



ArcelorMittal

Making sense of Steel industry data

Arcelormittal experience

ArcelorMittal: a global steel company



- ArcelorMittal, the global steel company with biggest production:
 - 90.4MtCS = 5.5% of world production: 84.7% BOF/ 15.3% EAF
 - Total scrap consumption: 26.8Mt; Total BF slag production: 22.2Mt
 - Vertically integrated: Coal; Iron ore; Pellets; DRI; Coke; Lime...
- ArcelorMittal climate aspects in a nutshell:
 - Total emissions steel making: 193Mt CO₂eq
 - Total emissions avoided thanks to scrap use: 34.8Mt CO₂eq
- Present in all (developed) steel markets:
 - 200.000 people; presence in 60 countries; steel production in 18 countries and 47 steel making sites – much more than any other steel maker
 - Operating all possible production routes: EAF; EAF/ DRI; BOF...

How a global steel company can manage its C-performance?

- ArcelorMittal has the unique opportunity to benchmark and learn from the best without confidentiality/ competition concerns
 - Who uses his carbon in the most efficient way?
⇒ a simple question with complex answer!
 - Analysis should exclude local advantages/ disadvantages or impacts on which the steel maker has no control
- Once the C-efficiency is determined per operation:
 - Performance evolution can be tracked
 - Analysis can be done on the factors that contribute the most to best performance and performance improvement
 - plans can be made; targets identified (f.e. 25percentile)

Comparing C-performances in steelmaking?



Steelmaking is a long chain => need to benchmark supply chains

- Harmonize the perimeter & remove disturbing factors
- Classical GRI “footprint” accounting:
 1. Collect data on the emissions: scope 1
 - But power from waste gases in internal vs external PWP? => include power from waste gases always in scope1!
 2. Include power emissions: scope 2
 - But intensity of power is very variable => clouding the inherent performance
 3. Harmonize perimeter upstream: scope 3
 - Limited to selected CO2 intensive upstreams: coke, pellets, DRI, HM, burnt lime/ dolomite, oxygen, nitrogen...

Downstream it is not possible to harmonize perimeters with limited data collection exercise => Large downstreams have disadvantage

Comparing C-performances in steelmaking?

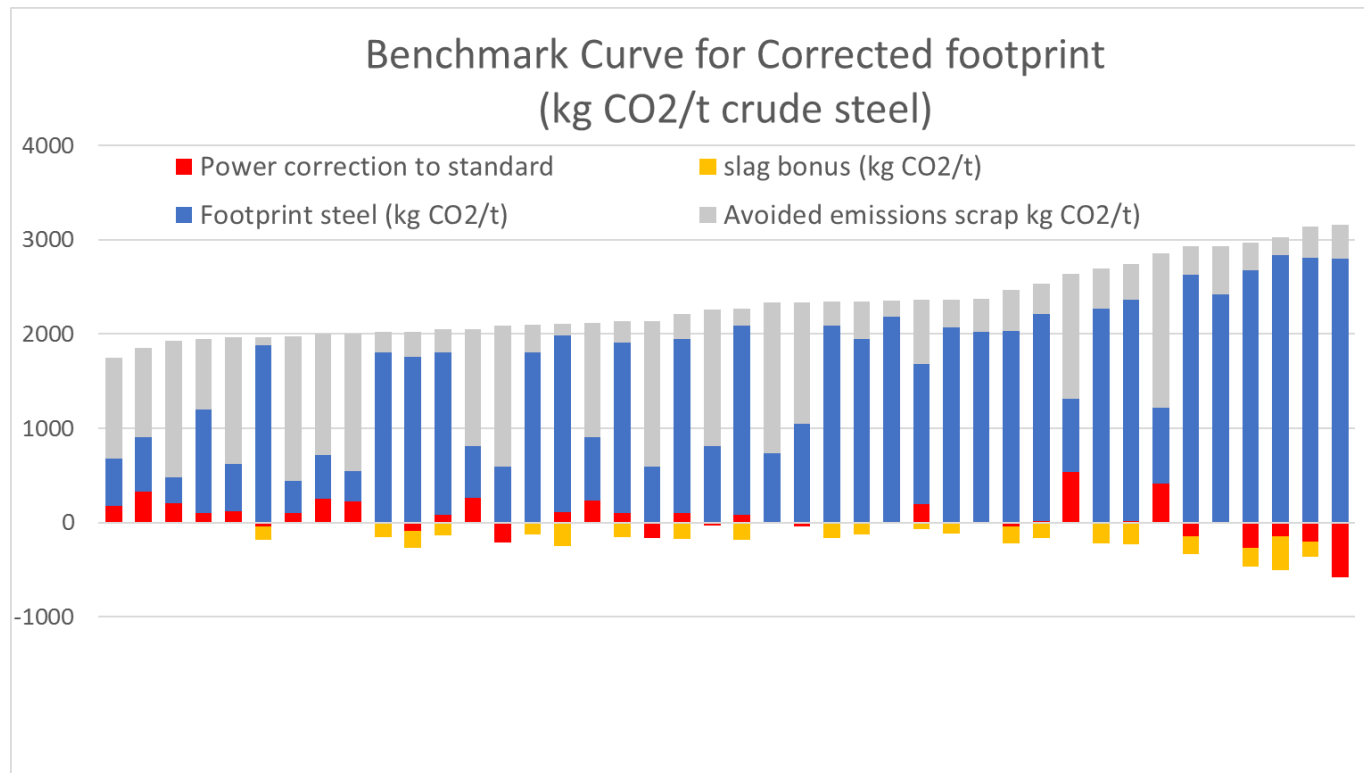


- Resulting footprint still not representative to track performance
 - Is the use of scrap an achievement?
 - Consideration: the scrap stock is limited and almost entirely exhausted (85%-92% recycled) => 500Mt of annual steel need of 1700Mt: if A uses more scrap B has less and needs to use more iron ore - but a little more scrap can hide a lot of process inefficiency!
 - Proposal: take scrap out of the footprint and treat it as a separate roadmap
 - Raw materials quality choice has an important CO2 impact
 - Analysis shows*: C=cost of 1t of slag = 550kgCO2
 - When benchmarking steel making this should be removed from the footprint and +/- same argument as for scrap: If A uses best ores B has to use the less good ones left or - different mining/ beneficiation policy?
 - Is slag production undesirable? When it is granulated it becomes a clinker substitute with a lower footprint => as long as clinker footprint >600kg/t: is there a need to penalize granulated slag production?

*The Carbon Cost of Slag Production in the Blast Furnace: A Scientific Approach; K. Buttiens, J. Leroy, P. Negro, JS. Thomas, K Edwards, Y. De Lassat; J. Sustain. Metall. Feb. 5 2016

Footprint benchmarking

- Correction for slag, scraps and power emission factor
- Precision not better than 10% due to downstream differences ($\approx 200\text{kgCO}_2/\text{t}$) but feasible with available figures
- A more useful way of reporting steel GHG data?



Conclusions (1)

- EN 19694 describes a benchmarking methodology for steelmaking operations
 - Detailed information on shop level is needed results can be precise to few %
 - Allows for detailed analysis of where and why performance is lost/ gained
- Above methodology applies the same principles but uses more global/ readily available data
 - Worldsteel/ GRI methodology compliant
 - Additional info necessary on scrap use, slag production and Scope 2
 - But, due to differences in downstream perimeter precision worse than 10%

Conclusions (2)

- 4 parallel and +/- independent roadmaps make up global footprint of steelmaking:
 1. Process performance of individual operators
 2. Intensity of available power mix (energy policy dependent)
 3. Raw materials quality (resource availability (and leakage aspect?) + raw materials policy)
 4. Scrap Use (dependent on worldwide availability or policies => leakage aspect?)
- Untangling the different relevant drivers determining the impact of steel making may lead to a better understanding of the role and the importance of these drivers as well as policies to address them