STEEL FOR PACKAGING

# Life Cycle Assessment (LCA) on Tinplate

*June 2015*

APEAL

The objective of an LCA is to create a product's complete environmental profile over its entire life cycle, showing the results with the aid of environmental indicators in a more understandable way.

In order to keep improving steel's environmental profile and communicate this in a totally transparent way APEAL, the Association of European Producers of Steel for Packaging has, since 2006 established and communicated a comprehensive LCA for tinplate production in Europe.

The latest study was conducted in 2014, according to the international standards for life cycle assessment ISO 14040/44 and the Worldsteel LCA methodology, using data from 2012-2013.

It evaluates the European production of tinplate coil in a so called cradle to gate analysis, meaning that all production steps from the extraction of raw materials to manufacturing of the coil were taken into account. In addition, the potential effect of recycling was calculated assuming the European average recycling rate. The boundaries of the study can be further extended past the steel factory gate to include downstream activities, particularly in collaboration with customers who are applying LCA's to their own product systems, and the use phase of their product.

The results show how the steel for packaging industry has made continuous improvements in its environmental performance. But an LCA is only as valid as the exactitude of its data. In our global economy, new products, processes, raw material options and manufacturing methods are routinely introduced and an updates are required to provide reliable and up to date data to meet the request of customers and external studies. Intended for use as the reference for tinplate packaging steel in Europe, and the only one to be used for relevant and up to date studies, the complete dataset is available from the International Life cycle database (ILCD).

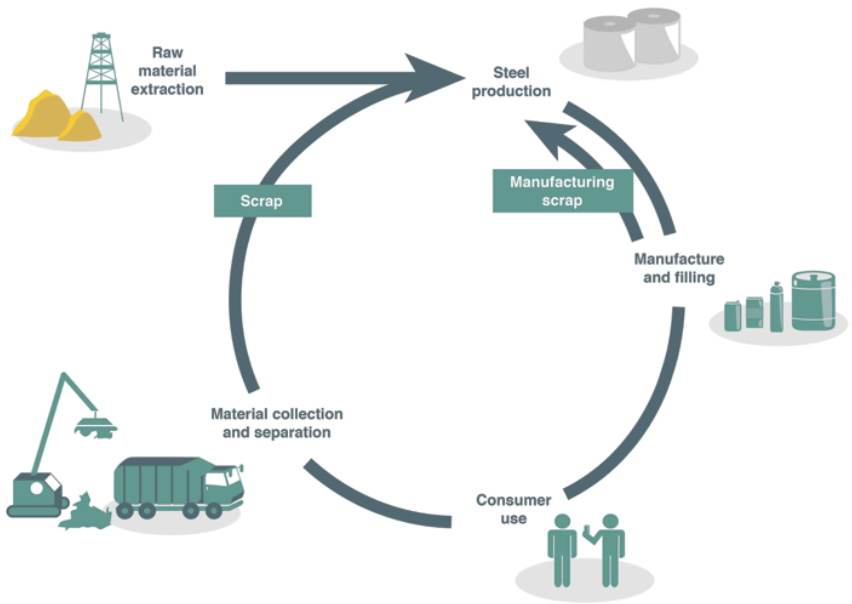
# THE IMPORTANCE OF LIFE CYCLE THINKING

**Life cycle thinking is vital for the future.**

LCA is well established as a sound environmental assessment tool that is easy to implement, cost effective and produces affordable and beneficial solutions for material decision making and product design.

Thinking in life cycles has an important advantage. With LCA the whole lifespan of a product can be evaluated: the production, use and disposal at the end of life. Environmental impacts occur along the entire supply chain: at the production site itself as well as in the extraction of raw materials and their transport, and at power plants supplying the energy to the production site. Capturing both direct and indirect impacts can help to avoid shifting environmental burden from one life cycle stage to another. Environmental regulations which only regulate one phase (use) of a product's life cycle can create unintended consequences, i.e. increased $CO_2$ emissions.

**The life cycle of steel**



# APEAL 2012-2013 TINPLATE DATASET

The results of the study clearly show that the European steel for packaging industry has continued its trend towards a more energy- and resource-efficient production.

The environmental impact of tinplate production is given for the five standard impact categories; global warming (GWP), acidification (AP), eutrophication (EP), photochemical ozone creation (POCP) and primary energy demand (PED).

Figure 1: APEAL 2012/13 Life Cycle Impact Assessment (LCIA) results for 1 kg tinplate coil without End of Life (EoL)

| Category | value | Unit |
|---|---|---|
| Global Warming Potential (GWP) | 2.27 | Kg CO2 eq. |
| Acidification Potential (AP) | 4.0E-03 | Kg SO2 eq. |
| Eutrophication Potential (EP) | 4.5E-04 | Kg Phosphate eq. |
| Photochemical Ozone Creation Potential (POCP) | 7.6E-03 | Kg Ethene eq. |
| Primary Energy Demand (PED) | 28.9 | MJ |

These LCIA figures demonstrate that, since 2006, CO2 emissions (GWP) of tinplate production have decreased by 12% and primary energy demand has dropped by 2%. Acidification decreased by 35% and POCP by 20%. Eutrophication has stayed at the same level.

**The importance of End-of-Life thinking, recycling**

Steel is the most recycled packaging material in Europe, and the high recycling rates associated with steel has a clear impact on the tinplate LCI figures.

By taking into account a 74% recycling rate for steel packaging (2012), primary energy demand is reduced from 28.90 MJ to just 19.7MJ, meaning over 30% saving from using scrap instead of primary resources. Emissions are also reduced by 46%, from 2.27 kg to just 1.23kg.

The effects of recycling on tinplate are shown in figures 2 and 3.

**Figure 2:** Evolution of Global Warming Potential since 2006 (for I kg tinplate coil) including effect EoL recycling credit (@2012 recycling rate)

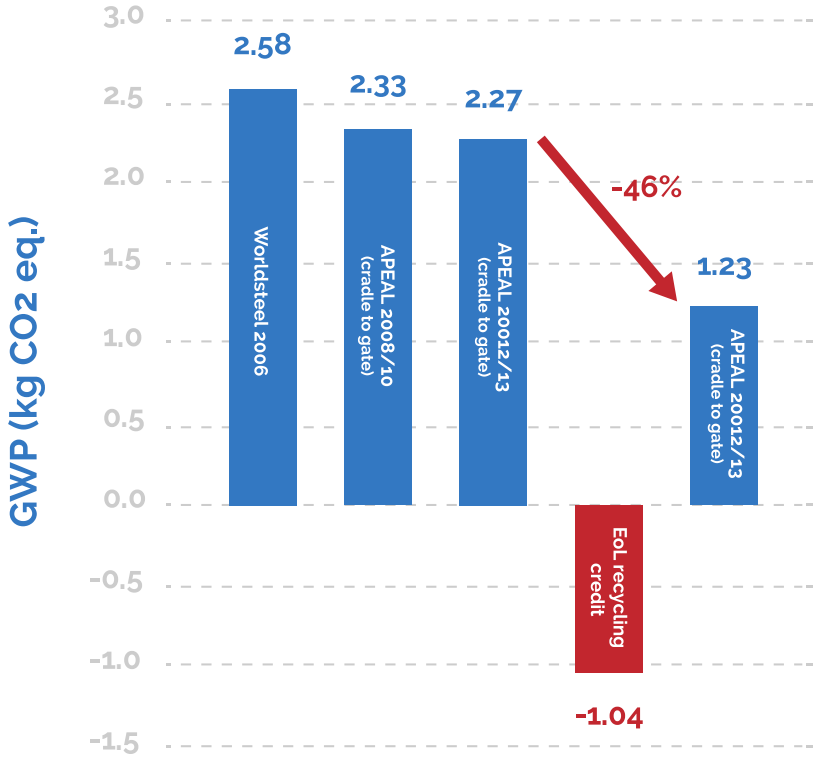
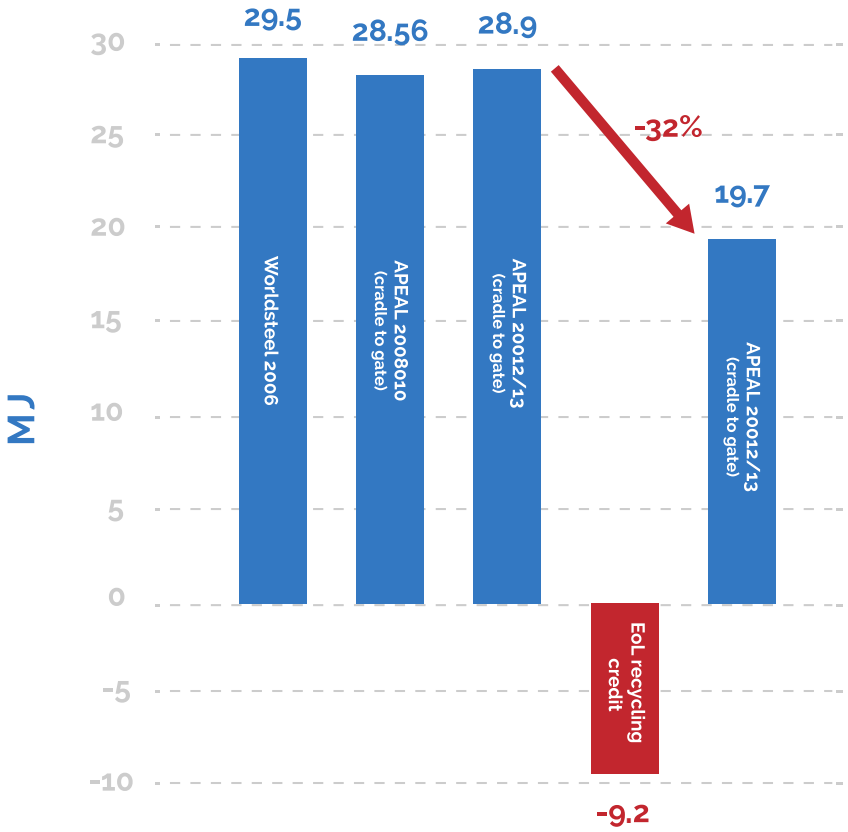



**Figure 3:** Evolution of Primary Energy Demand since 2006 (for I kg tinplate coil) including effect EoL recycling credit (@2012 recycling rate)



## ABOUT THE STUDY

The study evaluates the European production of tinplate coil in a so called cradle to gate analysis, meaning that all production steps from the extraction of raw materials to manufacturing of the coil were taken into account. In addition, the potential effect of recycling was calculated assuming the European average recycling rate.

**Data coverage:**

- The four APEAL members, ArcelorMittal, Tata Steel, ThyssenKrupp Rasselstein and U. S. Steel Kosice
- High coverage of data from 11 operating sites
- 95% of European tinplate production was covered by the study
- Data from production years 2012-2013
- Data collection on a site-by-site and process-by-process basis
- Data checked by independent external experts in a so-called critical review

The primary goal of this study was to update the LCI data for European tinplate products collected for the year 2008-2009 production.

The study was conducted according to the international standards for life cycle assessment ISO 14040/44 and the Worldsteel LCA methodology.

## IMPACT CATEGORIES

**Global Warming Potential (GWP 100 years):** Mainly caused by $CO_2$ and $CH_4$ emissions, which account for around 98% of GHG emissions from the steel industry. It is expressed in units of kg carbon dioxide equivalents (kg $CO_2e$).

**Acidification Potential (AP):** A measure of the acidifying potential of substances; primarily caused by $SO_2$ and NOx. Expressed in units of kg sulphur dioxide equivalents (kg $SO_2e$).

**Eutrophication Potential (EP):** A measure of the potential for the enrichment of nutrients in lakes and rivers, leading to abnormally rapid algae growth in water courses and damage to soils. Within the steel industry, EP is mainly caused by NOx emissions. Expressed in units of kg phosphate equivalents (kg $PO_4e$).

**Photochemical Oxidant Creation Potential (POCP):** A measure of the potential for the creation of low-level ozone and other air pollutants. Also known as 'summer smog'. Expressed in units of kg ethene equivalents (kg $C_2H_4e$). POCP is mainly caused by CO emissions.

# GLOSSARY

### Cradle to gate

At the beginning of an LCA study the system boundaries are defined, i.e. which process steps or life cycle phases will be considered and which not. A scope from cradle to gate covers all of the production steps from raw materials "in the earth" (i.e. the cradle) to finished products from the factories (i.e. the gate). A cradle to grave approach goes further and also includes the use phase and the end of life of a product.

### Critical review

LCA studies can be reviewed by an external expert to guarantee a high degree of quality. According to the ISO standard in some cases such a critical review is mandatory e.g. if the study comprises a comparative assertion disclosed to the public.

### Impact Categories

In LCA impact categories are used to present the results in a few key figures, in order to give a better overview of the effect on the environment. All inventoried resources and emissions are associated with one or more impact category, such as global warming potential or acidification potential, according to their contribution to this category. For example, both carbon dioxide and methane contribute to global warming. Methane, however, is 25 times stronger. The units in impact categories are equivalents to a defined reference substance (e.g. global warming is measured in carbon dioxide equivalents). How substances affect the environment and how intensively they do this is analyzed and defined by scientific methods.

### ISO standard

LCA has been standardised by the International Organisation for Standardisation (ISO). The international standard ISO 14040/44 defines how to conduct an LCA study and how to report the results.

## APEAL

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