CO_2 footprint reduction program with lower CO_2 ladle working linings

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The background situation

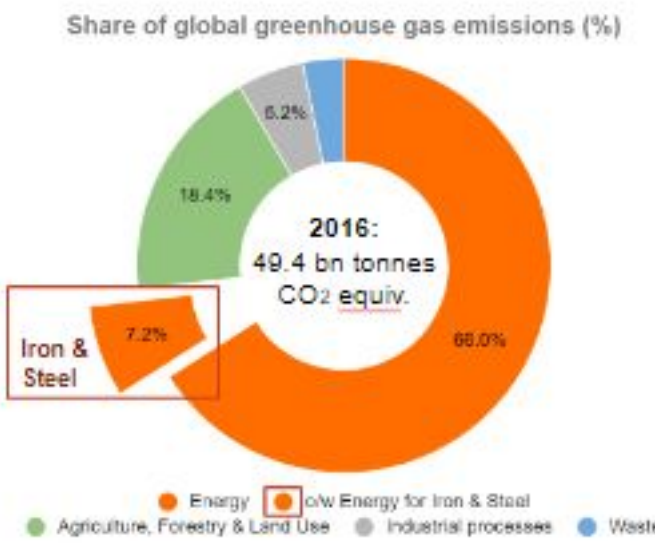
The European Commission has reinforced its objective to cut down **CO2 emission by 55% of 1990 level by 2030** (previous target: 40% of 1990 level).

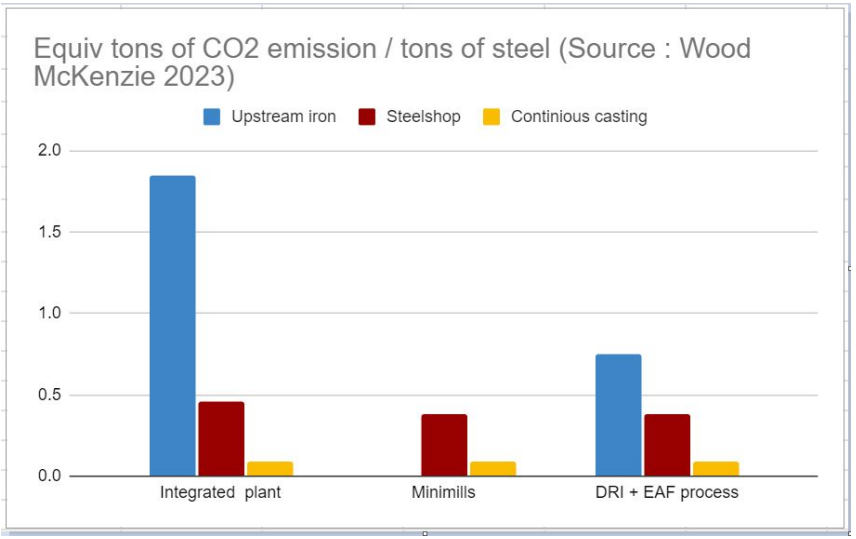
- Integrated plants **(BF/BOF) are responsible for most of the emissions** from the Iron & Steel industry
- **By late 2030's, ~50% of hot metal output will be above EU free allowances** (ETS) and carbon price will exclude them from the competitive landscape
- Steelmakers are evaluating **multiple strategies to reduce their emissions**, mainly based on substitution by Hydrogen which is expected to become cost competitive on the 2030 horizon.

The request from the customers

The search for CO_2 reduction by processing segment:
In addition, within Liquid Steel Processing, there are further options to examine lower CO2 levels.
As Ladle refractory contributes to 60% of all refractories within by volume, it would make logical sense to consider this application more closely.

By measuring the CO2 footprint for each raw material, as well as the complete formula and manufacturing processes to the finished product, it is clear that positive changes to CO2 reduction can be made, without affecting ladle lifetime.





Analysis of the customer request

Not all ladle linings are equal in their CO_2 footprint:
The mainstay of steel ladle working linings are Magnesia Carbon technology, as it is typically compatible with most steel making processes and slag chemistries.
However, due to the high level of CO2 within the naturally occurring mineral of Magnesite (approximately 52% CO2) and the high level of energy needed to bring this base mineral into a high quality raw material for brick making (fusion process) - then a high CO2 footprint exists.
However, by moving to alternative technologies, a lower CO2 footprint can be achieved.

Calderys solution

Through calculation of the A - Z of raw material processing, as well as finished product manufacturing, a new outlook is gained.

By considering a ladles typical design and the respective zones, as well as the average weight of refractory per vessel relining combined with total ladle lifetime,a calculation of total CO2 contribution can be very closely estimated.

Typical Fused Ingot (MgO) Cross Section

Benefits brought by the solution

Secondary steelmaking practices and slag chemistry largely dictate the design on the ladle wear lining.

The refractory has to be both chemically compatible to the steel and slags within the process, as well as demonstrate the necessary strength / durability requirements for the high levels of mechanical wear experienced.

However, from a base CO2 level - changes in working lining design and product selection can lower the initial CO2 footprint.

Even with minor changes, some significant gains can be made. The best and worse cases are illustrated.

1. MgC bricks solution			
Pack 1A		**Pack 1B**	
MC DBM	2140	MC DBM	2140
MC F	4997	MC DBM	2140
MC F	4997	MC DBM	2140
MC F	4997	MC DBM	2140
MC F	4997	MC DBM	2140
Tons of CO2	**121**	Tons of CO2	**54**

Worst Case
***121 tonnes of CO2 annually**

2. AMC bricks solution			
Pack 2A		**Pack 2B**	
MC DBM	2140	MC DBM	
MC F	4997	MC F	4997
AMC WFA LMg	5201	AMC baux LMg	769
AMC WFA LMg	5201	AMC baux LMg	769
AMC WFA LMg	5201	AMC baux LMg	769
Tons of CO2	**125**	Tons of CO2	**45**

Best Case
***45 tonnes of CO2**

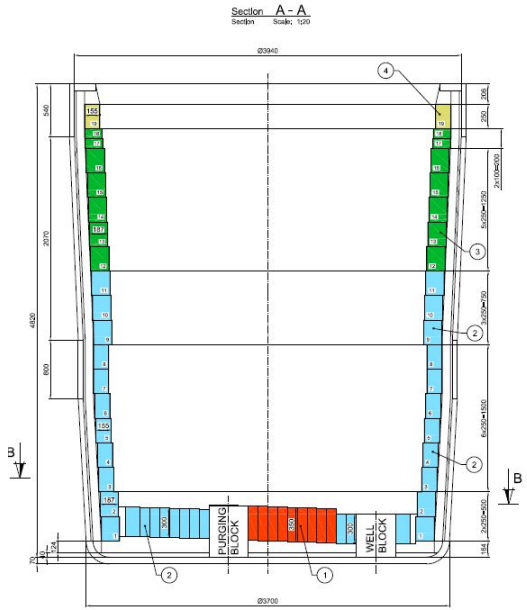
***Calculations under review**

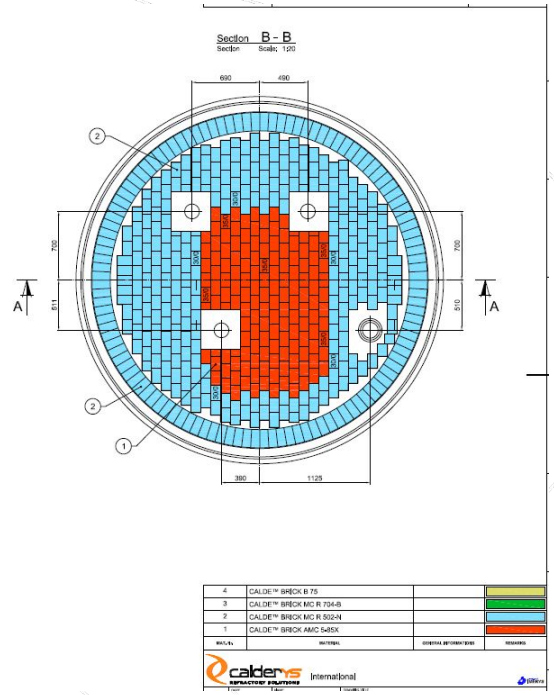
Assessment Program

As a leading provider of refractory products and services, Calderys has a duty through its product stewardship program to measure all relevant technical aspects of its products.

Expertise

Calderys specialists can offer new lining solutions that could not only meet the customers technical / commercial targets, but also offer a lower CO2 footprint vessel lining design without lowering performance.





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