



# **Critical review of the steel co-product allocation method developed by EUROFER in cooperation with the World Steel Association**

*Based on a report entitled “A methodology to determine the LCI of steel industry co-products”, dated 14<sup>th</sup> February 2014*

The present peer review report was prepared by PricewaterhouseCoopers Advisory SA (PwC) for EUROFER and The World Steel Association. We do not accept or assume any liability or duty of care for any other purpose or to any other person to whom the peer review report are shown or into whose hands they may come. The World Steel Association told us that it does envision distributing their report and this peer review report to a large audience: the use of their report and of the present peer review report is the sole responsibility of the World Steel Association.

We remind you that this peer review is only based on facts, circumstances and assumptions which have been submitted to us and which are specified in the peer review report. Should these facts, circumstances or assumptions be different, our conclusions might be different.

Moreover, the results of the peer review should be considered in the aggregate with regard to the assumptions made and not taken individually.

For all matters of interpretation, the original paper copy of the report take precedence over any other version.



## **Independent Reviewer's Commentary to the Management of the World Steel Association**

1. In March 2010, PricewaterhouseCoopers Advisory SA (PwC) was commissioned by the World Steel Association to undertake a critical review of the steel co-product allocation method ("the Allocation Method") developed by EUROFER, with the cooperation of the World Steel Association.
2. The overall objective of this review was to assess whether the allocation method was complying with the requirements of the ISO 14040 and ISO 14044 standards. This could be achieved through the review of the methodology report. A later request by EUROFER and the World Steel Association was to assess compliance of the methodology with the EN15804:2012 standard<sup>1</sup>.
3. The allocation method is described in a report entitled "A methodology to determine the LCI of steel industry co-products", dated 14<sup>th</sup> February 2014 ("the Methodology Report"). Our objective could be achieved through the review of the methodology report and via meetings, analysis of the underlying LCA database and exchanges with several LCA experts of the steel industry. Following our first review in July 2010, which contained several recommendations, a second report was issued by the World Steel Association, in February 2013, a third report in December 2013, and a fourth in February 2014 that the subject of the review herein.
4. Our work consisted of a comparison of the methodology used by EUROFER and the World Steel Association, in the context of the requirements of the ISO 14040 and ISO 14044 standards. Some requirements must be undertaken as a minimum in order to comply with the standards. The EUROFER and the World Steel Association's work was assessed against these in order to assess compliance. We also considered other optional elements of the ISO 14040 and ISO 14044 standards and provided feedback where addressing these issues would enhance the study.

---

<sup>1</sup> EN15084:2012 standard, "Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products"

4. In undertaking this review, we have systematically compared the data and information supplied by EUROFER and the World Steel Association with the requirements of the ISO 14040 and ISO 14044. The main following recommendations were raised:

- Scope and objectives of the study: clarification of the context and objectives of the report;
- Partitioning methods (all process stages considered within the steel plants): description of the full list of co-products, clarification of the partitioning rules / system expansion approach used to increase transparency of the method used;
- Partitioning method (blast furnace and basic oxygen furnace): we checked that the partitioning rules between steel/hot metal and slags matched the metallurgical model and that the partitioning keys between steel and slags were consistent with typical energy consumption values observed in steel production plants. We also checked that the metallurgical model was transparently described and that no double-counting or omission of inputs and outputs occurred. However, the scope of our review did not include the detailed review of the accuracy and completeness of metallurgical model and parameters used in the allocation rules.
- Results and sensitivity analysis: expansion of the sensitivity analyses section to include several additional scenarios.

5. EUROFER and the World Steel Association have taken into account all our propositions and feedbacks in their final report.

6. Our review found that, in the Methodology Report, the EUROFER and the World Steel Association method for allocating impacts between co-products within a steel plant has been set up in accordance with the requirements of the ISO 14040 and ISO 14044 standards.

7. Regarding compliance of the EUROFER and the World Steel Association method for partitioning impacts between co-products within a steel plant with EN 15804:2012, we can make the following observations. As advocated in section §6.4.3 “Allocation of input flows and output emissions” of EN 15804, the steel plant processes (e.g., blast furnace and basic oxygen furnace) have been divided into sub processes (e.g., in the base of the blast furnace: iron oxide decomposition, hot metal formation, heating of hot metal, reduction of silicium, manganese and potassium, dissolution of C, Si, Mn, P and slag melting).

Input and output data related to these sub-processes were quantified using thermodynamic equations that are used to manage the production process and are consistent with the quantities of energy consumed by the process at the site level.

Within each sub-process, the process modelling used to partition impacts between hot metal/steel and slag is based on physical properties of the flows (e.g., in the case of the blast furnace process, the following subprocesses are allocated to the hot metal: iron oxide decomposition, hot metal formation, heating of hot metal, reduction of silicium, manganese and potassium, dissolution of C, Si, Mn, P and the slag melting subprocess is attributed to the slag). In that sense, it can be considered that allocation have been “avoided as far as possible by dividing the unit process to be allocated into different

subprocesses that can be allocated to the co-products and by collecting the input and output data related to these sub-processes” (§6.4.3.2. of EN15804).

As a sensitivity analysis on the methodology used and although using an economic allocation is found not to be applicable in the case of the steel production<sup>2</sup>, the partitioning method developed is compared to an economic allocation approach in the sensitivity analysis section of the Methodology Report. For concrete, as compared to other allocation rules for slag vs steel (mass allocation, no allocation: 100% allocation to steel) and as compared to system expansion approach, the Partitioning Method and the economic allocation provide favourable results for the environmental footprint of concrete:

- In the case of a concrete using 300 kg/m<sup>3</sup> of cement, when 50% of the cement is substituted by slag, the CO<sub>2</sub> footprint of the concrete is reduced by 13% under the Partitioning Method and by 17-35% under the economic allocation rule.
- Under both the Partitioning Method and the economic allocation:
  - the CO<sub>2</sub> footprint of concrete is lower than under a mass allocation<sup>3</sup> or under a system expansion approach<sup>4</sup>
  - the CO<sub>2</sub> footprint of concrete is larger than under a no allocation approach<sup>5</sup>.

The Partitioning Method proposed is found to be compatible with EN15804:2012, and is, in the Methodology Report, transparently described and clearly positioned as compared to the economic allocation.

---

<sup>2</sup> Indeed, slags do not have an established economic value and estimation of this economic value is fluctuating, which makes the economic allocation rule unfeasible in practice.

<sup>3</sup> Using the same example of CO<sub>2</sub> footprint of a concrete with 300 kg/m<sup>3</sup> of cement, when 50% of the cement is substituted by slag, the CO<sub>2</sub> footprint of concrete would be increased by 30% under a mass allocation of steel and slag.

<sup>4</sup> Using the same example of CO<sub>2</sub> footprint of a concrete with 300 kg/m<sup>3</sup> of cement, when 50% of the cement is substituted by slag, the CO<sub>2</sub> footprint of concrete would remain the same under a system expansion approach.

<sup>5</sup> Using the same example of CO<sub>2</sub> footprint of a concrete with 300 kg/m<sup>3</sup> of cement, when 50% of the cement is substituted by slag, the CO<sub>2</sub> footprint of concrete would be reduced by 36% if slag was not allocated any impact from the blast furnace and/or basic oxygen furnace.