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Life Cycle Assessment of hot-dip galvanising process

Andrea Arguillarena, *María Margallo, Ane Urtiaga*
Chemical and Biomolecular Engineering Department. University of Cantabria. Santander. SPAIN ✉: arguillarena@unican.es

Introduction

Hot dip galvanising (HDG) is a surface treatment process used to prevent steel corrosion, increasing the lifespan of steel components in an economical way

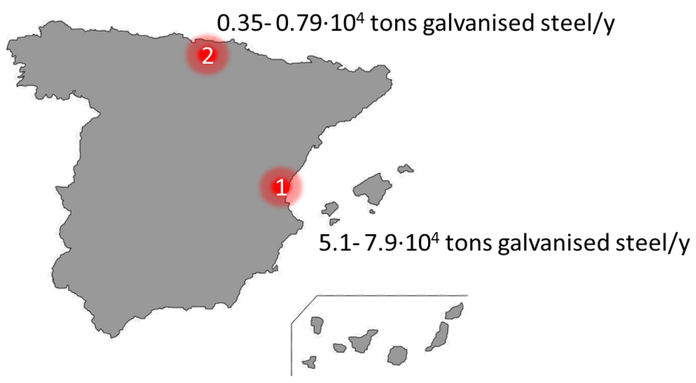

Figure 1. Production of galvanized steel of two HDG plants located in Spain (2016-2017)

Objectives

- ☑ To evaluate and compare the use of resources and the environmental impacts of two HDG plants located in Spain
- ☑ To propose alternatives to improve the environmental sustainability of HDG

Methodology

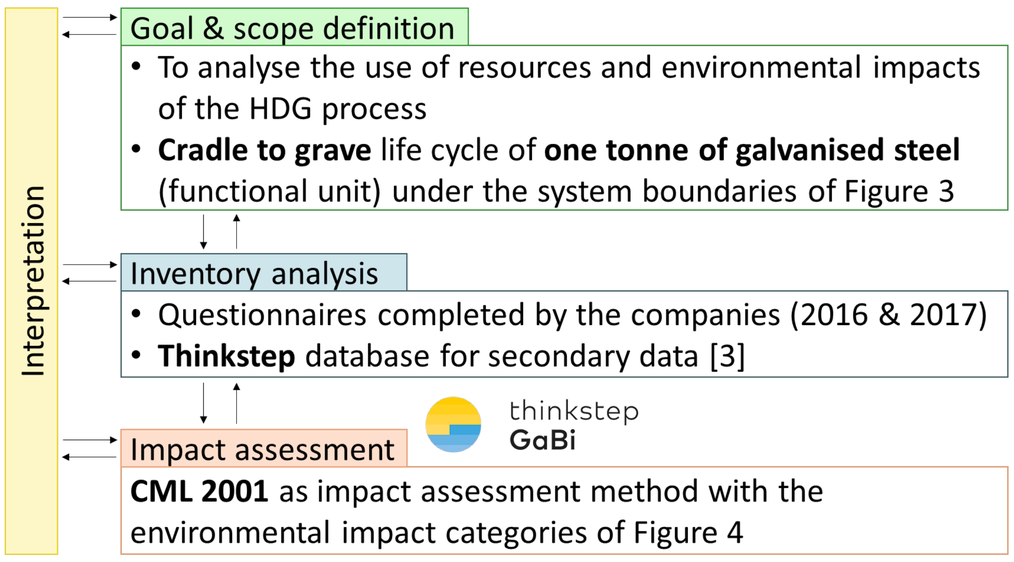

Figure 2. LCA stages [1, 2]

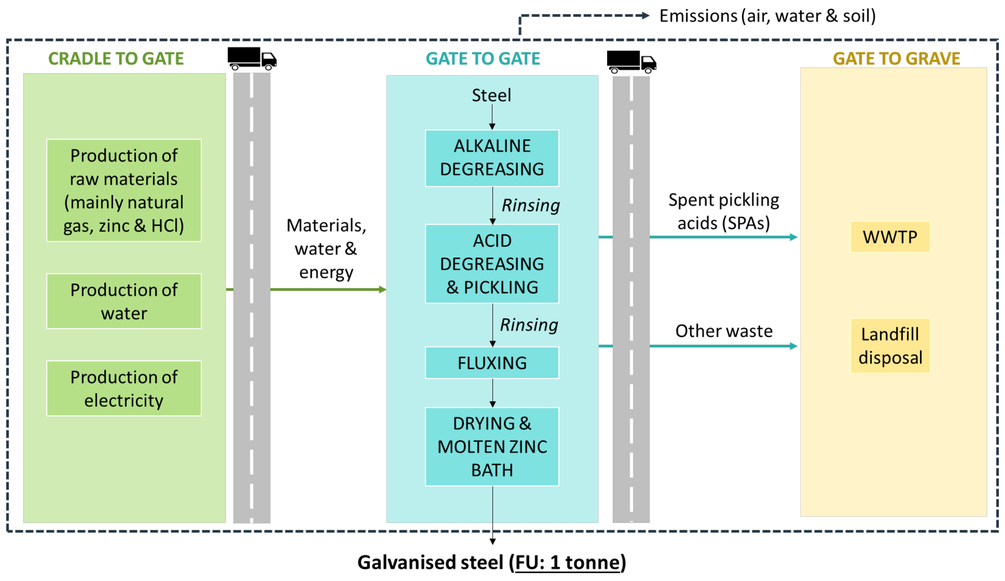

Figure 3. System description of the cradle to grave analysis of the HDG process

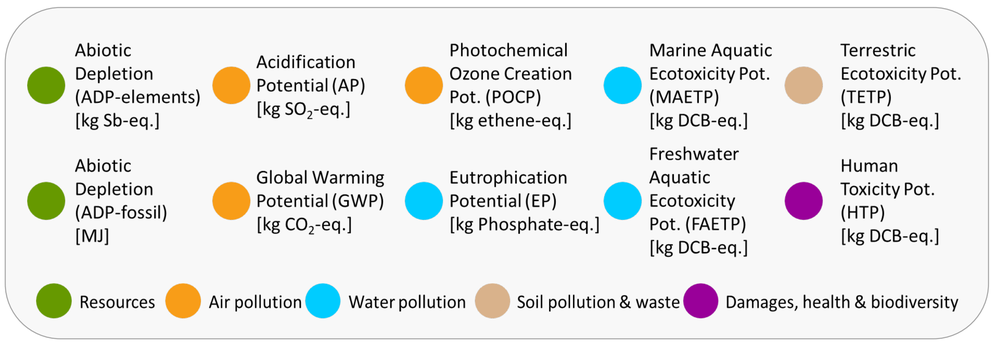

Figure 4. Environmental impact categories (CML 2001 as impact assessment method)

Results

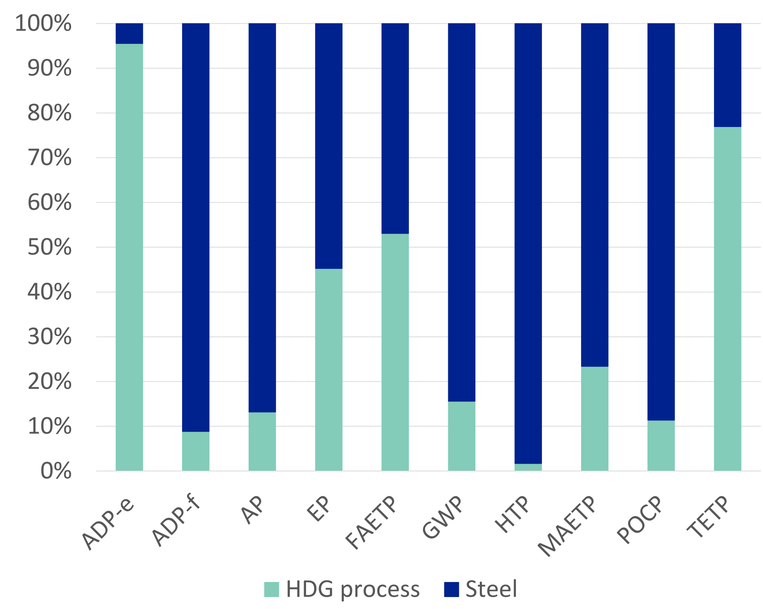

Figure 5. Contribution of the environmental impacts of steel production and the HDG process (HDG plant 1 in 2016)

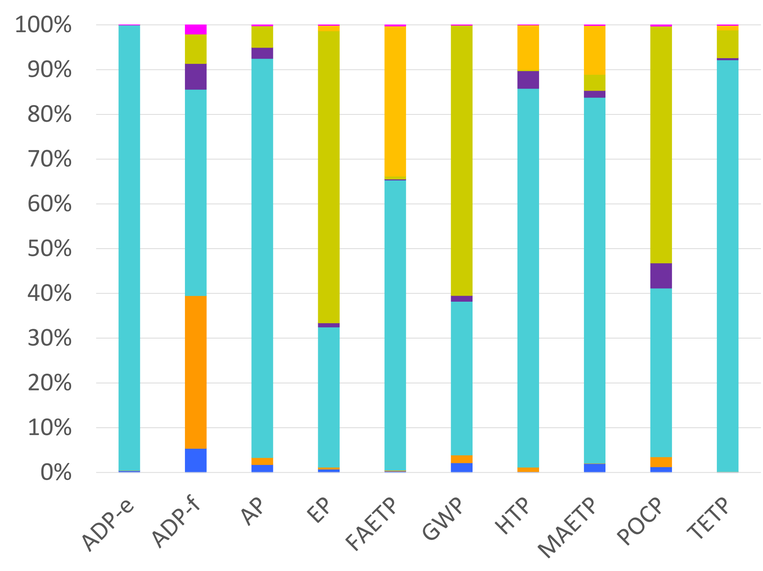

Figure 6. Main environmental impacts during the *cradle to gate* and *gate to grave* life cycle (HDG plant 1 in 2016)

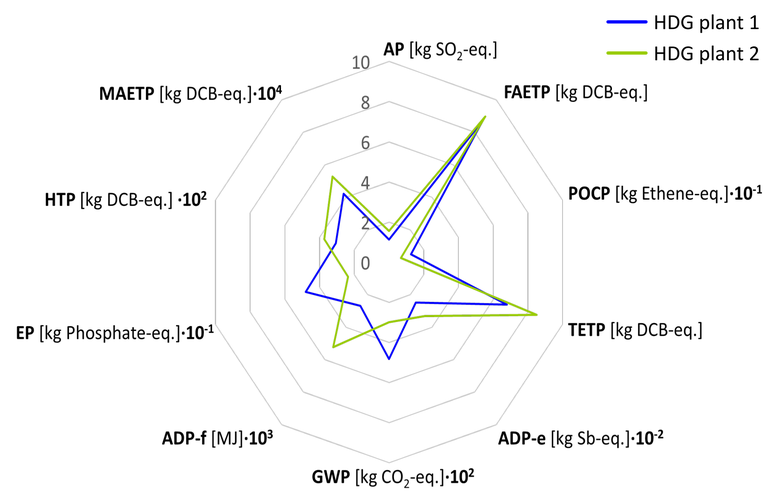

Figure 7. Environmental impacts of HDG plant #1 and HDG plant #2, in 2016

Conclusions

- ✓ Steel production is the main contributor in all the impact categories, in comparison with the HDG process, except for ADP-elements and TETP.
- ✓ Production of Zn and natural gas (cradle to gate), that are used in the zinc bath and drying stages of the HDG process (gate to gate), have the highest impacts in most of the impact categories. However, EP, GWP and POCP, are mostly impacted by landfilling (gate to grave).
- ✓ In general, the impacts of the HDG #2 plant are higher than in HDG #1 plant. However, GWP, POCP and EP impacts are higher in HDG #1, due to the use of landfilling for waste management.
- ✓ The impact on ADP-fossil is 95% higher in #2 plant, while both plants are very similar in their impacts on FAETP.

LIFE2ACID demonstrates a technological solution to recover metallic zinc and iron chloride from spent pickling acids (SPAs) of HDG, promoting the circular economy [4]. www.life2acid.eu

References

[1] ISO (2006a) ISO 14040: Environmental management - Life cycle assessment - Principles and framework. Geneva, Switzerland: International Organization for Standardization.
[2] ISO (2006b) ISO 14044: Environmental management - Life cycle assessment -Requirements and guidelines. Geneva, Switzerland: International Organization for Standardization.
[3] GaBi Database, Version 8.7.1. 2019
[4] LIFE2ACID Towards a sustainable use of metallic resources in the galvanic industry. http://www.life2acid.eu/

Acknowledgements

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Project Partners