Enhanced resource efficiency with packaging steel

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Abstract Packaging steel is used for the safe and efficient distribution of different products worldwide. In the long line of improvement of steel packaging the total volume of canned products per tonne of packaging steel has increased dramatically in the last 50 years. This result is directly linked to a better use of the resources necessary for making packaging steel. The recycling rate for packaging steel in the EU is now over 70 per cent. Efficient recycling can be seen as a multi-use system from the material point of view. The recycling of the core material enables the industry to avoid a CO_2 burden in the production route. These above mentioned characteristics have to be taken into account when studying the life cycle of packaging steel. Resource efficiency has direct effects on other life cycle parameters such as green house gas emissions or energy use. This will be shown in some examples. An outlook for future developments will be given as well.

1 Introduction

Packaging steel is used for the safe and efficient distribution of different products worldwide. The combination of a strong material with perfect barrier behaviours enables to deliver safe products to the consumer without losses [1].

The recycling rate for packaging steel in the EU is now 71 per cent; some member states such as Germany or Belgium have reached recycling rates of more than 90 per cent [2; 3]. Efficient recycling can also be seen as a multi-use system from the material point of view. Steel recycling is typically the electric arc furnaces (EAF) process that converts steel scrap into new steel by remelting it, but steel recycling also occurs when steel scrap is added during the basic oxide furnace (BOF) process [4]. The recycling of the core material enables the industry to avoid a CO_2 burden in the production route.

Furthermore, it can be demonstrated that in the long line of improvement of steel packaging the total volume of packaging steel per tonne of canned products has decreased dramatically in the last 50 years [2]. This result is directly linked to a better use of the resources necessary for making packaging steel.

These above mentioned characteristics have to be taken into account when studying the life cycle of packaging steel. Resource efficiency has direct effects on other life cycle parameters such as green house gas emissions or energy use [5]. This will be shown in some examples.

For many years, APEAL has commissioned life cycle studies and sustainability studies to clarify the benefits of packaging steel for the environment and the society. An outlook for future developments will be given in this article as well.

2 Recycling rate and reduction of CO_2 emissions

APEAL publishes yearly updates of the steel packaging recycling rates achieved in the 27 European countries. These data are compared with the Eurostats' Environmental Data Centre on Waste [6] data, which are published about one year later, and their coherence is verified.

2.1 Inreasing recycling rates in Europe

The recycling rates for steel have continuously increased since the 1970's. It is easy to explain what makes steel exceptionally recyclable: its magnetic properties make steel easy and economical to sort and recover, and well-established routes for collection and recovery of steel cans have ensured increasing recycling rates over the years.
It can be seen in fig. 1 that steel is amongst the most recycled packaging materials in Europe.

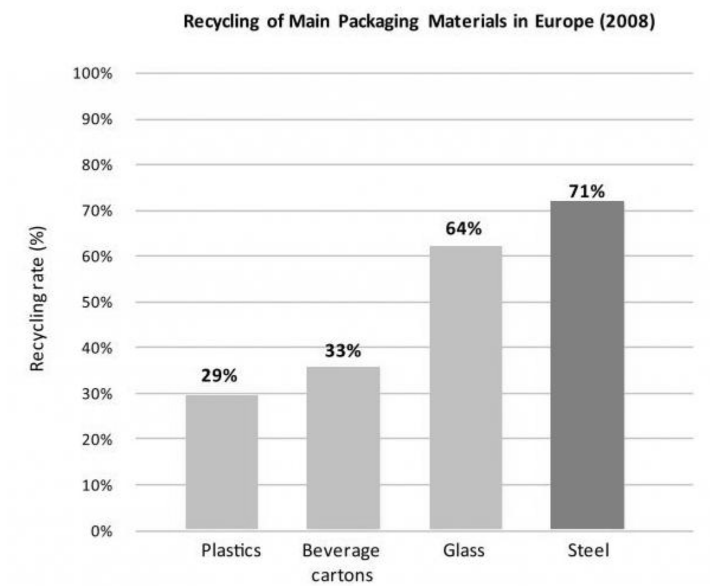

Fig.1: EU 27 recycling rates in 2008 for different packaging materials (Source: industry experts - APEAL, FEVE, ACE, PlasticsEurope) [3]

2.2 Calculation of reduction of CO_2 emissions due to recycling

Equivalence between the recycling rate and the CO_2 emission can be calculated given the following [7]:

minimum recycling	0%
maximum recycling	100%
CO_2 primary route[1]	100%
CO_2 secondary route[2]	29%

The link between recycling rate and CO_2 emission is given int he following formula:

$$\text{Indice } CO_2 = CO_2\text{-}1 * (1-RR) + CO_2\text{-}2 * RR \tag{1}$$

[1] Refers to the CO_2 emissions through primary steel production route.

[2] Refers to the CO_2 emissions through secondary steel production route. European average for EAF and BF recycling routes.

With:
Indice CO_2 = Indice of emission of CO_2
CO_2-1 = CO_2 primary = 100%
RR = recycling rate
CO_2-2 = CO_2 secondary = 29%

This equation enables to calculate the indices of CO_2 emission according to the recycling rates in table 1.

Tab.1: EU 27 recycling rates

year	recycling rate	CO_2 emissions
1991	25,0%	82,1%
1992	26,0%	81,4%
1993	29,0%	79,3%
1994	34,0%	75,7%
1995	41,0%	70,7%
1996	45,0%	67,8%
1997	52,0%	62,8%
1998	51,0%	63,5%
1999	47,0%	66,4%
2000	49,0%	65,0%
2001	55,0%	60,7%
2002	60,0%	57,1%
2003	61,0%	56,4%
2004	63,0%	55,0%
2005	63,0%	55,0%
2006	66,0%	52,8%
2007	69,0%	50,7%
2008	71,0%	49,2%

The table 1 data show a reverse tendency between recycling rates and indices of CO_2 emission, as is seen in figure 2. Indeed, with an increased efficiency of recycling, the indice of CO_2 emissions decreases.

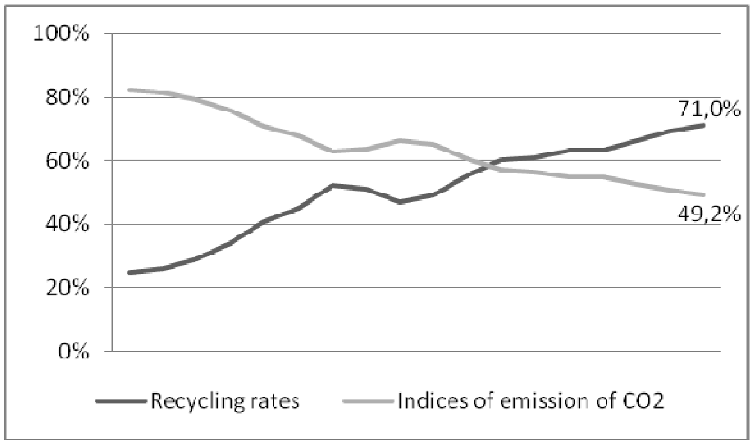

Fig.2: Evolution of EU 27 recycling rates and equivalent reduction in indice of CO_2 emissions (from 1991 to 2008)

3 Downgauging and reduction of CO_2 emissions

The optimisation of the packaging steel production processes and the enhancement of recycling are an important part of the ecological improvement of steel packaging. On the product side the downgauging of packaging helps saving resources, energy and emissions, too. Fig. 3 shows the weight reduction of some standard cans since 1990.

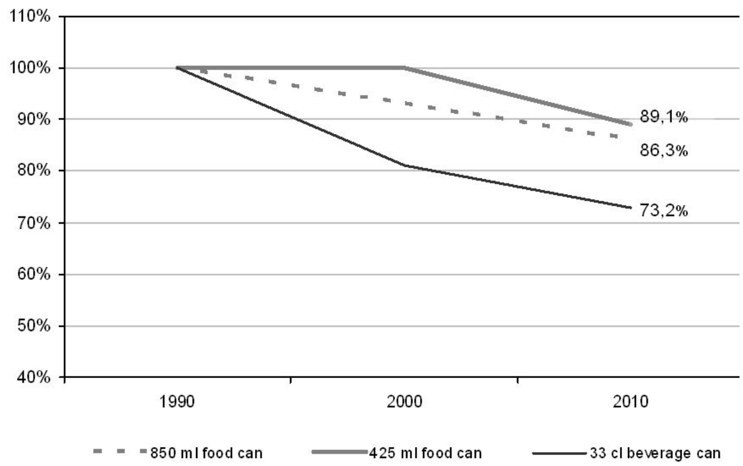

Fig.3: Development of weights of some standard steel packing in Europe [7]

The downgauging process directly results in a reduction of CO_2 emissions and energy use during the steel and packaging production and - related to transports - also during the total life cycle [3; 5]. In combination with the above shown effects of recycling, as shown in Fig. 4, the decrease of the CO_2 emissions per packaging is enormous.

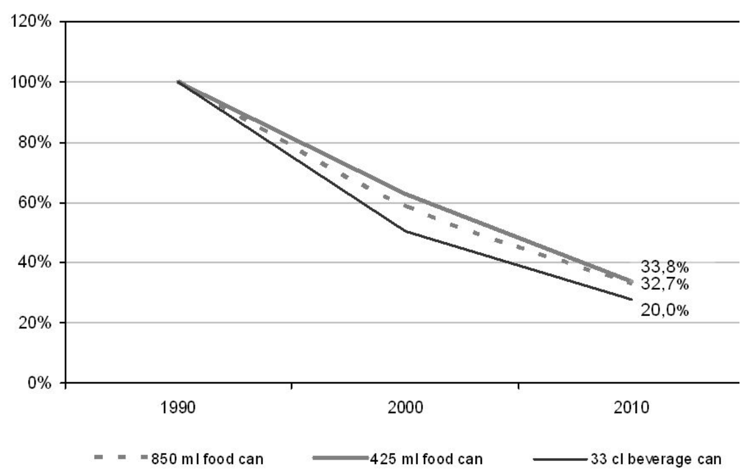

Fig.4: Development of CO_2 emissions of some standard steel packing in Europe [7]

4 Steel Industry and Sustainability

Goods packed in steel have a high benefit for the consumer over a long period of time. Indeed, the shelf-life is increased as the packaged goods are protected by the impermeability of the can and the protection it gives to light [8; 9].[3] In the previous sections it has been shown that the environmental impact has decreased dramatically in the last years. This has of course been the case in the whole long history of steel packaging. Environmental improvements show only one part of the whole evolution of steel packaging. Every product, also every packaging, has to be measured by its economic and social impacts, in other words - it has to be sustainable.

The social aspect of sustainability includes safety and health in the production of steel, which always has been very important for the steel industry [10]. The social aspect is important to make food available for the consumer in a cost efficient way. When steel packaging is referred to, it is interesting to note that the distribution system requires energy only for transporting the food. No additional cost in energy is required, as to modify for instance the ambiant atmosphere. Indeed, the packaging is gas tight and unbreakable. It is also non-transparent, ensuring that the filling goods are protected perfectly.

The steel for packaging industry has intensively increased the steel grades available in order to offer the material needed to make lighter steel cans possible in the market.

5 Future work - Development of an LCA for steel for packaging

Researches in the world steel industry underline the importance of the use of a life cycle analysis for environmental assessment of their production [6]. Several

[3] Shelf-life refers to "the period between the manufacture and the retail purchase of a food product, during which time the product is in a state of satisfactory quality in terms of nutritional value, taste, texture, and appearance" [8]

studies are available comparing through the means of life cycle analysis (LCA) different construction materials amongst which steel [4; 11; 12]

In the past APEAL has taken part in different LCA / LCI projects [5; 13]. At the moment a European LCI for packaging steel in ongoing. The LCI data will be reviewed by independant experts and will be published by APEAL. This LCI data set will be updated periodically.

6 References

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