Greenhouse Gas Emissions Intensity Performance Thresholds for Crude Steel
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Greenhouse Gas (GHG) Emissions Intensity Performance Thresholds for Crude Steel

Welcome and Introductions
Anne-Claire Howard, CEO, ResponsibleSteel

GHG Emissions Intensity Performance Thresholds, Standards and Procurement
Matthew Wenban-Smith, Policy and Standards Director, ResponsibleSteel

CRU Steel Carbon Module
Paul Butterworth, Head of Steel Analysis, CRU
1. Steelmaking, GHG emissions and scrap
2. Why specifying low embodied carbon steel is not enough
3. A better way to measure performance and support lower emissions
Steelmaking, GHG emissions and scrap

Iron ore

Blast Furnace (BF)

Basic Oxygen Furnace (BOF)

Electric Arc Furnace (EAF)

scrap
Iron ore and scrap for steelmaking: the BF/BOF route

- **Iron ore**: Source: ArcelorMittal
- **Scrap**: Source: ArcelorMittal

From Net Zero Steel Pathway Methodology Project
Iron ore and scrap for steelmaking: the EAF route

Blast Furnace (BF)
Direct Reduced Iron (DRI)
Electric Arc Furnace (EAF)
Basic Oxygen Furnace (BOF)

Iron ore
scrap

Source: ArcelorMittal
From Net Zero Steel Pathway Methodology Project
Steelmaking direct from iron ore has higher CO$_2$ emissions

Primary sources
Iron ore
- 18-22 GJ
- 1t steel
- 0.1t CO$_2$

Iron ore

Ironmaking
Pig iron
- 18-22 GJ
- 1t steel
- 0.1t CO$_2$

Secondary sources
Scrap
- 5-7 GJ
- 1t steel
- 0-0.5t CO$_2$

Steelmaking
- 1-2t CO$_2$

Sources: ArcelorMittal
From Net Zero Steel Pathway Methodology Project
Increasing scrap use lowers emissions intensity for any steelmaking route

![Graph showing the relationship between percentage of scrap used as an input and GHG emissions intensity (tonnes CO2/tonne crude steel)].

**Graph Title:** Carbon Steel: GHG Intensity Threshold (tonnes CO2/tonne crude steel)

**Y-axis:** GHG emissions intensity (tonnes CO2/tonne crude steel)

**X-axis:** Percentage of scrap used as an input

[Further analysis and data points from responsiblesteel.org]
Simple measures of carbon intensity incentivise the use of scrap.
1. Steelmaking, GHG emissions and scrap
2. Why specifying low embodied carbon steel is not enough
3. A better way to measure performance and drive lower emissions
If scrap supply is limited, a simple focus on emissions can drive perverse outcomes.

Increased scrap input reduces emissions for site A.
If scrap supply is limited, a simple focus on emissions can drive perverse outcomes.

Increased scrap input reduces emissions for site A.

Decreased scrap input increases emissions for site B.

If scrap supply is limited, a simple focus on emissions can drive perverse outcomes.
And scrap supply *is* limited

Global steel demand outlook

- Primary (iron ore)
- Secondary (end-of-life scrap)

Source: ArcelorMittal
From Net Zero Steel Pathway Methodology Project
1. Steelmaking, GHG emissions and scrap
2. Why specifying a low embodied carbon threshold for steel is not enough
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A better way to measure performance and support lower emissions

Better than average, given the level of scrap input

Worse than average, given the level of scrap input

Percentage of scrap used as an input

Carbon Steel: GHG Intensity Threshold (tonnes CO2/tonne crude steel)

Average emissions intensity for a given level of scrap use
High Iron Ore Percentage Routes

Better than average performance. Every steel mill should be able to achieve this through efficiency improvements and/or sourcing of low GHG input material and/or low GHG energy sourcing, green energy offsets.

High Scrap Percentage Routes

Better than average performance. Every steel mill should be able to achieve this through efficiency improvements and/or sourcing of low GHG input material and/or low GHG energy sourcing, green energy offsets.

Likely to require additional investment and/or application of existing technologies such as DRI, biomass, ...

Further low GHG energy sourcing, green energy offsets, fossil carbon replaced with bio-char, etc

Likely to require major capital investment in new technologies, Hydrogen, biomass, carbon capture, etc

Further low GHG energy sourcing, green energy offsets

NZ New technologies, optimized production, zero emissions energy, minimum emission input materials

NZ Minimum emission input materials, Zero emissions energy
An emissions intensity measure is not enough on its own...

Carbon Steel: GHG Intensity Threshold (tonnes CO2/tonne crude steel)

Percentage of scrap used as an input

Real GHG reductions

Average emissions intensity for a given level of scrap use

responsiblesteel.org
We also need decarbonisation pathways, targets and commitments...
<table>
<thead>
<tr>
<th>• An SBT/ Net Zero Target: the company or site has a science-based targets for decarbonization aligned with the achievement of the Paris Agreement: SBT/net zero</th>
<th>Drives and rewards planning and commitment to new technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GHG emissions intensity performance for crude steel production that takes account of the proportion of scrap used as an input material</td>
<td>Drives and rewards low GHG steel production, irrespective of production route and the proportion of scrap</td>
</tr>
<tr>
<td>• Steel product level carbon footprints – embodied carbon in the purchased product</td>
<td>Measures embodied carbon for the end user, supports end user target setting and tracks success over time</td>
</tr>
</tbody>
</table>
ResponsibleSteel Certified Steel

- Steelmaker has a credible science-based decarbonisation target, aligned with achievement of the goals of the Paris Agreement
- Steelmaker implements TCFD recommendations
- Steel production site meets all 12 Principles of the ResponsibleSteel Standard
  - Responsible sourcing of input materials
  - Crude steel GHG emissions intensity performance threshold met, taking account of scrap input
  - Crude steel GHG emissions intensity performance banding
  - Product GHG footprint data available through environmental product declaration

Label mock-up for illustration only
Labelling/claims options under discussion
*Input materials specifications not illustrated
DRAFT VERSION 2-0 due out for second public consultation in April, together with requirements for the responsible sourcing of input materials

Further development with members and stakeholders May to September

Finalisation and formal approval by November 2021
Some key questions...

- What value should the threshold be set at?
- A single threshold, or several performance bands?
- Scope boundaries?
- What about stainless steels?
- Disclosure at site level, or allow averages across multiple sites?
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Dr. Paul Butterworth
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Regional emissions intensity comparison

y-axis: CO₂ intensity, Scope 1–3, t-CO₂/t-liquid steel
x-axis: external scrap steelmaking charge, %

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Regional emissions intensity overlay

y-axis: CO$_2$ intensity, **Scope 1–3**, t-CO$_2$/t-liquid steel
x-axis: external scrap steelmaking charge, %

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Global emissions intensity

y-axis: CO₂ intensity, **Scope 1–3**, t-CO₂/t-liquid steel
x-axis: external scrap steelmaking charge, %

1. Coal-based DRI
2. Gas-based DRI
3. Traditional BF/BOF
4. Use of Fe-bearing reverts

**Configuration; artefact of cost modelling**

**Scrap-based EAF**

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scope 1, 2 and 3 – integrated (BF-BOF)

y-axis: frequency, %

x-axis: steelmaking CO₂ intensity, t-CO₂/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scopes 1, 2 and 3 – integrated (BF-BOF)

y-axis: frequency, %

x-axis: steelmaking CO₂ intensity, t-CO₂/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scopes 1, 2 and 3 – integrated (BF-BOF)

- y-axis: frequency, %
- x-axis: steelmaking CO$_2$e intensity, t-CO$_2$/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scopes 1, 2 and 3 – integrated (BF-BOF)

y-axis: frequency, %
x-axis: steelmaking CO$_{2e}$ intensity, t-CO$_2$/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scopes 1, 2 and 3 – EAF

y-axis: frequency, %

x-axis: steelmaking CO\textsubscript{2} intensity, t-CO\textsubscript{2}/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scopes 1, 2 and 3 – EAF

y-axis: frequency, %

x-axis: steelmaking CO₂ intensity, t-CO₂/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Moving through Scopes 1, 2 and 3 – EAF

y-axis: frequency, %
x-axis: steelmaking CO$_2$e intensity, t-CO$_2$/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Comparing sectors – BF-BOF vs EAF, Scope 1, 2 and 3

y-axis: frequency, %
x-axis: steelmaking CO$_2$e intensity, Scope 1–3, t-CO$_2$/t-steel

DATA: CRU Steel Cost Model and Emissions Analysis Tool
Stainless steel emissions (conceptual): austenitic and ferritic grades

y-axis: CO$_2$ emissions, **Scope 1–3**, 304-grade (austenitic), t-CO$_2$/t-HRC
x-axis: stainless scrap consumption, % gross metallic charge

y-axis: CO$_2$ emissions, **Scope 1–3**, 430-grade (ferritic), t-CO$_2$/t-HRC
x-axis: stainless scrap consumption, % gross metallic charge

DATA: CRU Stainless Steel Cost Model, CRU Nickel Cost Model
A new conference to provide the steel value chain with a deep dive into trends and best practice on how to decarbonise.

For more details go to:
www.crusteeldecarb.com
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