Background

Trans-Rak designed its first racking system to replace traditional wooden frames, which are unstable, potentially unsafe, uneconomic and environmentally unfriendly.

In 2011, the company developed a new removable product version – the R-Rak - which offers a more flexible and cost-effective solution for customers, crucially **with significantly lower environmental impact**, in that it can be **reused many times over a period of several years.**

At the end of 2014, Trans-Rak commissioned a study by Loughborough University to evaluate the **environmental performance of R-Raks** compared to wooden racks and to assess current design with a view to reducing **environmental impact further**, without compromising performance or reliability.

Details of the Study

Development of R-Raks

Environmental awareness and reduction of carbon impact has been a driver for Trans-Rak from the outset. The R-Rak racking system was designed to facilitate more vehicles being loaded into containers, and is environmentally positive in enabling higher volumes to be shipped in containers over fewer journeys.

Environmental Evaluation – Wood versus Steel

This study included a whole-lifecycle environmental comparison of the R-Rak system versus wooden racks (Life Cycle Analysis). It was found that wooden racks are significantly more harmful to the environment than the R-Rak system. In particular, the fumigation process necessary to treat the wood to allow it to be exported is both damaging to ecosystems and hazardous to human health. However, even with this fumigation process ignored, as might be the case with domestic shipping, the R-Rak still has a lesser impact on the environment than wooden racks.

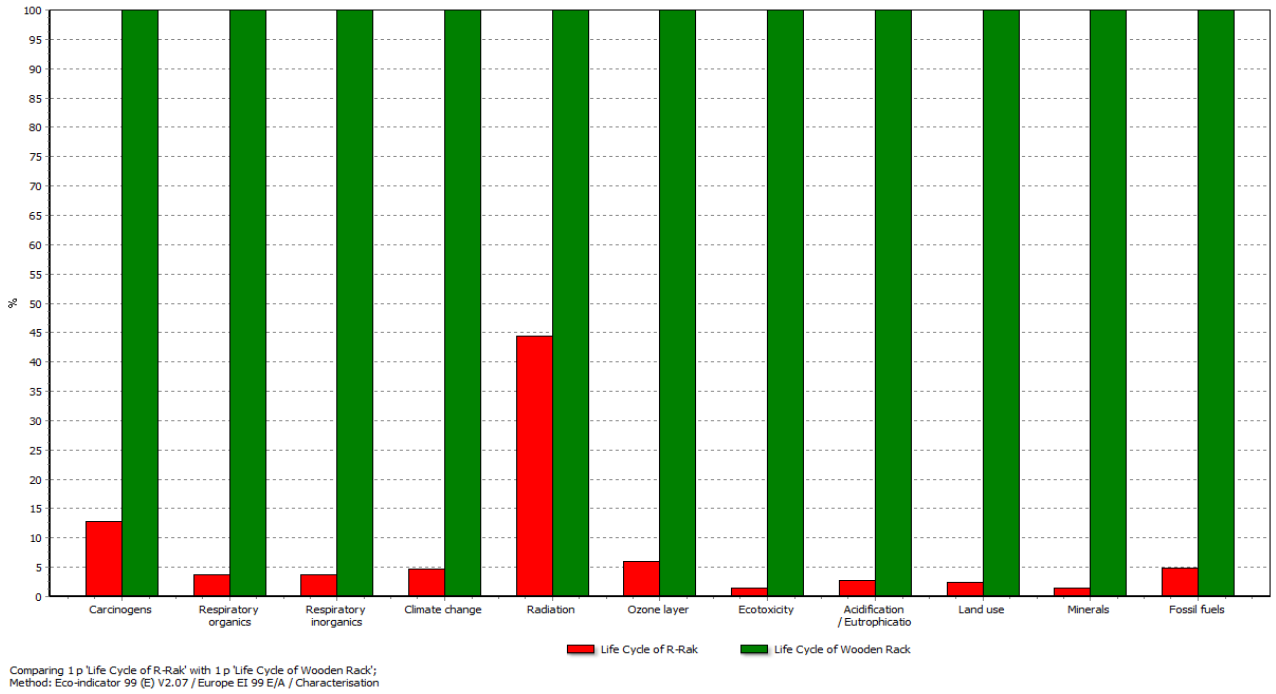
A partnership was set-up between Trans-Rak and final-year Masters students at Loughborough University from a variety of engineering and design degree programmes. Part of the result of this partnership was a full Life Cycle Assessment, in accordance with ISO standards 14040 and 14044, to compare the environmental impacts of the R-Rak system and disposable (wooden) racking systems. It was found that "R-Rak's impact upon the environment is less than that of the wooden racks over the 7 years cycle"; with a single R-Rak delivering 56 useful cycles over a 7 year service life in use for rail transit. Conversely 56 wooden racks would be required (to be produced and then destroyed) to fulfil the same service over the same period. Clearly this demonstrates that wooden racking has a much greater negative environmental impact than the R-Rak, which offers a more sustainable option, even taking into account the manufacturing process.

One of the issues with wooden racking is the fumigation agent Methyl Bromide used to treat the wood which is harmful during application and incineration to both humans and the environment. It was also found that the main contribution to the R-Rak's environmental impact is from the transportation of the

system during the use-phase of its lifecycle rather than from any harmful materials or processes during manufacture or at end-of-life.

The full results of the assessment are included below. It can be seen that over all aspects of environmental harm, the R-Rak (Red) is considerably less damaging than wooden racking (Green).

Normalised impacts and supporting numerical data (table below).



This gives the numerical results that are used to produce the graphs as well as a normalised graph which shows the total R-Rak environmental impact compared to that of wooden racks. Finally, the columns are split into three categories to give the relative amount of harm in human health, ecosystem quality and depletion of resources.

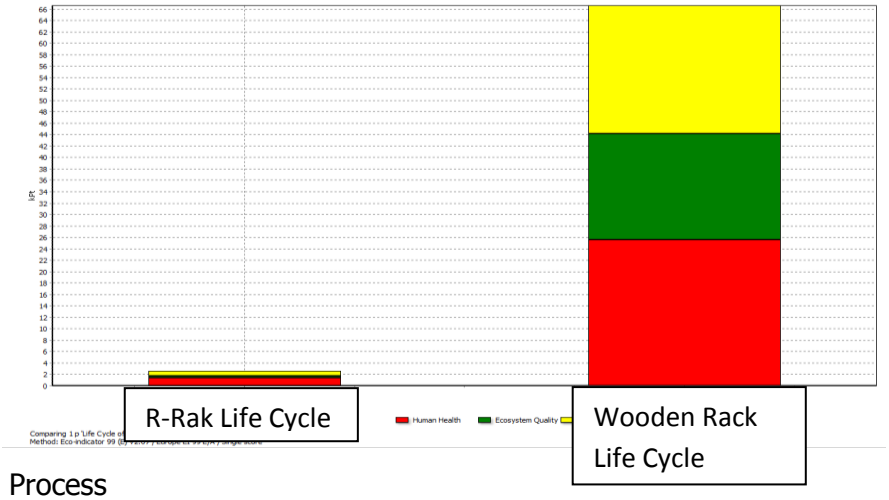
Sel	Impact category	Unit	Life Cycle of R-Rak	Life Cycle of Wooden Rack
☑	Abiotic depletion	kg Sb eq	150	3.17E3
☑	Acidification	kg SO2 eq	103	3.45E3
☑	Eutrophication	kg PO4--- eq	36.4	1.09E3
☑	Global warming (GWP100)	kg CO2 eq	2.32E4	4.92E5
☑	Ozone layer depletion (ODP)	kg CFC-11 eq	0.00206	0.0342
☑	Human toxicity	kg 1,4-DB eq	2.69E4	1.5E6
☑	Fresh water aquatic ecotox.	kg 1,4-DB eq	1.16E4	3.4E5
☑	Marine aquatic ecotoxicity	kg 1,4-DB eq	1.56E7	4.48E8
☑	Terrestrial ecotoxicity	kg 1,4-DB eq	181	4.6E3
☑	Photochemical oxidation	kg C2H4	6.48	170

Human Health

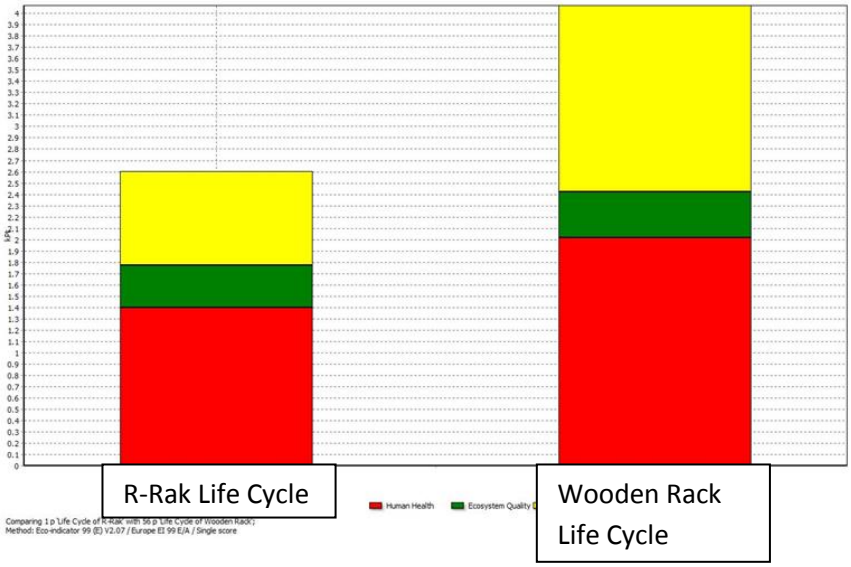
Ecosystem Quality

Resources

With Fumigation Process



Without Fumigation Process



'Total Product Design: Trans-Rak Intermediate Report. 2015'

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