

Global Stainless Steel Life Cycle Inventory

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The International Stainless steel Forum (ISSF) has undertaken a commitment to provide the best possible information to the industry stakeholders in the area of life cycle assessment (LCA), delivering transparent and authoritative data on the production of stainless steel from its raw materials.

This paper, and opportunity for engagement, describes the processes involved in managing the life cycle inventory building, data presentation, data application, and ability of our peers to influence decisions based on a life cycle management principle.

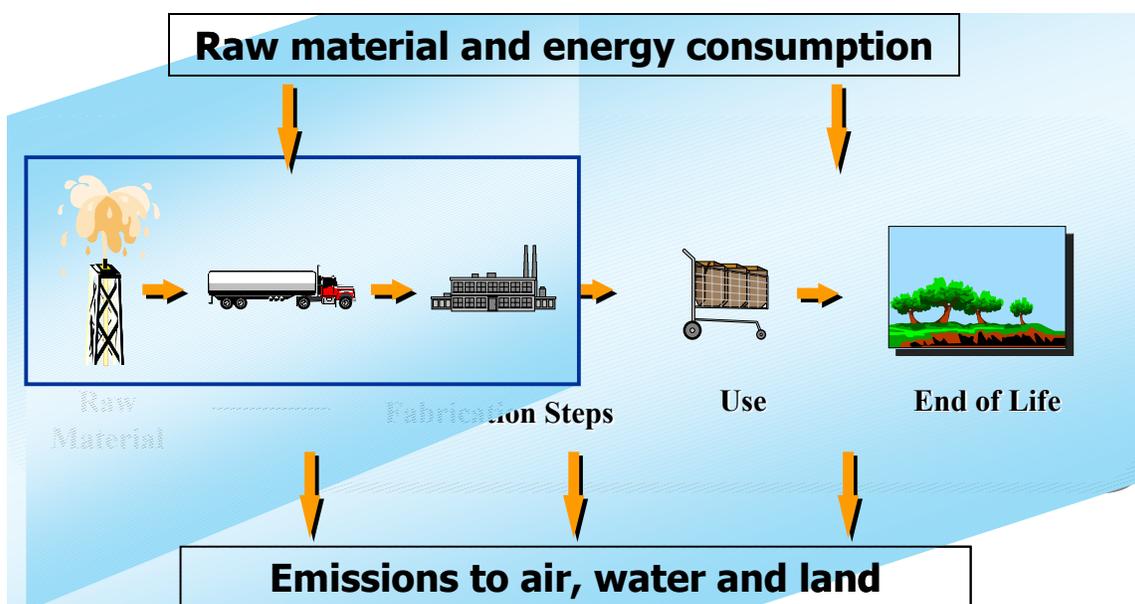


Figure 1: The Product Life Cycle

Inventory Building

The Life Cycle Inventory (LCI) building is a fundamental basis necessary to carry out further environmentally based assessment. The LCI is a holistic view of the inputs and outputs for a given system (such as the production of stainless steel) in order to carry out a life cycle assessment.

The inventories for all the production process that occur in manufacturing the product under study are collated so that a clear profile of the production route, and the contribution of each stage can be assessed by the LCA practitioner.

A full cradle-to-grave study looks at the production from raw material (cradle), through the use phase, and end-of-life (grave). The ISSF LCI is a cradle-to-gate study, where the analysis of data is from raw materials through to the stainless steel product at the works gate. This allows the user to model the use phase.

An example of the completeness of the inventory is illustrated in Figure 2, for the electric arc furnace. Such a model is used for every process stage required to make stainless steel from its raw material extraction, through to the processing on the steel works.

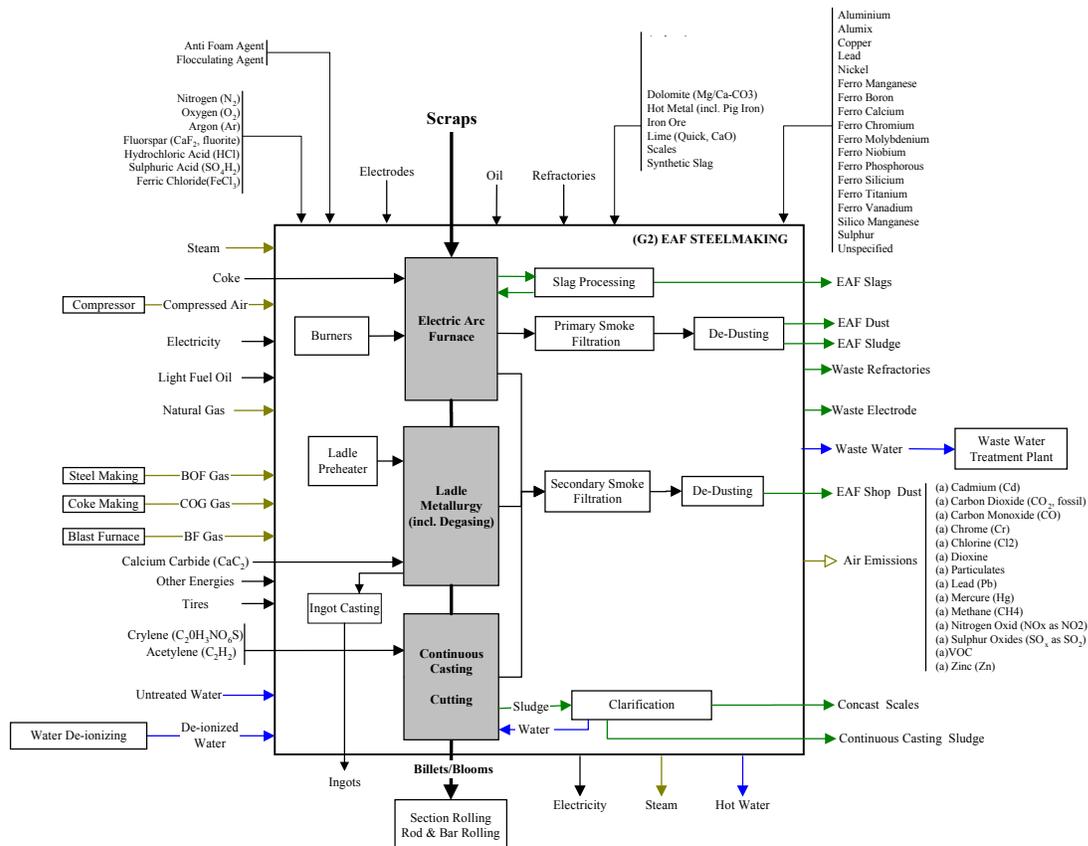


Figure 2: LCI model of Electric Arc Furnace

The set of International Standards represented by ISO14040, outline the approach and rigor to which the exercise must adhere, including the necessity for independent third parties to critically review the work.

Global Life Cycle Inventory

The experience gained from the life cycle studies at Eurofer¹, and the IISI² is being extended in order to complete a LCI for global stainless steel. The datasets involved in this study will cover major stainless producers in Europe, Japan, Korea, and North America with the focus on global averages for the production of austenitic and ferritic grades (flat products). The data collection phase also covers long products, duplex grades, and stainless steel from scrap and ore based steelmaking. In Japan, the Life Cycle



experts of the Japanese Iron & Steel Federation have completed a similar LCI study for flat and long stainless products, and have agreed to allow this data to be aggregated into the global LCI study for the ISSF. Similarly in S. Korea, and N. America, stainless steel LCI have been collected for flat and long products to make this a truly global concern. More representation is also welcomed, and will only add to value and integrity of the study.

The scope of the project is to provide high quality LCI data for further case studies involving the life cycle assessment stage, in the form of case studies for specific product application for stainless steel.

The methodology and practicalities of data collection have been reduced to a questionnaire, designed for the European stainless producers, and as such greatly simplifies complexities of data submission.

Initiatives such as these studies benefit from multi-company involvement. The work is carried out on a confidential basis, so at no point is company data divulged to any third party. The results of the study are aggregated by region and as global values, and with complete control on the communication policy. The advantage to the individual steel producer is that their own data is put into context of their region, or the global results, and for own interpretation.

The Case for Stainless Steel

The development of the global stainless LCI will allow further technical interpretation of the production processes, and product applications, for the companies involved, and the users of the stainless products. The case for investing the resource in life cycle management is becoming clearer with the development of process and product related regulation.

In the case for process regulation, integrated pollution prevention and control (IPPC) requires rigorous data focused on the production route in order that operating licenses are granted; the demand to demonstrate emission reductions, energy efficiency, and benchmarks for the industry on a common basis rely on clear and transparent methodology that life cycle inventory exercise has at its foundation. In the case for product applications, Integrated Product Policy (IPP), end of life directives (e.g. ELV, WEEE), and environmental product declarations (EPD) are becoming important factors on the route to market. The provision of these data, and the ability to communicate and understand the implications of the results will be a key parameter in the decision-making processes of the near future, as the principles of sustainable development integrate into management systems.

Product Development processes use these integrated decision making tools, for example the customers of the stainless industry, such as the automobile manufacturers have 100's of component and several full vehicle LCA, some public, some internal, and use them in the decision-making process for the best environmental option of the vehicle. Steel in the widest sense is a major contributor to many product systems, and therefore an obvious



target for the decision maker. The automobile sector is not alone in using life cycle studies in their decision process; the construction industry, process industry, medical industry, and others are all addressing the environmental axis of their product.

It is important to note that LCA should be used for product systems in the life cycle of that product, rather than material vs. material at the point of production, as it is difficult to fairly align system boundaries, and processes to provide a comparison on the same basis, and furthermore, even harder to predict how different materials perform through the use and end-of-life stages – this is where the real assessment is made as the use phase is often associated with the greatest burden.

Policy makers in the regions of the World also have databases and expertise in using life cycle approaches, and encourage the life cycle management approach. Examples include the European Union (eLCA project), US EPA (LCAccess), UN Environmental Program (UNEP/SETAC), & the Japanese Ministry of Environment (National Project), amongst others.

If the stainless steel industry is not represented in these initiatives, engaged in the databases of access to data and expertise, or has knowledge of the assessment studies occurring corresponding to the stainless product, then there is a significant risk of isolation in an area where other companies see opportunities for market place gains.

Internal & External Benefits

The value of the IISI/ISSF as a hub of global stainless LCI saves resources from companies who can better use them for market and regulatory focused implementation of these LCI data. Among the key topics for the stainless steel industry are the longevity of the product, the routes and rates of recycling, and the resource efficiency in production process.

The value of the LCI study must be realised internally and externally. The internal value creation is gained from a comprehensive assessment of emissions, energy and material use throughout the process, and the ability to troubleshoot through assessment tools that benchmark against industry averages/minimum/maximum values, and provide contribution analyses for each emission or flow under study. The participating stainless steel companies from the Eurofer LCI have already received and used such an assessment tool, and develop the results further in conducting studies for their own stainless products in use and recycling phases.

Externally, the value of an LCI can be developed in the case of ISSF for case studies to illustrate the applications of stainless steel as the material of choice, to project the positive image of the industry or product, address the environmental legislation issues, and provide data when required by the stakeholders.

The IISI/ISSF, through the LCA Forum is progressing the life cycle thinking approach to the LCA area, in terms of performing assessments on steel products in their use phase such as the latest ultra-light steel auto body – advanced vehicle concept (ULSAB-AVC)



results; and a major project on addressing the need for comprehensive recycling data for steel, aimed at defining the modeling of recycling/end-of-life, recycling rates, and LCI for recycling processes.

The extent of data requests is also increasing, and already involves the EUCAR Light Recyclable Car LCA coordinated by the major European Automobile Manufacturers, to address the auto industries response to the End Of Life Vehicle Directive. Requests are reviewed individually, to ensure that the best advice and most appropriate stainless grade and finish is delivered, and to this extent requests are processed from the construction industry, and for individual products including; the processing of stainless sheet, packaging studies, and a LCA/risk assessment, amongst others.

The stainless steel industry has a responsibility as a major supplier, and as a customer of other industries to provide life cycle information, and be pro-active in the strategy for future studies, and use of the resource available through ISSF.

Conclusion

This paper briefly describes the approach that the ISSF is making to address the stakeholder issues relating to life cycle assessment. Apart from the ability to do business with the stainless steel customers in showing best practice, and demonstrable evidence of the ecological credentials of stainless steel, such as the resource use, air and water emissions, energy consumption, and waste profiles, the life cycle projects can be applied in market development activities in the same way as, our customers efforts are already active in assessing the stainless product life cycle on our behalf.

Life cycle assessment is one of the platforms for materials competition, and comparison, and it is essential that the industry organise a proactive approach to collecting the best data, together with effectively communicating and marketing of the results for effective return.

References

1. Orlandi, M-C; Hay, A; Koundakjian, P; European LCI on Stainless Steel Flat Products, 2002.
2. International Iron & Steel Institute (IISI) Worldwide LCI Study for Steel Products, 1999/2000 Methodology Report (www.worldsteel.org/lci)