Tarkett is investing in an industrial-scale separation line which is scheduled to open in Q4 of 2019. This line is scalable, which means that capacity can be increased to suit the market demand for post-consumer recycling of carpet tiles.

Tarkett is committed to engage with its customers and other key stakeholders in order to facilitate the shift towards closed loop recycling of carpet tiles as part of its commitment to the Circular Economy.

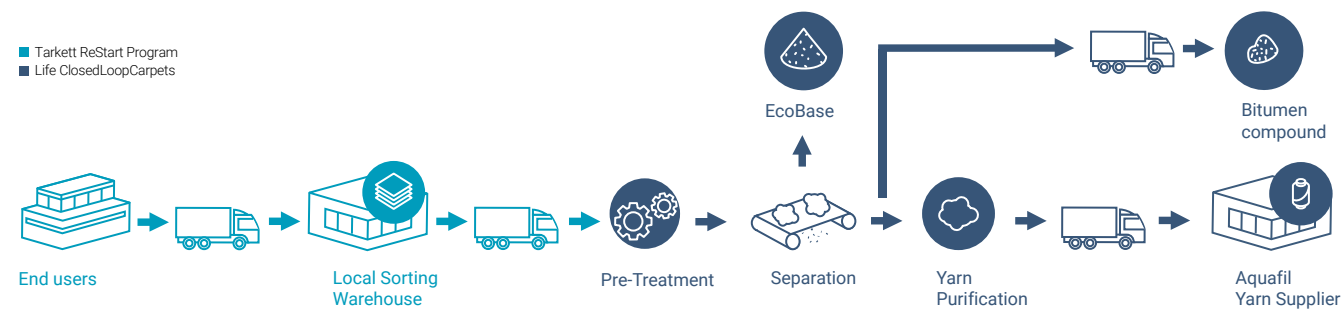


Figure 2 Tarkett ReStart Program and Life ClosedLoopCarpets



Environmental benefits

Tarkett conducted a Life Cycle Assessment (LCA) as part of the project, in order to assess and quantify the environmental benefits of carpet recycling through the LIFE project, in terms of energy and carbon savings.

Methodology

This Quick-Scan LCA follows the procedures of ISO 14040 and 14044. It is called quick-scan LCA (also known as screening or streamlined LCA) because of its limited scope compared with a standard LCA. In this Quick-Scan LCA, this means that no direct contacts with waste processors were sought and that no peer review was carried out. The results of a Quick-Scan LCA can be communicated to third parties as long as it is explicitly mentioned that the results are the outcome of a Quick-Scan LCA and hence indicative.

The following graph shows the reduced CO₂ impact of recovering carpet materials for recycling.

Tarkett carpet recycling process results in a net reduction of CO₂ emissions, as using recycled materials saves energy compared to extracting virgin raw materials. The most significant positive environmental impact is replacing virgin Nylon, which has a relatively high CO₂ footprint, with high quality upcycled Nylon.

The pilot-line yields a reduction of 1,59 ton CO₂-eq. emissions per ton processed EcoBase carpet tile, in comparison to the 'waste-to-energy' scenario

Global Warming Potential (kg CO₂eq.)

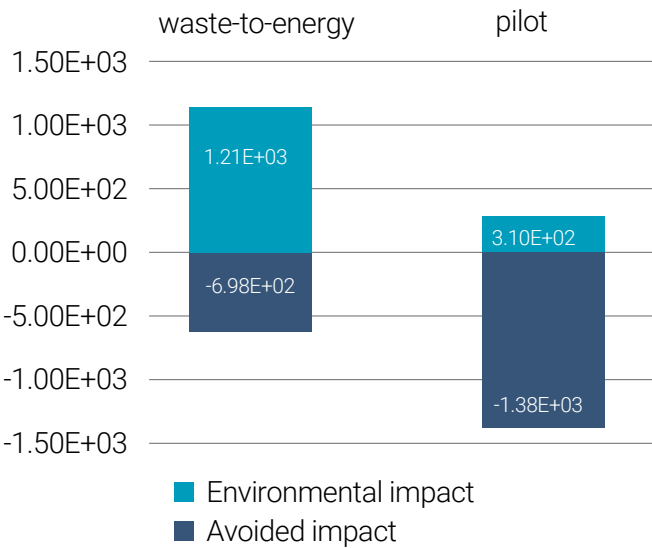


Figure 3 Global warming potential: impact of carpet recycling (pilot and industrial scale operation) versus waste to energy

Contributions to EU policies

By recycling carpet materials in a closed loop, saving energy and raw materials, Tarkett is contributing to several EU policies:

The EU action plan for the circular economy

This is the EU's overall plan to accelerate Europe's transition to a circular economy by maximising the value of healthy materials, preventing waste and conserving natural resources. The plan includes initiatives to boost levels of recovery, recycling and reuse. It stands to deliver major economic benefits, contributing to innovation, growth and job creation.

The Europe 2020 strategy – a resource efficient Europe

One of the seven flagship initiatives of the Europe 2020 strategy aiming to deliver smart, sustainable and inclusive growth. This is Europe's primary strategy for generating growth and jobs, backed by the European Parliament and the European Council.

The roadmap to a resource efficient Europe (COM(2011) 571)

This roadmap is part of the European 2020 strategy and outlines how Europe can achieve a sustainable economy by 2050. It proposes ways to increase resource productivity and decouple economic growth from resource use and the environmental impacts of industry. One of the key elements is turning waste into resource, thereby saving virgin materials, energy and other resources.

The Waste Framework Directive (2008/98/EC):

This Directive is intended to help move the EU closer to a 'recycling society', seeking to avoid waste generation and use waste as a resource. In particular, the Sixth Community Environment Action Programme calls for measures aimed at ensuring the source separation, collection and recycling of priority waste streams, avoiding landfilling or incineration whenever possible.

By developing a high quality separation technology through the LIFE ClosedLoopCarpet project, Tarkett has taken a major step towards the closed loop recycling of carpets, setting an example for the industry in reducing energy and carbon emissions and conserving natural resources. Tarkett gratefully acknowledges the support of the European Commission's LIFE programme for its support in making this possible.



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About Tarkett

With a history stretching back 135 years, Tarkett is a worldwide leader in innovative flooring and sports surface solutions, with net sales of more than €2.8 billion in 2018. Offering a wide range of products including vinyl, linoleum, rubber, carpet, wood and laminate flooring, artificial turf and athletics tracks, the Group serves customers in over 100 countries across the globe. Tarkett has 13,000 employees and 35 industrial sites, and sells 1.3 million square meters of flooring every day, for hospitals, schools, housing, hotels, offices, stores and sports fields. Committed to "Doing Good. Together.", the Group has implemented an eco-innovation strategy based on Cradle to Cradle® principles and promotes circular economy, with the ultimate goal of contributing to people's health and wellbeing, and preserving natural capital. Tarkett is listed on Euronext Paris (compartment A, ISIN: FR0004188670, ticker: TKTT) and is a constituent of the SBF 120 and CAC Mid 60 indexes. www.tarkett.com.