

Recycled rubber components: engineering more sustainable products for the solar market

TCT-Europe is a UK based, European company focused on the design, engineering, prototyping and volume manufacturing, using compression moulding, of products made from recycled rubber crumb. The company was set up three years ago, with operations in the UK and Poland, to take advantage of the growing innovation in sustainable materials emerging in Europe. According to Sarah Skinner, Managing Director and co-founder of TCT-Europe, the key is to understand the material possibilities of rubber crumb in products and use engineering and design to create equivalent or improved alternatives to current virgin synthetic rubber or plastic options.

According to ETRA (European Tire Recycling Association), there are over 3,900,000 tons of tyres removed from cars, lorries, agricultural and other vehicles in the EU-27 Member States which are currently classified as waste. In recent years there has been a significant improvement in the recycling of 'End of Life' Tyres in the EU. Now, less than 9% are sent to landfills, 17% are reused/exported/re-tread, 38% are recycled, and another 36% are used for energy production. Of those tyres that are recycled 63% are channelled into granulation/powders, for use as a base material for new products.

The initial focus for TCT-Europe has been to design and build volume OEM barrier, support blocks and cable management systems for European solar PV companies. TCT-Europe is

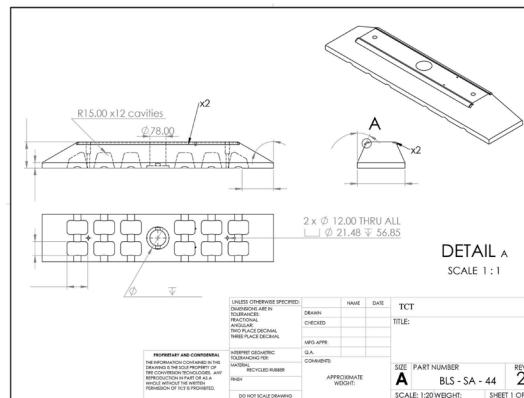
also looking into products for solar car ports and solar charging points. This design process has been supported by key learning and design success from its sister company in the US Tire Conversion Technologies Inc, who have been in business since 2004 and who have built products for solar companies including SMA, Sunpower and K2.

So why build products from recycled tyre rubber? According to Mechanical Engineer and co-founder of TCT-Europe John Lidderdale, there are a number of drivers for this.

Tyre rubber has some key material qualities including high tensile and impact strength, resilience and abrasion resistance. It's flexible in low temperatures and has decent heat resistance. In addition, because tyre rubber is vulcanised the material has a good

ageing stability and is able to withstand UV and last for long periods outside, which is not

According to the ETRA, 121,000 units of energy are required to produce 1kg new rubber but only 2,200 units of energy to produce 1kg of recycled crumb rubber. The result is to produce 4.35 tons of CO₂ from the production process of natural rubber but only 97 kg CO₂ to produce the same amount of recycled rubber. So, the benefit is both in minimising CO₂ emissions contributing to climate change and contributing to the process of sustainable management of natural resources.



Design



New Markets



Manufacturing

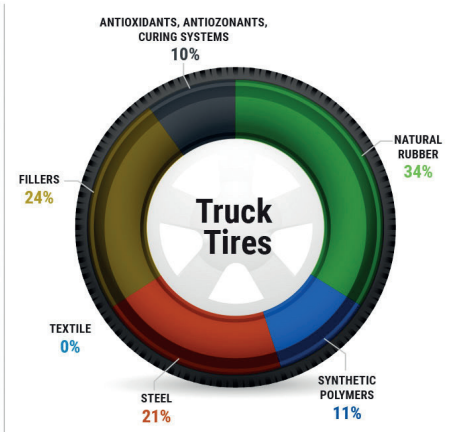
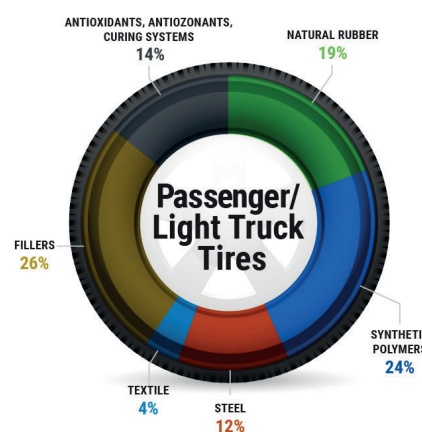
the case for many other virgin synthetic rubbers or plastics.

The second area is greater sustainability than virgin plastic/synthetic rubber alternatives. Part of this is greater energy efficiency, the amount of energy used for recycling tyre rubber needs to be less than the amount of energy used to process natural or new synthetic rubbers. For recycled tyre crumb it is important to look at the energy required to collect and process the tyres. The key is therefore to have the tyres processed as close to source as possible and for the products using that tyre crumb to be located close to these processing facilities. This is why TCT-Europe has located its manufacturing facility in Poland which is both close to the source of the crumb and to its European customers for the end products.

Another factor in sustainability is the end of life of products. TCT-Europe are designing units that can last for years outside. As with most plastics though, the material will weaken each time products are taken back to recycle. In the case of recycled rubber products, the crumb is combined with polyurethane binders and eventually these build up and the crumb can no longer be effectively recycled. Products can be

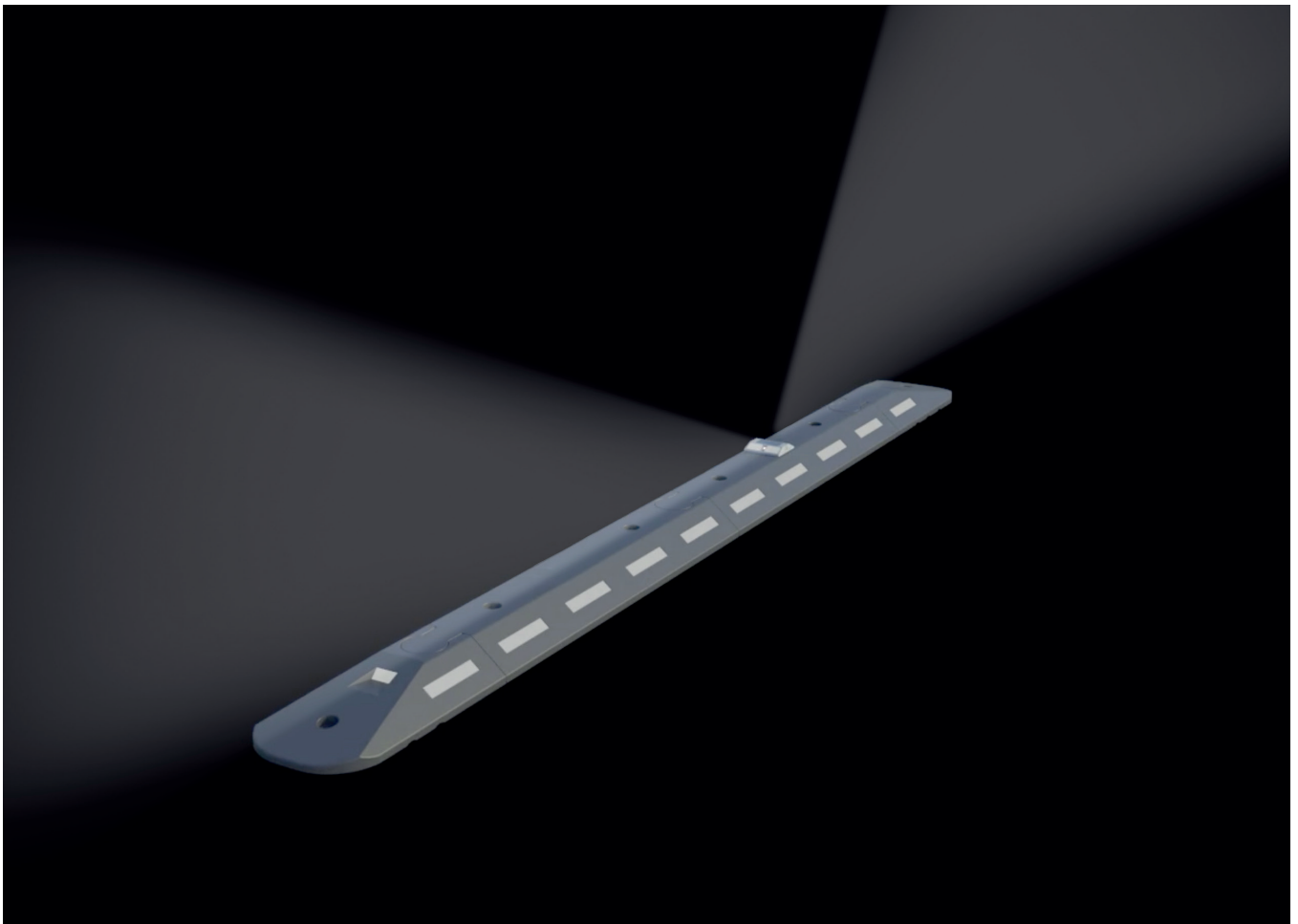
recycled 3-6 times at which point TCT-Europe will send the units out to be recycled into more permanent structures such as roads or concrete. Rubber is increasingly used in these structures as it adds key properties such as a reduction in stopping distance on road surfaces.

In parallel to their work with the solar market TCT-Europe has also had the opportunity to expand into the UK military. In 2020 TCT-Europe received funding from Innovate UK to build a demonstration project to showcase the possibilities of recycled rubber barrier products on military bases.



Europe has developed an increasingly sophisticated tyre recycling industry in which the fabric metal and carbon black materials are extracted from the tyres and resold, and the remaining synthetic/natural rubber crumb with residual fillers is ground down into various crumb sizes, typically <2mm, to be used as a base material for new products

‘Work here is ongoing but there is a real opportunity to use the flexible, durable properties of rubber with a renewable active power source in the form of the solar stud to provide a new range of products and services.’



Embedded solar stud in the lane separator

Work here has allowed TCT-Europe to expand its research into new areas including adding new materials to the crumb to strengthen our rubber products, research into barrier products to use where PVC roofing materials may become affected by rubber or other materials placed on top of them; research into embedding electronics into rubber and marrying recycled rubber products with recycled plastic of various flavours. All of these have fed back into products designed for the solar market

One of the exciting new areas of focus linked to embedded electronics is a partnership

with Clearview Intelligence, a key UK innovator in the area of intelligent transport systems. The two companies are currently working together to look at combining the Clearview solar road stud with one of TCT-Europe's barrier products to provide an active light source for bike lanes. The addition of the stud increases the visibility of the bike lane up to 10 times as compared to using reflective materials.

Work here is ongoing but there is a real opportunity to use the flexible, durable properties of rubber with a renewable active power source in the form of the solar stud to

provide a new range of products and services. Together with Tire-Conversion technologies Inc, TCT-Europe have been issued with a provision patent for developments in this area. US 63/154,069 'Compression moulded rubber products incorporating active and passive electronic devices'

Problem resolution is at the core of the company's focus. TCT-Europe are interested in working with UK and European companies looking for design and engineering expertise for new or adapted products, and with a need for volume manufacturing of final units.

 www.tire-conversion.com