

Illustrative Examples

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2023-01-19



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DECARBONISING

PRACTICAL STRATEGIES

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Illustrative Examples

Case	Steel	Process	Scrap
1	CS	EAF-LF	100%
2	CS	EAF-LF	20%
3	SS	EAF-AOD	80% (SS)

The studied cases are consisting of following process:

- EAF-LF: Electric arc furnace (remelting scrap) and ladle furnace (quality adjustment)
- DR-EAF-LF: Reduction shaft furnace (DRI) + EAF (melting mixes of DRI and scrap) + LF (adjustment)
- EAF-AOD: EAF (Remelting scrap/alloy) +AOD (decarburization, reduction and refining). Applied specially for stainless steel production.

Following two steel grades are select of interest:

- Carbon steel (CS): EN 1.0503, 0.5% Mn, 0.5%C.
- Stainless steel 304 (SS): EN 1.4301, 18%Cr, 8%Ni, 1.4% Mn, 0.03%C.

Evaluated Reporting Frameworks: worldsteel CO2 methodology, ResponsibleSteel, SBTi

The production route of CS with BF-BOF will be included later

Illustrative Examples - Inventory

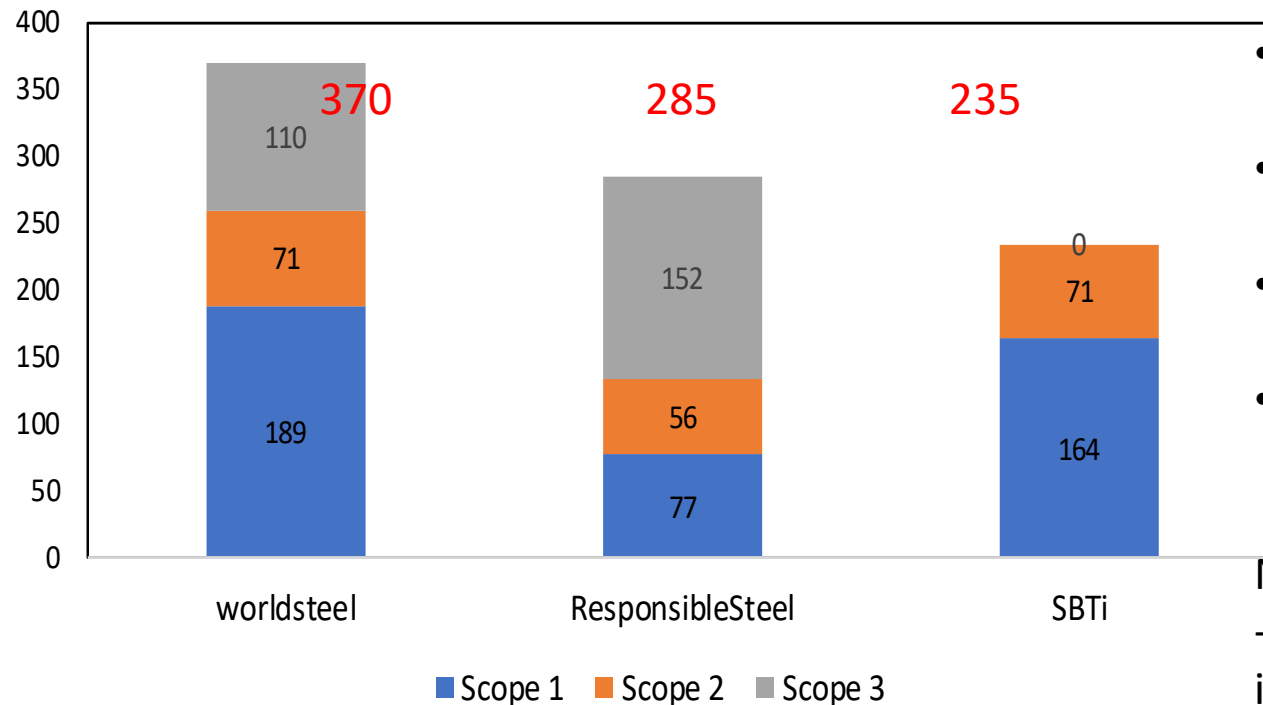
Assumptions:

- The calculation basis is **1 ton hot-rolled steel**.
- Emission factors are using **CO2 emission factor from worldsteel CO2 Data Collection-version 10 (2021) (ex CH4 and N2O)**
- The plant is Europe-based thus, **electricity is EU mix**.
- **DRI is H2-based**.
- The scrap used in the production is **from end-of-life scrap**.
- Assuming **100km transport** distance (diesel, truck) of solid raw material (e.g., scrap, lime, coke, iron etc.)
- No dust generation.
- No metal loss during casting and hot rolling.
- No bioenergy, co products are considered.

	Inventory	Unit	kgCO2/unit			CS	CS	304 SS
				Upstream	Direct	EAF-LF	DR-EAF-LF	EAF-AOD
				100Scrap	20Scrap	80SS Scrap		
			Amount	Amount	Amount			
EAF/BF	Carbon scrap	kg	0.007		1012	200	67	
	SS scrap	kg	0.007				700	
	EAF coal	kg	0.79	3.66	13	8	2	
	Coke	kg	0.224	3.257			2	
	Electricity	kWh	0.145		389	651	469	
	Natural gas	kWh	0.067	0.202	25	25	25	
	Lime	kg	0.95		19	11	29	
	Dolomite	kg	1.1		16	69	10	
	Magnesite	kg	0.0636		0.5	0.5	7	
	Electrode	kg	0.65	3.663	2	2	2	
	FeSi	kg	4	0.004	2	4.7	5	
	FeMn	kg	2.789	0.183				
	FeCr	kg	5.987	0.275			77	
	FeNi	kg	8.676	0.037			56	
	Oxygen	Nm3	0.355		30	25	15	
	Pellet	kg	0.000137			1214.5		
	H2 gas-DRI	GJ	5			5.48		
	Electricity-DRI	kWh	0.145			362		
	(DRI)	kg				905		
LF/AOD	SS scrap	kg	0.007				100	
	Lime	kg	0.95				60	
	Dolomite	kg	1.1				21	
	Magnesite	kg	0.0636				16	
	Oxygen	Nm3	0.355				69	
	Ar	Nm3	0.103				17	
	N2	Nm3	0.103				27	
	Natural gas	kWh	0.067	0.202	123	123	123	
	FeSi	kg	4	0.004			20	
Hot rolling	Electricity	kWh	0.145		99	99	99	
	Natural gas	kWh	0.067	0.202	516	516	516	
Transport	Truck (100km, diesel)	kg	0.0256		1063	1508	1172	

Illustrative Examples-Case 1

EAF-LF-100%Scrap-Carbon Steel Emission kgCO2/t Steel



- Reported Emission: worldsteel>ResponsibleSteel>SBTi
- ResponsibleSteel: excl. HR (EI, NG) → low S1,S2
- worldsteel excl. Mining+Transport → low S3
- SBTi excl. Mining+SecondaryMetallurgy → low S3
SBTi S3 (36%) <40%, not report S3

Note:
-SBTi not used for intensity comparison but it can affect other initiative

Product: Carbon steel (CS): EN 1.0503, 0.5% Mn, 0.5%C.

Material: 100% CS Scrap

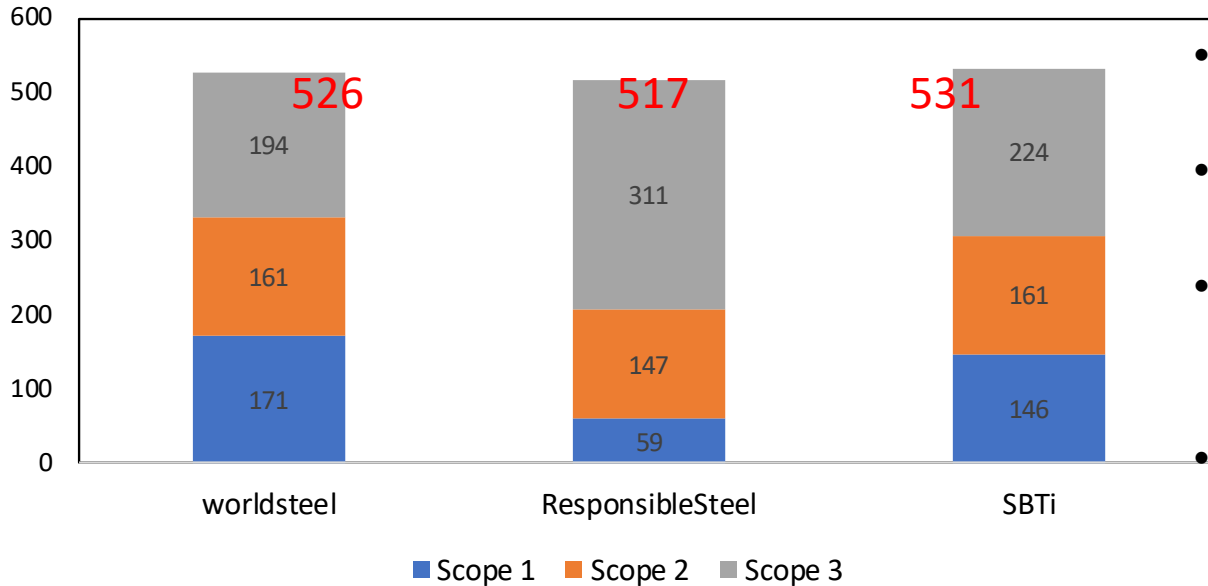
Process: EAF-LF



Purchase commitment:
50% of below steel by 2030
a. ResponsibleSteel certified or
b. Steel produced with SBT or
c. Low embodied carbon steel

Illustrative Examples-Case 2

DR-EAF-LF-20Scrap/DRI-Carbon Steel Emission kgCO₂/t Steel



- ResponsibleSteel: excl. HR (EI, NG) → low S1,S2
- worldsteel excl. Mining+Transport → low S3
- SBTi excl. Mining+SecondaryMetallurgy → low S3
SBTi S3 (42%) >40%, report S3
- ResponsibleSteel: incl. Mining +High slag former use → high S3

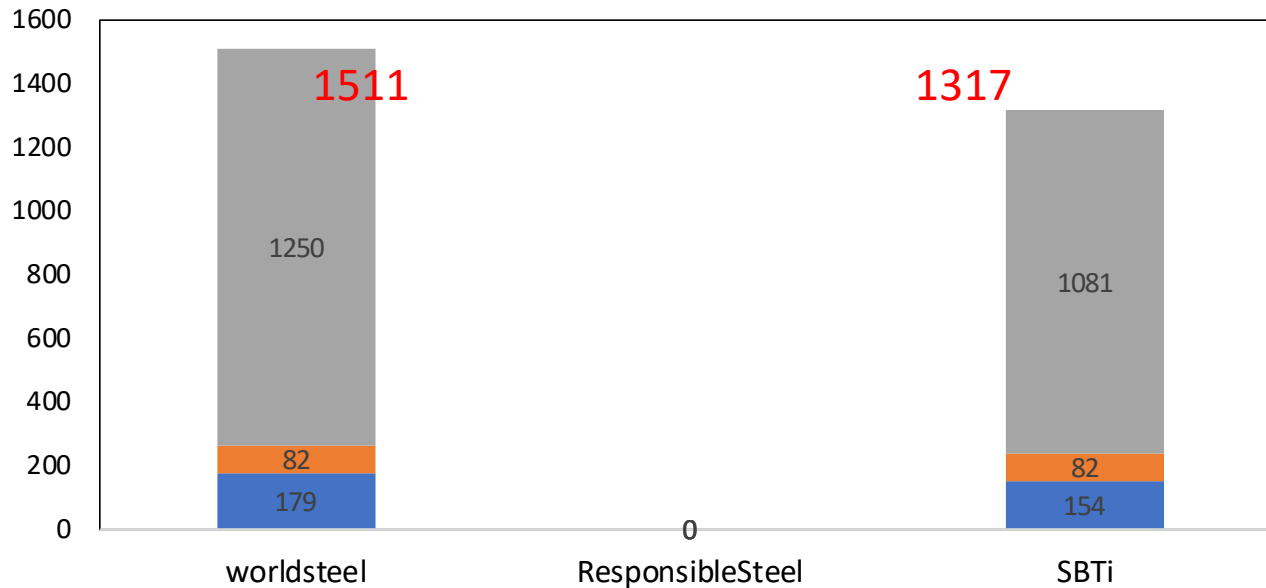
Product: Carbon steel (CS): EN 1.0503, 0.5% Mn, 0.5%C.

Material: 20% CS Scrap+H₂-based DRI

Process: EAF-LF

Illustrative Examples-Case 3

EAF-AOD-80%Scrap-304 Stainless Steel Emission kgCO₂/t Steel



■ Scope 1 ■ Scope 2 ■ Scope 3

Product: Stainless steel 304 (SS): EN 1.4301, 18%Cr, 8%Ni, 1.4% Mn, 0.03%C.

Material: 80% SS Scrap

Process: EAF-AOD

- ResponsibleSteel: excl. HR (EI, NG) → low S1,S2
- ResponsibleSteel: not applied for high alloy steel(>8%)
- SBTi excl. SecondaryMetallurgy → low S3
SBTi S3 (82%) >40%, report S3



Question