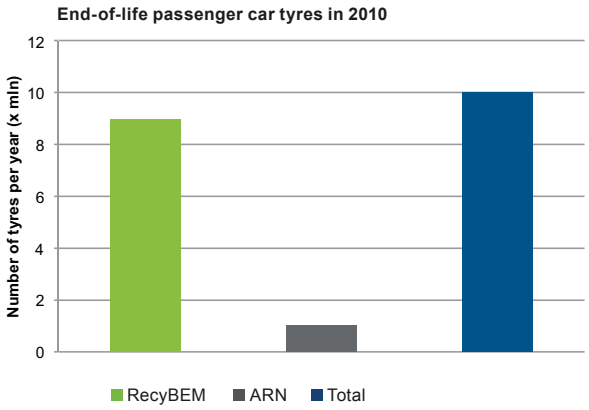
RecyBEM and ARN are together responsible for recycling almost 10 million car tyres each year. The two organisations have had a joint Ecotest carried out into the recycling chain for these tyres.

ARN

RecyBEM is responsible for the implementation of the Dutch Decree on Car Tyre Management on behalf of the tyre sector, and each year collects almost 9 million car tyres from more than 10,000 garages and tyre service companies, and from 500 municipal environmental and waste collection stations.

In the Netherlands, ARN is responsible for managing the recycling of end-of-life cars, and is charged with ensuring that the legal standard of recycling 85% of vehicle weight is achieved. In this framework, ARN is charged with removing from the environment approximately one million car tyres from around 250 car dismantling companies.



Both RecyBEM and ARN are bound by legislation that focuses on the recycling percentage; the higher the proportion recycled, the better. However, the world is constantly on the move and alongside recycling, other factors need to be considered:

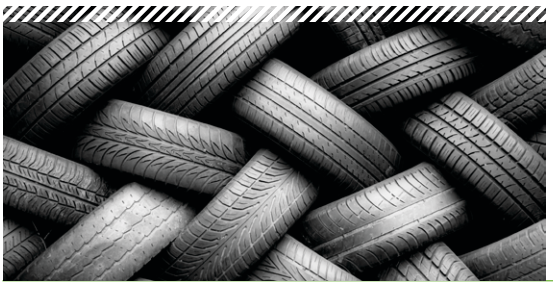
- What is the CO_2 emission of the recycling process and how does it relate to the recycling targets?
- The energy yield from the use of waste substances as fuels is improving. Could this be an alternative for recycling?
- The collection and recycling system is subject to a range of factors that determine the eventual costs for manufacturers of car tyres. What is the relationship between the recycling target and these costs?
- Where in the chain can we improve performance?

Ecotest provides better insight into the impact of the chain

Existing Life Cycle Assessment (LCA) studies assess the chain according to the scores on approximately 10 different indicators. The large number of indicators makes it difficult to give a weighting to the different effects of a chain, and interpret the relevance of those effects. Ecotest on the other hand quantifies the impact of the chain on the key indicators, and in that manner tests the relationship between:

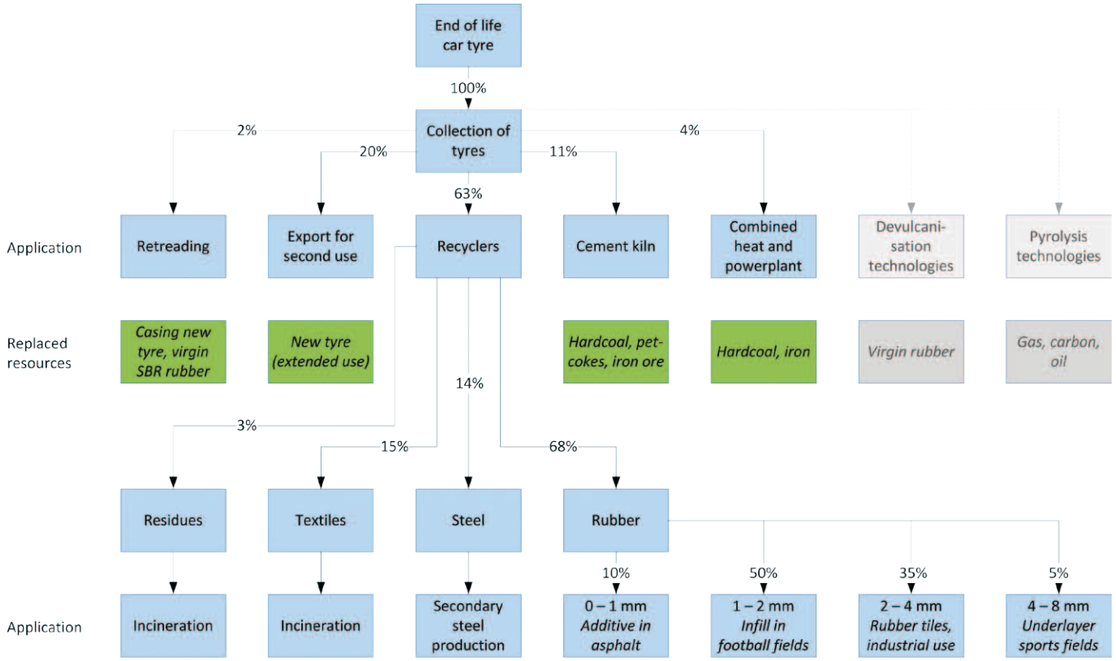
- Ecology (CO_2 footprint)
- Raw material preservation (recycling percentage)
- Economy (costs)

Ecotest is a tool for continuously optimising the chain in the future. Ecotest is not an academic study but a practical tool based on real-life information from the chain, which makes as little use as possible of information from standard databases. Ecotest does use LCA techniques, in accordance with the ISO standard, and calculates using LCA-software SimaPro.



System boundaries

Ecotest is focused on the currently employed processing and recycling routes (chain options) for end-of-life car tyres.



Ecotest calculates the environmental performance of each chain option, and then determines the recycling percentage and costs.

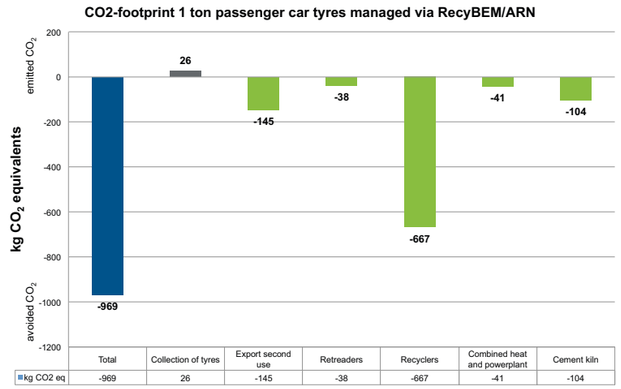
Important principal choices for Ecotest

- Transport throughout the chain is considered.
- For the composition of the tyre, the percentage distribution of the main components of a tyre (rubber, iron and textile) as specified by the recyclers has been used. Within each chain option, the application of the end-of-life tyre is compared with the direct alternative. The end-of-life tyre for example is the alternative for coal in the combined heat and power plant or for coal and iron ore in the cement kiln.
- A passenger car tyre is suitable for retreading only once.
- The profile tyre exported for reuse elsewhere in the world has an estimated extended useful life of 20%. This means that 20% of the raw materials and energy required for the production of a new tyre are saved. The end-of-life processing of exported profile tyres in the countries of sale is equal to the end-of-life processing of a newly purchased tyre in these countries.
- The end-of-life processing of the recycled product is considered, if deviating from the end-of-life processing of the primary product or material.
- The costs are calculated from the manufacturer's perspective, namely the total of the costs for collection, sorting and having the tyre processed by a recycler, including the income from the sale of reusable tyres by the collection company. The costs and income generated in the remainder of the chain are not considered.

For the study, as far as possible, use was made of real-life data. Extensive interviews were for example held with five recyclers, and for the chain options cement kiln, combined heat and power plant and retreading, intensive contacts were established with the parties actually processing the tyres from the RecyBEM/ARN system. To assess the data for secondary applications of granulate, contact was established, among others, with manufactures of artificial pitches and road builders.

Result of Ecotest car tyres

CO_2-footprint
By processing 1 tonne of car tyres via the RecyBEM/ARN system, 969 kg of CO_2 equivalents (CO_2-eq) are saved. This compensates for approximately one third of the emissions released in the production of a new tyre (2,830 kg CO_2-eq per tonne). The graph shows the total emission saving in the blue column. The green columns reflect the absolute distribution of the score across the various chain options. The emissions for collection and transport of 26 kg CO_2-eq are easily compensated for by the savings achieved through the various chain options.



Which chain option delivers the best performance?

To answer this question, the performances of each chain option when processing 1 tonne of end-of-life car tyres were compared. The emission saving for each chain option appears in the figure alongside the recycling percentage and the costs per chain option. The costs shown are the costs from the manufacturer's perspective.

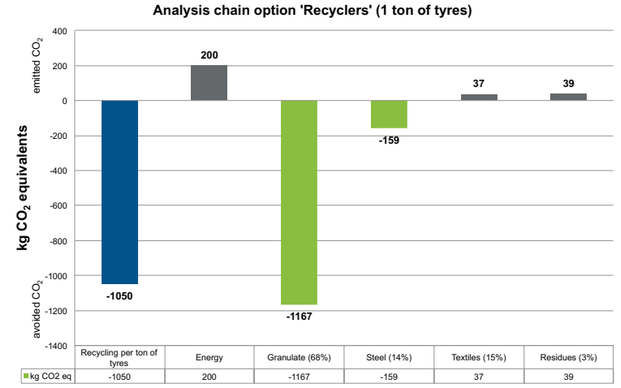
Conclusions

- RecyBEM and ARN encourage the chain option 'recycling' with a high percentage of material recycling and a high CO_2 emission saving, but at present with relatively high costs for the manufacturer.
- Retreading results in a considerable CO_2 emission saving, but is only applicable to a limited extent due to strict requirements on the carcass of the reused tyre.
- Combined heat and power plants and cement kilns deliver comparable results in terms of CO_2 emission saving, but the rubber is lost for material recycling.

The recycling option (by delivering an 80% score), results in more than the required percentage of material recycling laid down at 20% in the Dutch Decree on Management of Car Tyres. This option also delivers a major contribution to the percentage of material recycling as laid down in the Dutch End-of-Life Vehicles Management Decree.

Ecotest gives insight into the main savings from each chain option

By way of example, the graph shows the details of the performance of the 'recycling' chain option. The use of rubber granulate saves far and away the highest percentage of emissions, since it saves on the production of primary synthetic rubber. The energy required for processing the tyres (shredding and granulating) has a limited effect on the result.

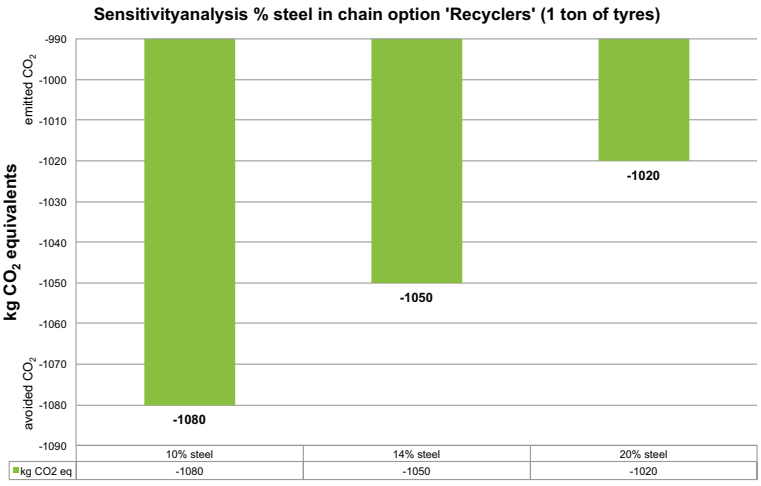


1 Source: Continental, 'Life Cycle Assessment of a Car Tyre' and historical figures RecyBEM/ARN
2 In practice, 100% application is not possible for all options, for example because not all end-of-life tyres are suitable for retreading.

ecotest

Ecotest also calculates the impact of principal choices on the result

The graph is an example of a sensitivity analysis for the proportion of steel measured by the recyclers following shredding and granulation. The proportion of steel ranges between 12% and 20%. Ecotest uses the weighted average of the measured percentages, namely 14%. To determine the sensitivity of this principal choice, a steel proportion of 12% and 20% were also calculated. The sensitivity analysis shows that the impact of the steel percentage on the total kg CO_2-eq of this chain option is limited.



Sorting centre with the capacity to sort 10,000 tyres a day (Source: Lintire)

Ecotest continues to monitor the performance of the product chain

RecyBEM and ARN are continuing to monitor the performance of the product chain using Ecotest. If one of the chain options becomes more important, or if technological developments offer new recycling possibilities, Ecotest will allow to rapidly analyse and assess these possibilities. RecyBEM for example is investing in new techniques for devulcanisation and pyrolysis. Using Ecotest, these techniques have been theoretically assessed. For devulcanisation, the assumption was made that 50% of the raw materials from a new tyre are replaced with devulcanised material. For pyrolysis, an output was assumed of relatively pure flows of gas, carbon and oil. On the basis of current knowledge and the data available on optimisation through innovation, it is expected that these options will be able to generate considerable CO_2 emission savings for each tyre, as compared to incineration with energy recovery and recycling.

Testimonial

Kees van Oostenrijk (director sector association Band & Milieu / RecyBEM B.V.) and Aarnout van Duuren (General Manager, ARN Auto Recycling B.V.) are very enthusiastic about Ecotest. Ecotest delivers a current dashboard for the essential parameters including CO_2 emission saving, costs and savings in primary raw materials. In this simple manner, a clear insight is established into the sustainability performance of the various processing routes for an end-of-life car tyre. The strength lies in the use of real-life data, as supplied by all affiliated recycling companies and other businesses in the chain. Ecotest will continue to be used. We will keep all data up to date. We can also simply calculate and compare new processing routes, thereby offering possibilities for optimising the total chain. ARN intends to use the results of Ecotest as a basis for sustainable purchasing in its tendering process. Ecotest shows that the recycling of end-of-life car tyres in the Netherlands is already at a very high level. Both the RecyBEM and ARN system deliver a top performance.