



**PE INTERNATIONAL**  
EXPERTS IN SUSTAINABILITY

# Environmental Information Sheet

according to Environmental Product Declaration (ISO 14025)





**Reflexion Brand**

**Laser Cartridge Remanufacturing**

Based on the LCA study  
conducted by PE INTERNATIONAL



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	<p><b>Declaration</b></p> <p><i><b>Environmental Information Sheet</b></i></p>
<p><b>LaserNetworks Inc.</b>  <b>Oakville, Ontario, CANADA</b></p> 	<p><b>Declaration holder</b></p>
<p><b>PE INTERNATIONAL</b>  <b>www.pe-international.com</b></p> 	<p><b>Study conducted by</b></p>
<p><b>Remanufacturing system of laser cartridges</b></p> <p>This environmental information sheet principally follows the rules of an Environmental Product Declaration according to ISO 14025. It describes the environmental performance of the above-mentioned system. This environmental information sheet is based on a LCA study conducted according to ISO14040 et sqq.</p> <p>All relevant environmental data are disclosed in this information sheet.</p>	<p><b>Declared product or system</b></p>
<p>The study, on which this environmental declaration is based, contains in detail:</p> <ul style="list-style-type: none"> <li>- Product and system description</li> <li>- Information about materials</li> <li>- Specifications on manufacturing the product and related systems</li> <li>- The scope of the LCA</li> <li>- Information on the product in use, singular effects and end of life</li> <li>- LCA results</li> <li>- Summary with main environmental aspects</li> </ul>	<p><b>Content of the declaration</b></p>
<p>15<sup>th</sup> November 2007</p>	<p><b>Date of issue</b></p>
 <p>Dr.-Ing. C. Herrmann (project manager of PE INTERNATIONAL)</p>	<p><b>Signature</b></p>



**Summary**

**Environmental Information Sheet**

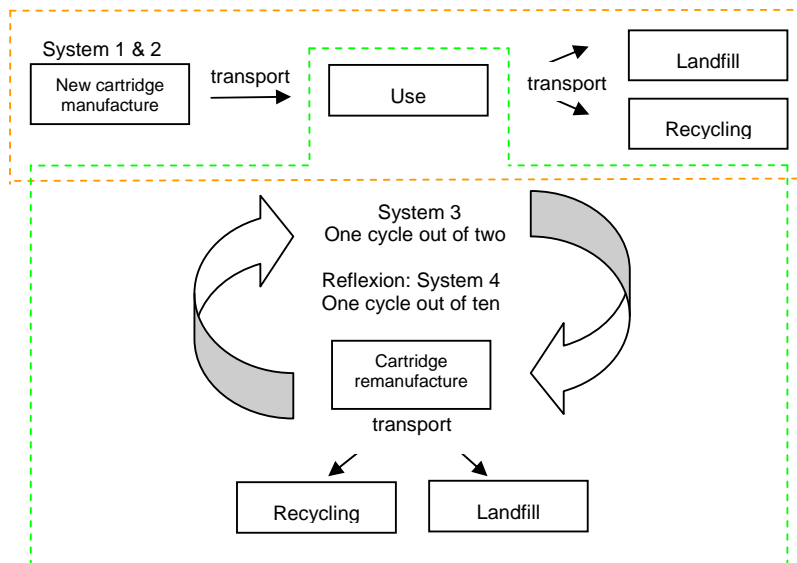
The remanufacturing system of Reflexion is based on a continuous manufacturing process for all materials related to laser cartridges. The evaluated product is the 4345 cartridge, which is according to its size, materials and handling requirements, a representative cartridge for the entire range of products by Reflexion Brand.

**Product and system description**

The remanufactured cartridges are reused ten times on average, in which the Reflexion system exchanges several parts earlier according to their quality condition and replaces them with longer-life components. Those exchanged parts are almost entirely delivered to recycling treatment instead of any type of disposal. Reflexion also organizes the logistics for the reuse loop with its customers.

The **Life Cycle Assessment (LCA)** was carried out according to DIN ISO 14040 et sqq. Specific data from Reflexion as well as the data base "GaBi 4" were used. The LCA was carried out for the manufacturing/remanufacturing phase of the product, packaging, logistics, and End of Life. Four systems have been considered; new, single use system with either landfilling (1) or materials recycling (2) at End of Life, remanufacturing (3) where the empty cartridge is re-used only once, and the continuous remanufacturing system of Reflexion (4) according to the following table:

**Scope of the LCA**

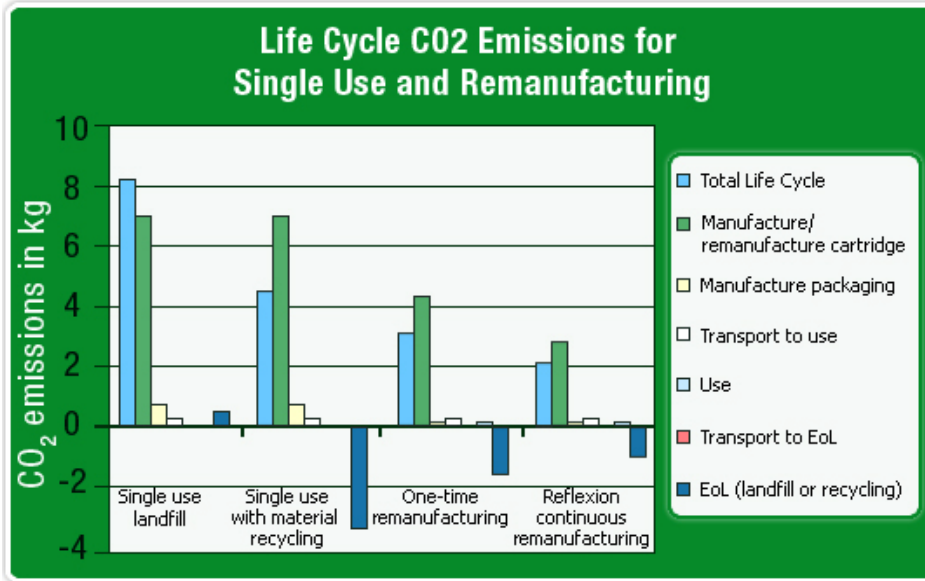


The scope of the life cycle phases cover:

- Manufacture of the product at single use or remanufacturing where the product is broken down into modules based on materials. Also the packaging materials are regarded.
- Transport of the new or remanufactured cartridge with respectively single use packaging or re-use packaging by truck from the production plant to the user; in case of remanufacturing less weight for landfill is considered relating to use cycles of packaging, but additional transport for the return of re-useable packaging.
- Use phase with no impact from paper or toner consumption is excluded, because it is equal for all systems. Landfilling of packaging materials is also modelled within the use phase.
- Transport of the empty cartridge (5% of toner left in cartridge) with municipal waste transport to landfilling plant or respectively with the same individual transport system of Reflexion;
- End of Life (EoL) by landfilling as part of a general municipal waste landfill or respectively recycling of materials according to exchanges of re-used parts based on use cycles and landfilling only of some very minor residual materials or parts

The environmental impact in CO<sub>2</sub> emissions for the four systems is symptomatic and applicable for all other environmental indicators as well. More details are provided in the table with numeric LCA results.

**Results for all systems showing CO<sub>2</sub> emissions**

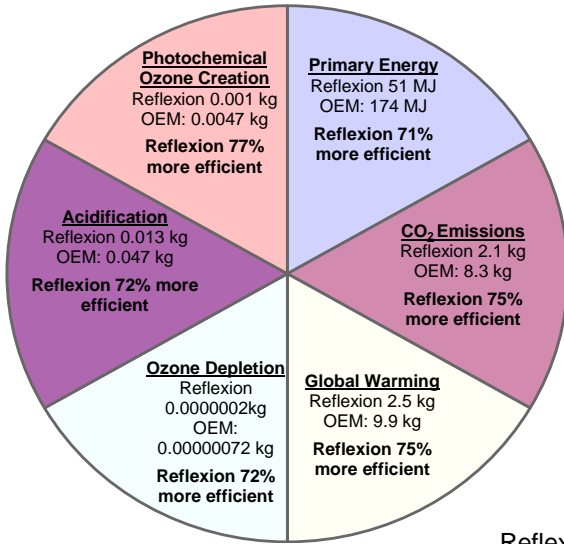


**Total Life Cycle Results of the LCA**

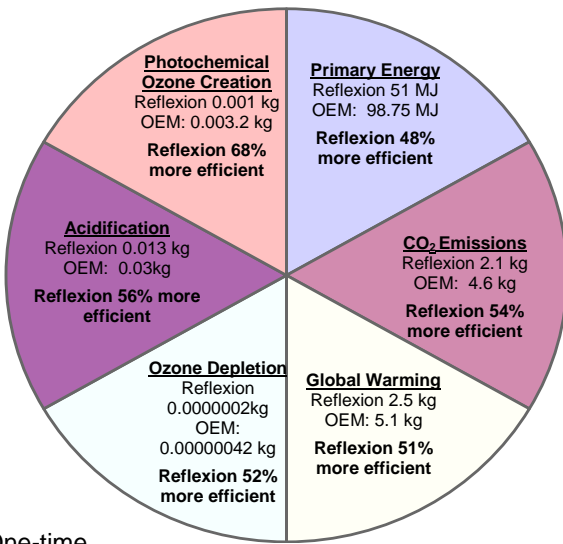
Environmental indicators	Unit per cartridge	Single use EoL landfill	Single use EoL material recycling	One-time re-manufacturing system	Reflexion continuous remanufacturing
Primary energy	[MJ]	174	98.75	66	51
CO <sub>2</sub> emissions	[kg]	8.3	4.6	3	2.1
Global Warming Potential (GWP)	[kg CO <sub>2</sub> eqv.]	9.9	5.1	3.3	2.5
Ozone Depletion Potential (ODP)	[kg R11 eqv.]	7.2 * 10 <sup>-7</sup>	4.2 * 10 <sup>-7</sup>	2.7 * 10 <sup>-7</sup>	2.0 * 10 <sup>-7</sup>
Acidification Potential (AP)	[kg SO <sub>2</sub> eqv.]	4.7 * 10 <sup>-2</sup>	3.0 * 10 <sup>-2</sup>	2.0 * 10 <sup>-2</sup>	1.3 * 10 <sup>-2</sup>
Photochemical Ozone Creation Potential (POCP)	[kg etheneeqv.]	4.4 * 10 <sup>-3</sup>	3.2 * 10 <sup>-3</sup>	2.0 * 10 <sup>-3</sup>	1.0 * 10 <sup>-3</sup>

**Total life cycle results for all systems**

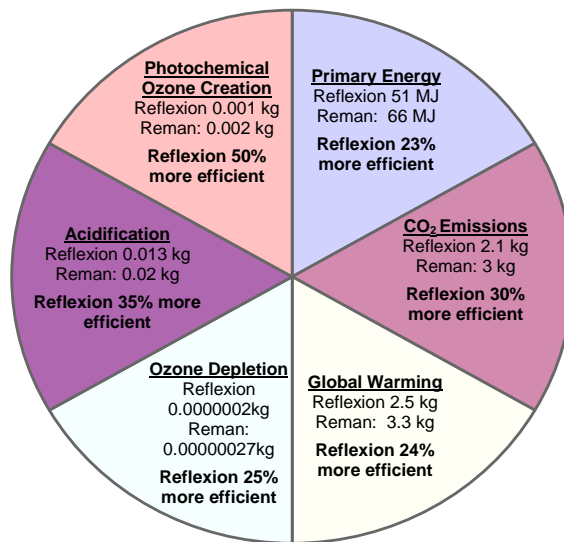
**Reflexion vs Single-use (OEM)  
 EoL Landfill**



**Reflexion vs Single-use (OEM)  
 EoL Materials Recycling**



**Reflexion vs One-time  
 Remanufacturing**



The calculated results from the LCA show, that for example from the single use, EoL landfill scenario 8.3 kg of CO<sub>2</sub> emissions in total are generated, of which the manufacture covers about 7.1 kg. In comparison to this, the Reflexion approach significantly reduces the dominant impact from manufacture by applying the same reuse parts at several life cycles. There is an additional reduction by gaining all possible recycling potentials, which results in a credit. The net value of manufacture and recycling credit results in 2.1 kg CO<sub>2</sub> emissions, which is a reduction potential of almost 75% in comparison to single use. A comparable situation is given for all other environmental impact categories as well.

Where all materials are recycled at End of Life and not landfilled, as in the new and one-time remanufacturing systems, the results are still quite favourable for the Reflexion system. In the single use scenario the CO<sub>2</sub> emissions are in total approximately 54% greater than the Reflexion system. In the one-time remanufacturing system, where new cartridges are refilled once, the impact is still greater by 30%.

In all scenarios where the End of Life is recycling, 100% recovery is assumed, with landfilling only where no other option exists. In actual fact, only about one third of cartridges are recycled. The Reflexion system ensures that most cartridges are diverted from landfilling by maintaining logistics throughout the entire life cycle. This is a further proof of the credibility of the Reflexion philosophy of 'reuse or recycle any valuable material'.

**Summary and conclusion  
 from results**