ANALYSIS OF CARBON FOOTPRINT IN THE LIFE CYCLE OF HOT-DIP GALVANIZING PRODUCTS

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carbon footprint CO_2

MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE

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Ministry of Environment launched an intensive programme of national trials aimed at assessing the "carbon footprint" and "water footprint" of the product, and the GHG inventory of organizations and the promotion of technologies and "best practices" with low carbon content.

The programme involved the most representative realities of various Italian manufacturing sectors: food, wine, textile industry, distribution, infrastructures, transports.

The Company

Irpinia Zinc s.r.l. carries out the activity of "Hot-dip galvanizing of steel products". The industrial plant and registered office are located in "Calaggio" Industrial Zone of the town of Lacedonia, in the province of Avellino. Our company is active since 1987 and operates a production plant which extends over a covered surface of 7,700 sqm and a yard of 25,000 sqm. It is the biggest plant in southern and central Italy with a galvanizing kettle whose size is 15.50 m x 1.85 m x 3.25 m. The Company has been always focusing on technological innovation, excellence of the product, protection of the environment, and protection of health and safety of its workers.

It is certified according to ISO 9001:2000, UNI EN ISO 14001:2004, registered EMAS N° IT – 000361 and certified according to the standard OHSAS 18001:2007 with regards to health and safety at workplace.

The Project

The goal of the project, co-financed by the Ministry of Environment and Protection of the Territory and the Sea, was to quantify and report emissions of greenhouse gasses related to the hot dip galvanizing process of steel products.

In particular, the objective of the study was to calculate the potential contribution of the process to 'global warming' through the quantification of significant emissions of greenhouse gasses produced or avoided during the entire life cycle of the finished product expressed in terms of CO_2 equivalent.

Methodology

The principles, requirements and guidelines for quantifying climate footprint of products subject to analysis were derived from technical specification UNI ISO/TS 14067 "Greenhouse gasses - Carbon footprint of products – Requirements and guidelines for quantification and communication".

The quantification of environmental performance, in particular, was carried out by reference to what defined by the document PCR "CORROSION PROTECTION OF FABRICATED STEEL PRODUCTS", according to the methodology of the Life Cycle Analysis (LCA – Life Cycle Assessment) regulated, in turn, by the international standards of the ISO Series 14040.

In summary, the following normative references were considered:

- ISO/TS 14067 – Greenhouse gases – Carbon footprint of products – Requirements and guideline for quantification and communication;
- UNI EN ISO 14040 – 14045: LCA – Life Cycle Assessment;
- Product Category Rules : CPC 88731 – Corrosion Protection on fabricated steel products (Version 1.0 – dated 2011-10-27).

Functional Unit and reference flow

According to the criteria identified by the PCR document of reference, this study adopted a functional unit consisting of three types of steel plates, treated on each side, with a surface of 1 m^2 and characterized by a thickness of 2, 5, 8 mm, and a quantity of steel equal to 15,6 kg, 39 kg and 62,4 kg respectively, which the suitable amount of covering material was applied to.

The reference flow was represented by the quantity of adhered zinc, necessary to ensure the protection of the steel articles.

The products covered by the study had the following average composition, resulting from case studies reported in the literature:

Plate thickness (mm)	Zinc	Steel
2	5.9%	94.1%
5	3.4%	96.6%
8	4.2%	95.8%

Process Map

According to what established in the PCR reference document, the galvanizing process subject to the LCA analysis was split into three "modules": Upstream Module – Core Module – Downstream Module.

UPSTREAM MODULE

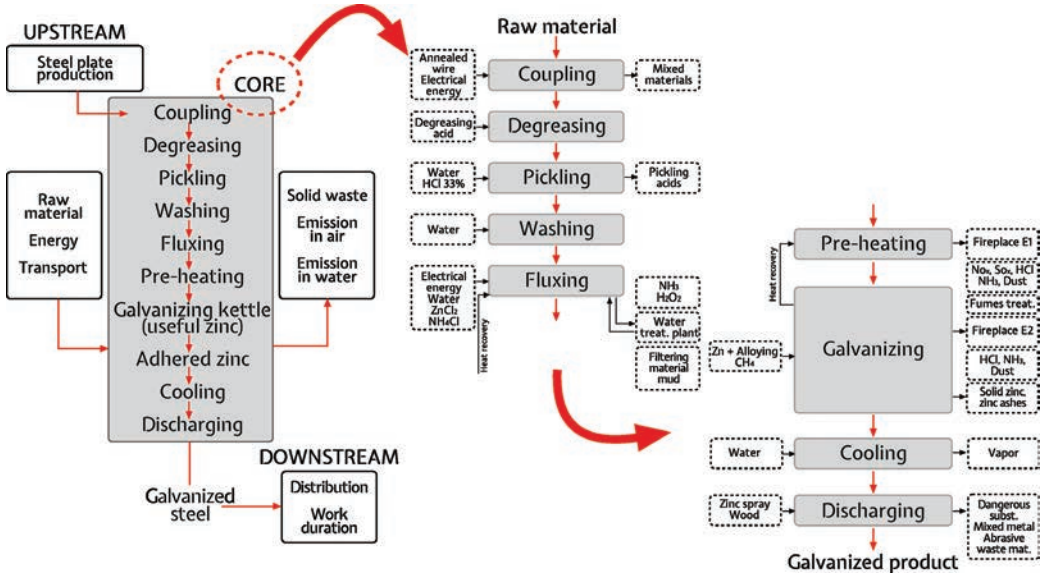
It included the production of the steel articles. Since this process fell outside the production site evaluated for emission detection and impacts characterization, reference to the database Ecoinvent 3.0 was made.

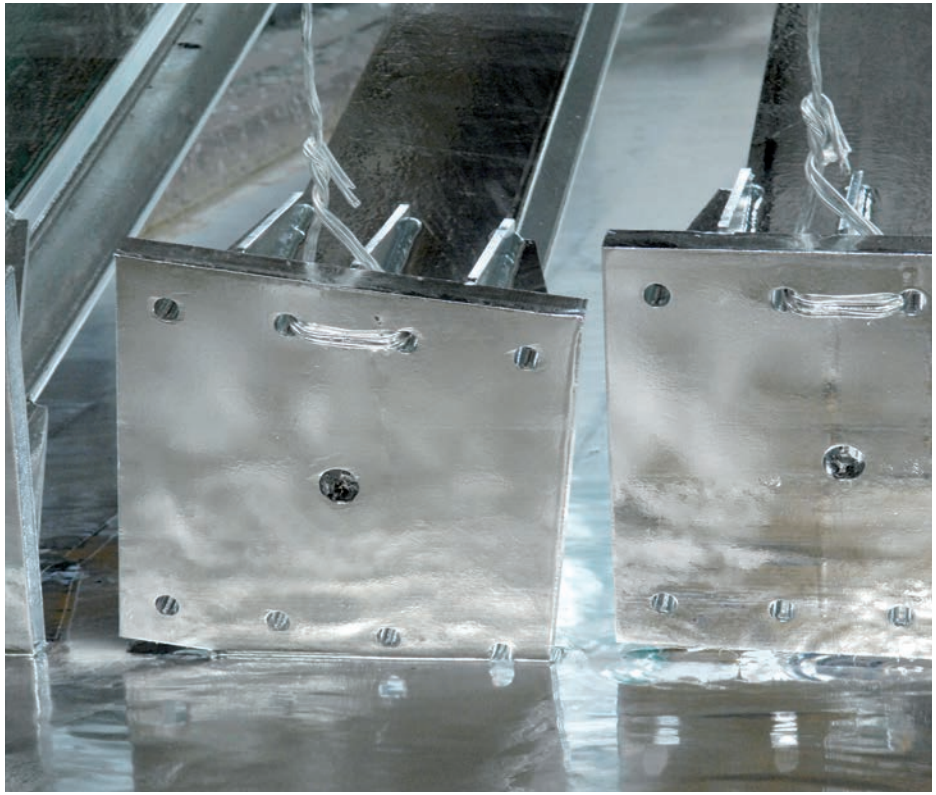
DOWNSTREAM MODULE

It included the use phase of galvanized articles and was developed by evaluating the possible duration of the protection depending on environmental working conditions of the product according to UNI EN ISO 14713; that standard graphically shows the trend of the probable protection duration depending on the thickness of the coating and the kind of environment during the use of the article. For the calculation an average duration of 40 years was assumed. The end-of-life phase is to be configured in relation to the different type of product so that it is difficult for the manufacturer to control it. For this purpose it was considered as advised on the industry PCR.

CORE MODULE

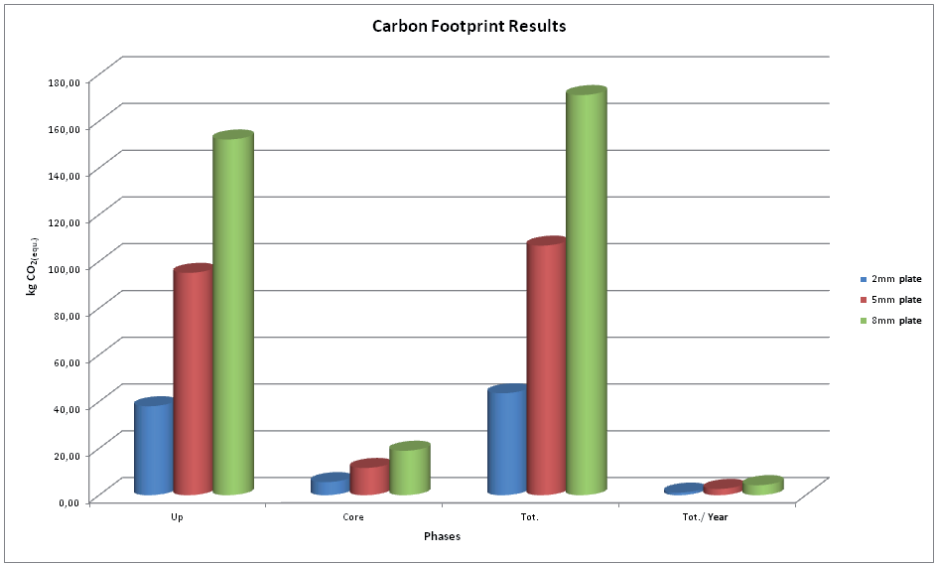
It represented the heart of the production process carried out within the plant.





Results

The final results of the Carbon Footprint expressed in $kgCO_{2\ (equ.)}$ are shown in the following diagram.



Results obtained from the study clearly showed that the largest contribution in terms of mass between the various streams in input and output from the system, was constituted by items related to the treatment of flue gases and, in particular, to the emission of carbon dioxide.

Conclusion

The study was conducted in order to quantify the Carbon Footprint related to the process of hot-dip galvanizing steel products, performed at Irpinia Zinco s.r.l.

The results of the Life Cycle Assessment procedure, used for the evaluation of the impact, for the process under consideration showed a value of the carbon footprint of:

- 43.61 $kgCO_{2eq}$ for the plate thickness of 2 mm;
- 106.76 $kgCO_{2eq}$ for the plate thickness of 5 mm;
- 171.18 $kgCO_{2eq}$ for the plate thickness of 8 mm.

The impact expressed in terms of '$kgCO_{2eq}$ per kg of galvanized steel leaving the production site' was calculated approximately 0.3 $kgCO_{2eq}/kg_{galvanized\ steel}$.

These results are in line with those of other similar European plants.

The study showed that the life cycle phase of greater impact is represented by the treatment of exhaust flue gases from the galvanized process which weigh for 80% of the total on average, followed by the upstream phase of the process for manufacturing the steel articles (10-12%). The contribution of other process phases and of the treatment and final disposal of articles once become waste, was found as being negligible.

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CERTIFICAZIONE DI SISTEMA SICUREZZA OHSAS 18001 DNV

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