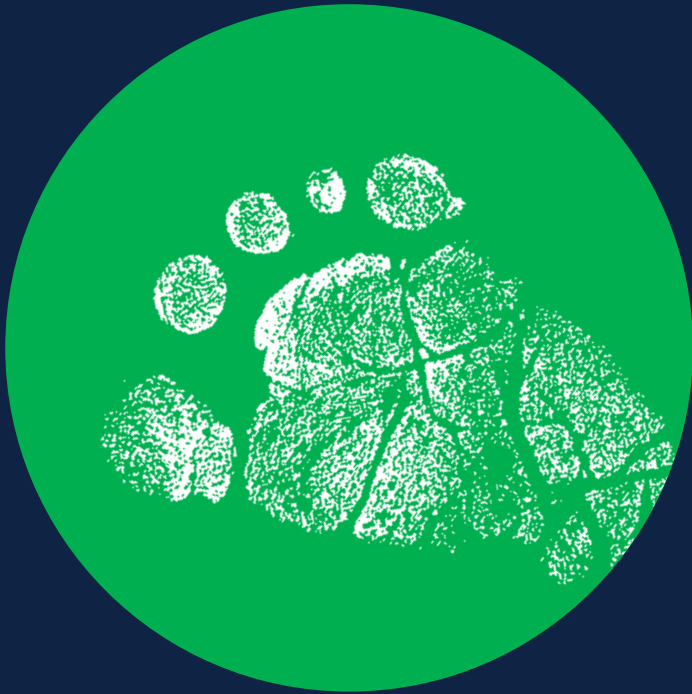


Why carbon footprint is mandatory in design

Johan Anderson | 2022-11-02 | Version 1

SSAB



Carbon footprint
is a design parameter.



Abandoning fossil fuels
is just the start.



Numbers are
King.

Global

Market leader

14,000

professionals in over 50 countries

Annual steel production capacity:

8.8 MILLION TONNES

96 BILLION SEK

Revenue in 2021

Steel making since

1878

- SSAB main production sites
- SSAB production sites
- SSAB tubes production
- Sales coverage
- SSAB Shape

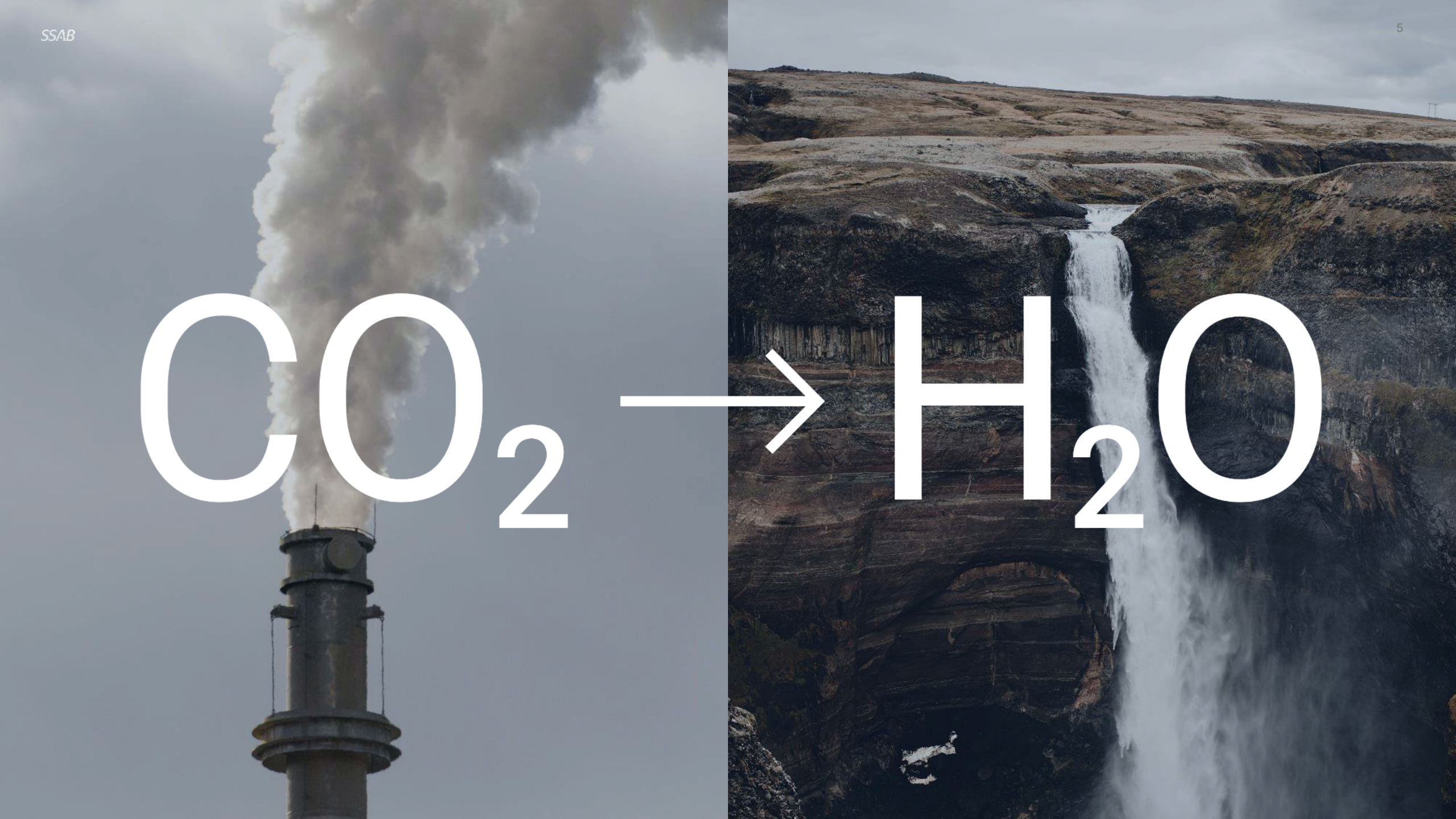
The SSAB logo, consisting of the letters "SSAB" in a bold, sans-serif font, with a stylized graphic element to the left.



Update since
Stålbyggnadsdagen
2021



Eva



$\text{CO}_2 \rightarrow \text{H}_2\text{O}$



Volvo TA15



Volvo Trucks



Volvo A30G



Hiab Multilift Hero



Polestar 0

 **Lindab®**

 **PEAB**

 **RUUKKI**
Building your tomorrow.

...and more partners

SSAB invests 45 billion SEK

Two new steel mills for fossil-free steel

Luleå Raahе



Global knowledge sharing the green hydrogen opportunity

Hydrogen Iron and Steel Making Forum
Stockholm, 12th October 2022

Some of the participants at HyIS 2022:

ArcelorMittal

Baowu

BHP

Energiron Tenova

JFE

JSW

LKAB

Midrex

Nippon Steel

Posco

Primetals

Responsible Steel

Rio Tinto

Salzgitter

Tata Steel

ThyssenKrupp

Vale

VoestAlpine



Together for a Green Future!



h2ironsteelforum.com
fossilfreesteel.com



Carbon footprint is a design parameter.

What is carbon footprint?

CO₂e

Quantity: CO₂e emissions.

Unit: Metric tonnes.

Tool: Life cycle assessment (LCA).

Reports: EPD, WtW, TtW, Scope 1-3, EN 15804+A2,
Module A1-A5, B1-B7, C1-C4, D.

Other names: GWP, Greenhouse gases, GHG.

Why a design parameter?

- Tensile properties
- Compressive properties
- Shear properties
- Modulus of elasticity
- Hardness
- Density
- Permeability
- Thermal expansion
- Shrinkage
- Specific heat
- Creep
- Relaxation
- Fatigue
- **Carbon footprint**

Why a design parameter?

- Tensile properties
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- Fatigue
- **Carbon footprint**

It is specific.
It is measurable.
It is relevant.
It is needed to achieve goals.
It is product specific.
It takes an engineer.





Product sheet

BLOC seat

1516-900Designed by
Atle Tveit, Lars Törnø

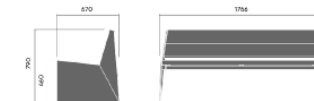
Bloc seat is available with or without a backrest and armrests, and can be used on its own or joined in rows and back to back.



AWARD FOR DESIGN EXCELLENCE

Anchoring/assembly

Free-standing/mounted to the ground



95 kg

Primary material

Hot-dip galvanised and powder-coated steel

The powder coating process was developed to satisfy the tough requirements of the Norwegian offshore industry. Corrosion class CS-M



8 mm

Secondary material

Linseed oil proofed Nordic pine (standard wood)

Standard wood with a 15-year anti-rot warranty. High-quality FSC-certified timber. Hardness: 17 on the Brinell scale. For outdoor use.



45 mm

Sustainability

Indicators	Global warming	Total energy used	Recycled materials
Unit	kg CO ₂	MJ	%
Cradle to Gate A1-A3	201.03	3373.08	2.03

Certifications**Warranty**

- Lifetime warranty against rust
- 15 year warranty on powder coating
- 15 year warranty on wood
- Spare parts always available

Product sheet

BLOC seat

1516-900

Designed by
Atle Tveit, Lars Tørnø

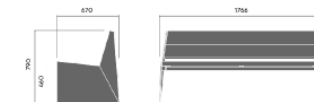
Bloc seat is available with or without a backrest and armrests, and can be used on its own or joined in rows and back to back.



AWARD FOR DESIGN EXCELLENCE

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95 kg

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Hot-dip galvanised and powder-coated steel

The powder coating process was developed to satisfy the tough requirements of the Norwegian offshore industry. Corrosion class C5-M



8 mm

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Linseed oil proofed Nordic pine (standard wood)

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Cradle to Gate A1-A3	201.05	3273.09	2.02

Certifications



Warranty

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- 15 year warranty on powder coating
- 15 year warranty on wood
- Spare parts always available

Visit www.vestre.com for more information.
Specifications are subject to change without notice.
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uk@vestre.com
www.vestre.com



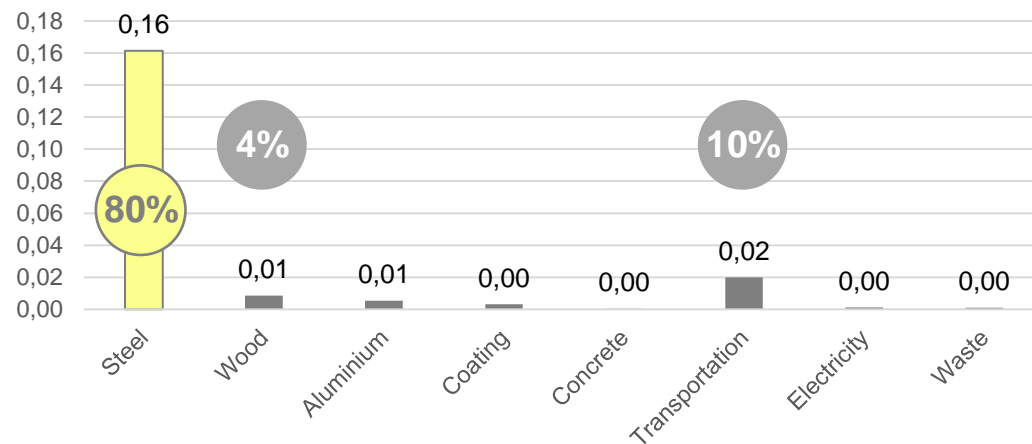
Sustainability

Indicators	Global warming	Total energy used	Recycled materials
Unit	kg CO2	MJ	%
Cradle to Gate A1-A3	201.05	3273.09	2.02



Vestre Urban Furniture

201 kg CO₂e
for a 95 kg outdoor sofa



Customer and
business driven.

100% transparent.

Going for zero.



Carbon footprint is not a nice-to-have. It is a business qualifier.



Abandoning fossil fuels
is just the start.

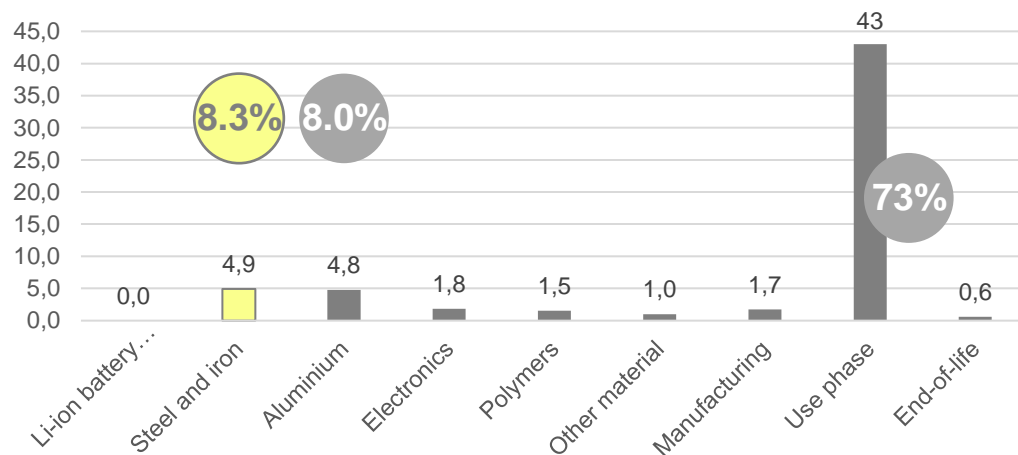
Petrol car vs. electric



Volvo XC40 (2021) with Petrol E5



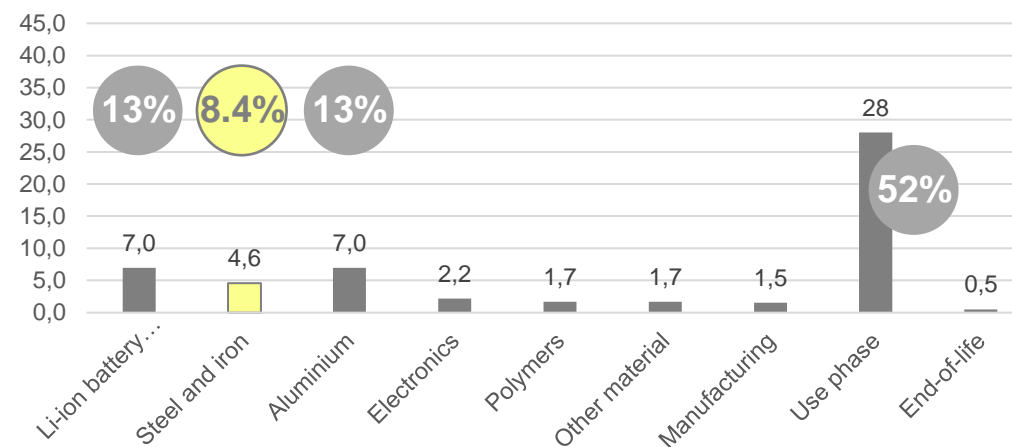
59 tonnes CO₂e
per 200,000 km lifetime range



Volvo XC40 Recharge (2021) with Global electricity mix



54 tonnes CO₂e
per 200,000 km lifetime range



Reflection: BEV with global electricity mix almost as bad as petrol (-9%)

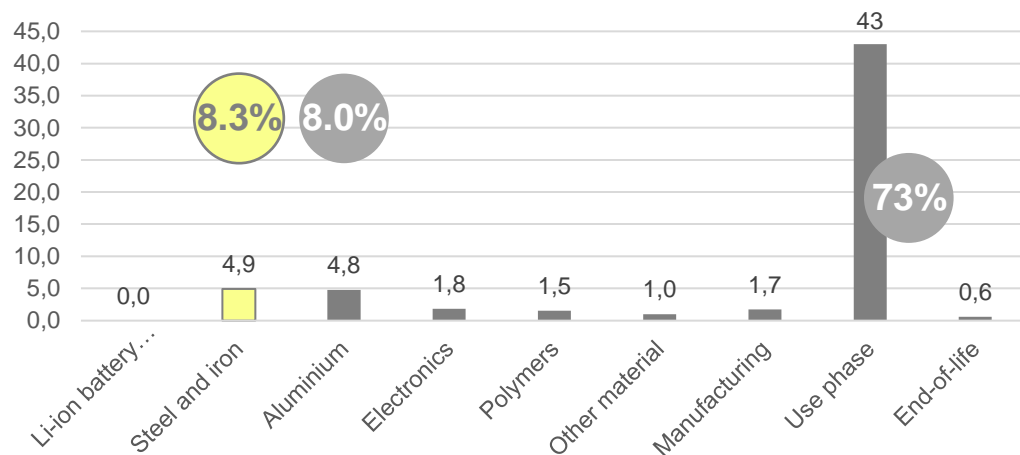
Petrol car vs. electric



Volvo XC40 (2021) with Petrol E5



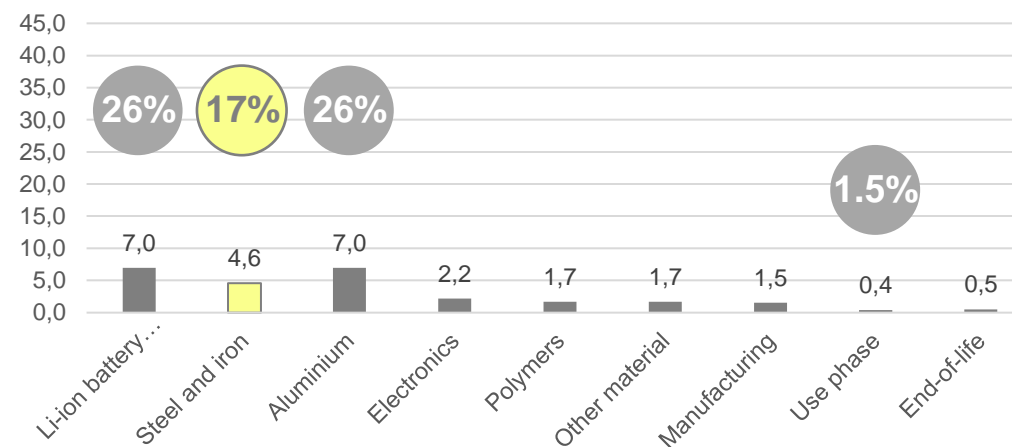
59 tonnes CO₂e
per 200,000 km lifetime range



Volvo XC40 Recharge (2021) with Wind mix



26 tonnes CO₂e
per 200,000 km lifetime range



Reflection: Steel becomes important for a BEV with renewable electricity (17% of total footprint)

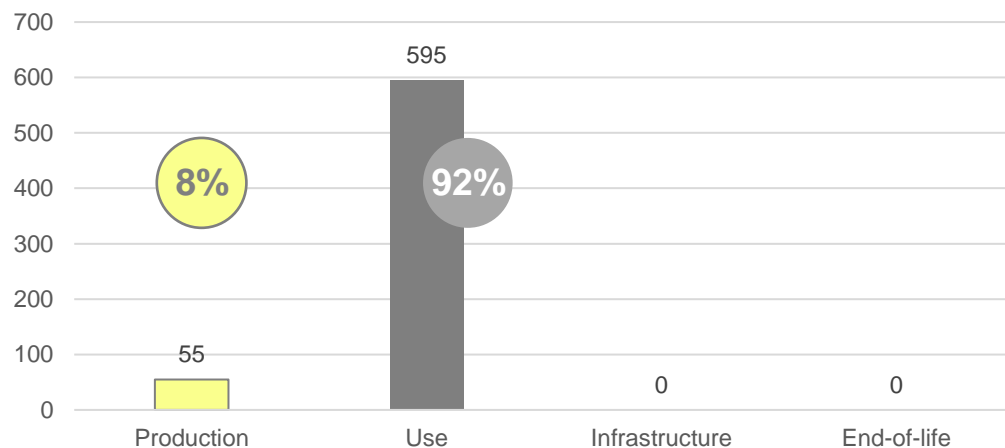
Diesel wheel loader vs. electric



Liebherr L566 Diesel B7



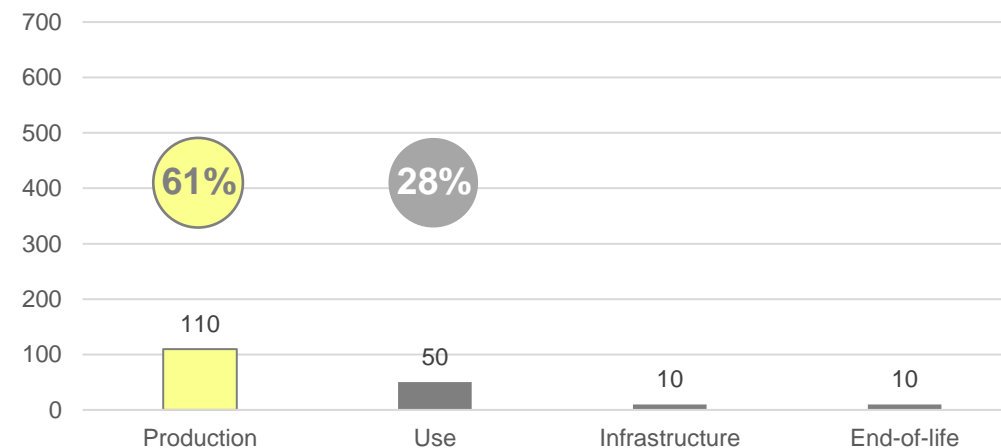
650 tonnes CO₂e
during lifetime



Liebherr L556 BEV Renewable Mix



180 tonnes CO₂e
during lifetime



Reflection: BEV with renewable electricity much better than diesel (-72%). Steel and batteries are the largest part of the production footprint.

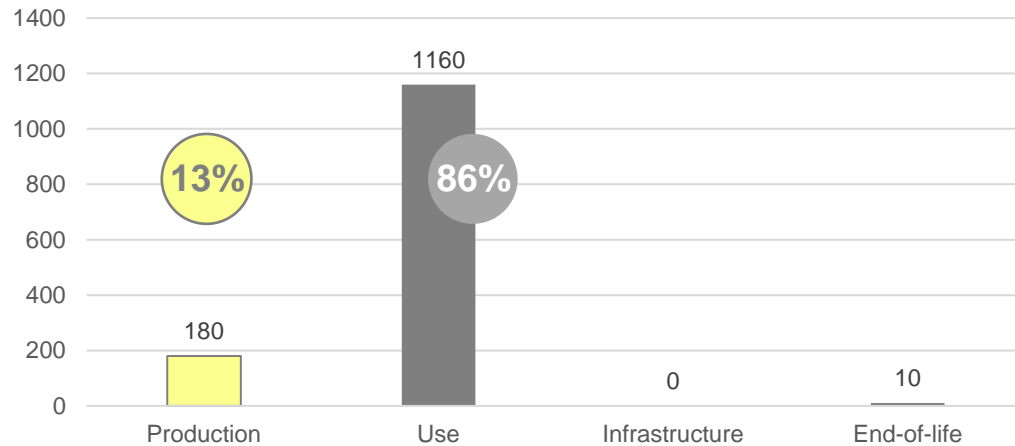
Diesel mobile crane vs. hydrogen



Liebherr LTM 1160-5.2 Diesel B7



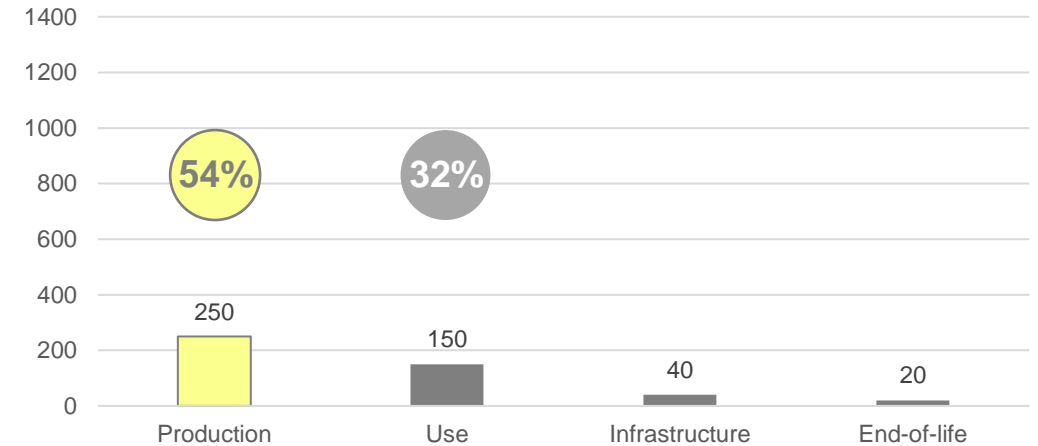
1350 tonnes CO₂e
during lifetime



Liebherr LTM 1160-5.2 Green H2



460 tonnes CO₂e
during lifetime



Reflection: H2 fuel reduces the footprint significantly (-66%). Steel is the dominant part of the production footprint.

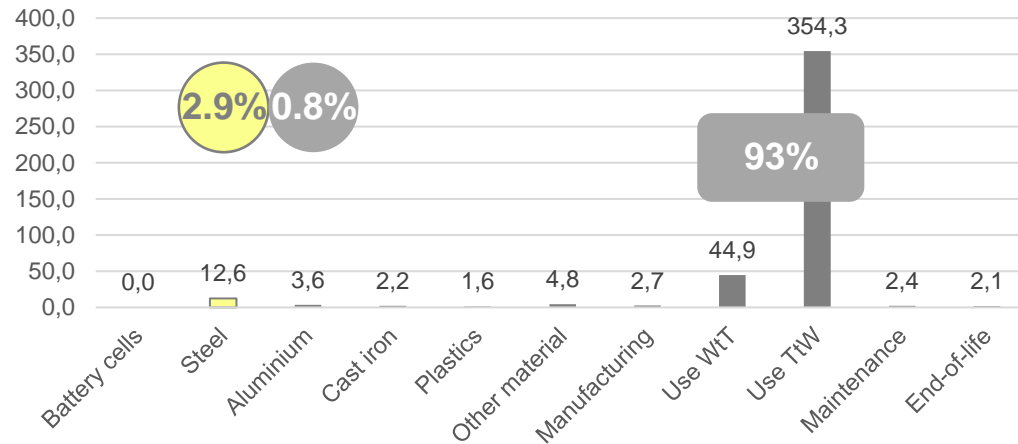
Diesel truck vs. electric



Scania P17 28t 6x2*4 320hp Euro6 ICEV with B7 Diesel



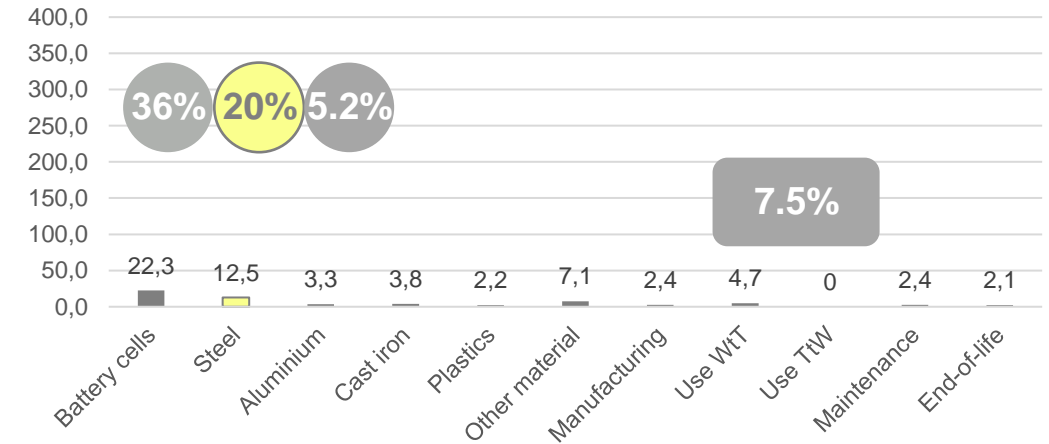
431 tonnes CO₂e
per 500,000 km lifetime range
with 6.1 tonnes average load



Scania P17 28t 6x2*4 300 kWh BEV with EU Wind Power



63 tonnes CO₂e
per 500,000 km lifetime range
with 6.1 tonnes average load

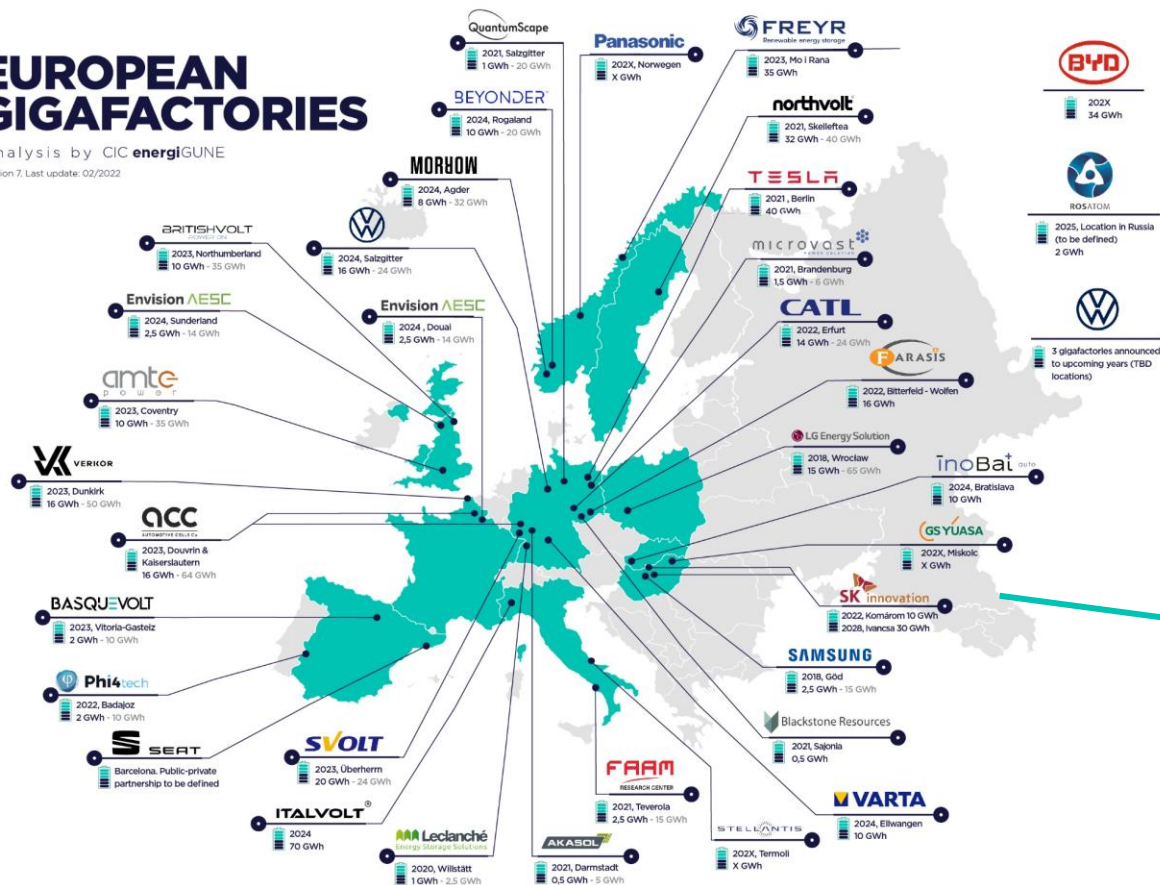


Reflection: Steel becomes important for a BEV with renewable electricity (20% of total footprint)

Development brings down battery footprint

EUROPEAN GIGAFACTORIES

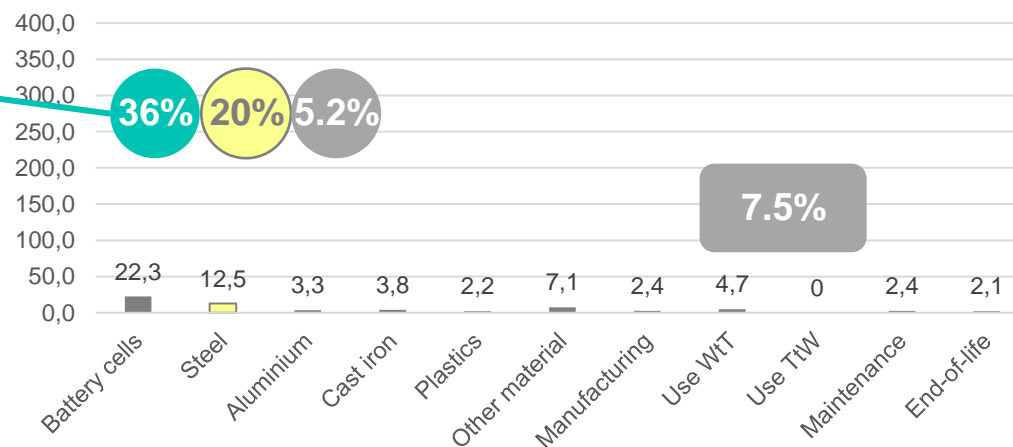
Analysis by CIC energigUNE
Version 7. Last update: 02/2022



Scania P17 28t 6x2*4 300 kWh BEV with EU Wind Power



63 tonnes CO₂e
per 500,000 km lifetime range
with 6.1 tonnes average load

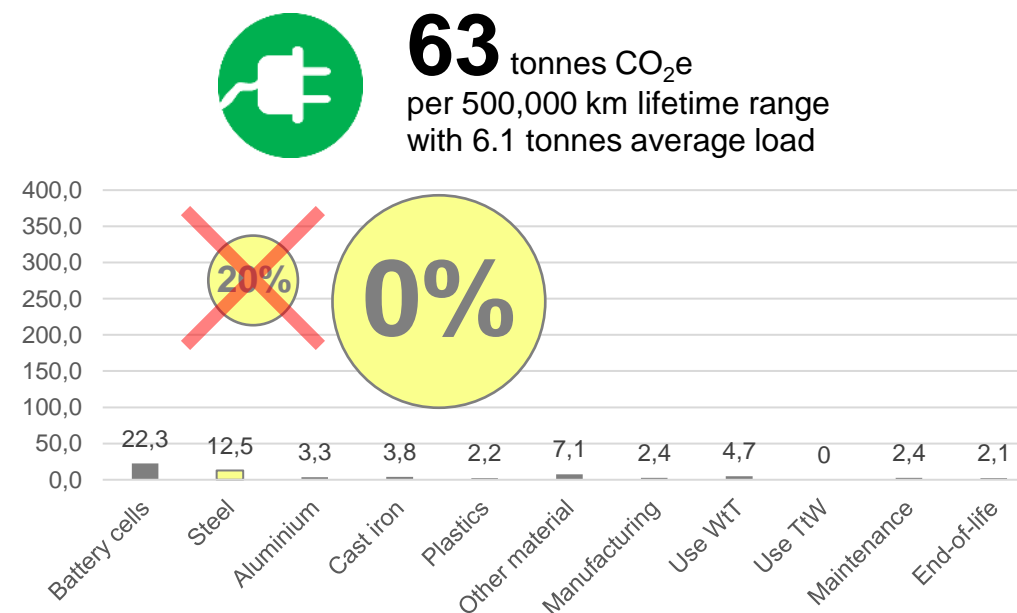


Fossil-free steel will eliminate 12.5 tonnes CO₂e.

Scope 1: SSAB production:	0.0 t CO ₂ e/t steel.
Scope 2: SSAB energy use:	0.0 t CO ₂ e/t steel.
Scope 3: LKAB iron ore production:	0.0 t CO ₂ e/t steel.
<hr/>	
Total:	0.0 t CO ₂ e/t steel.



Scania P17 28t 6x2*4 300 kWh BEV with EU Wind Power





Fossil-free steel will eliminate CO₂e

Scope 1. SSAB production:	0.0 t CO ₂ e/t steel.
Scope 2. SSAB energy use:	0.0 t CO ₂ e/t steel.
Scope 3. LKAB iron ore production:	0.0 t CO ₂ e/t steel.
<hr/>	
Total:	0.0 t CO ₂ e/t steel.



Lime



Manganese

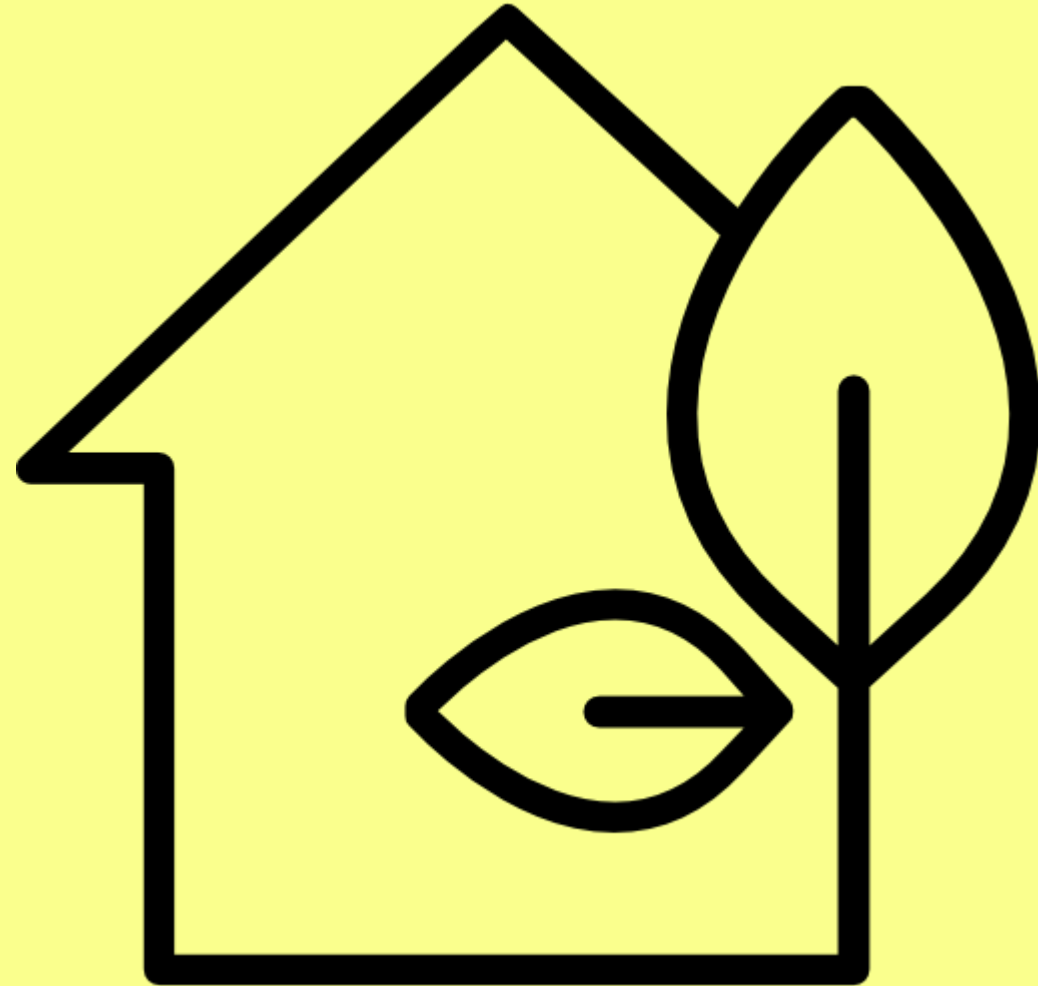


Silicate

Requesting
elimination of carbon
footprint in the
complete value chain



Passive house
Energy-plus
Efficiency-plus
Plus-energy
Ultra-low energy
Solar power
Off-grid

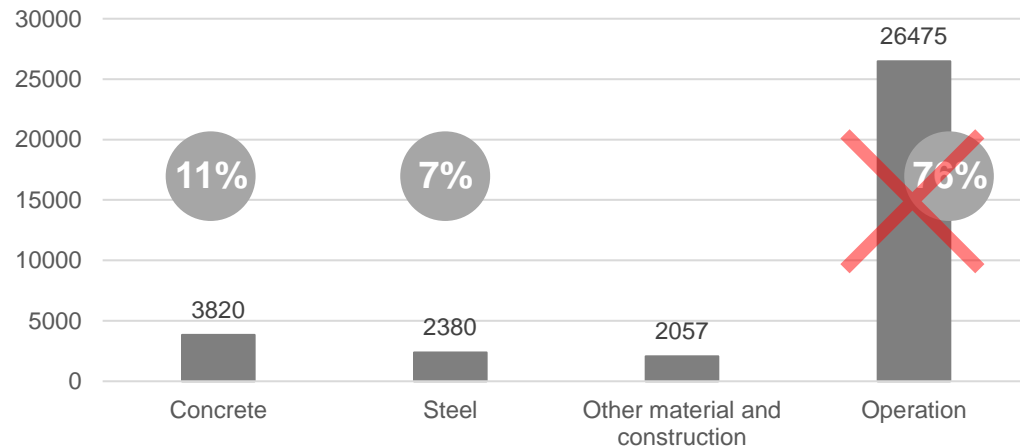


Carbon footprint for a steel framed warehouse



Distribution Warehouse in Stoke-on-Trent, UK (2007)

34732 ton CO₂e/CO₂
for the **lifetime** carbon footprint (25 years)



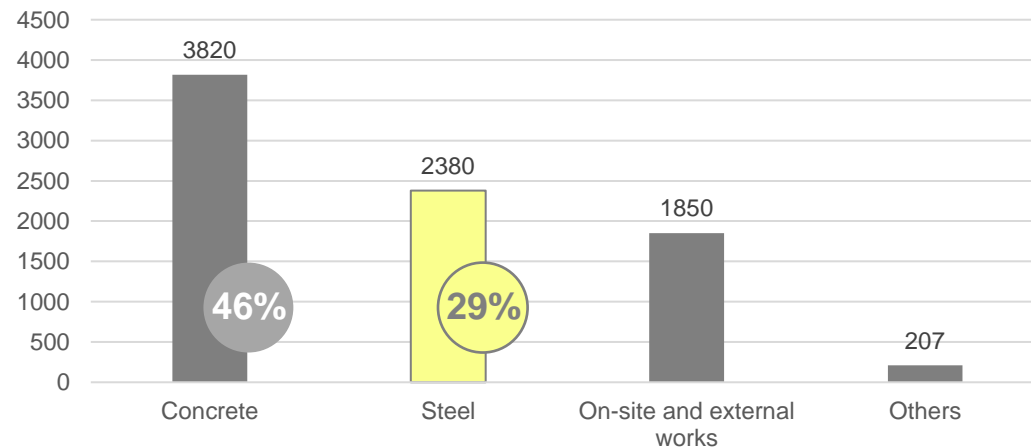
Trend:
Embodied footprint
will dominate the
carbon footprint

Carbon footprint for two steel framed industrial buildings



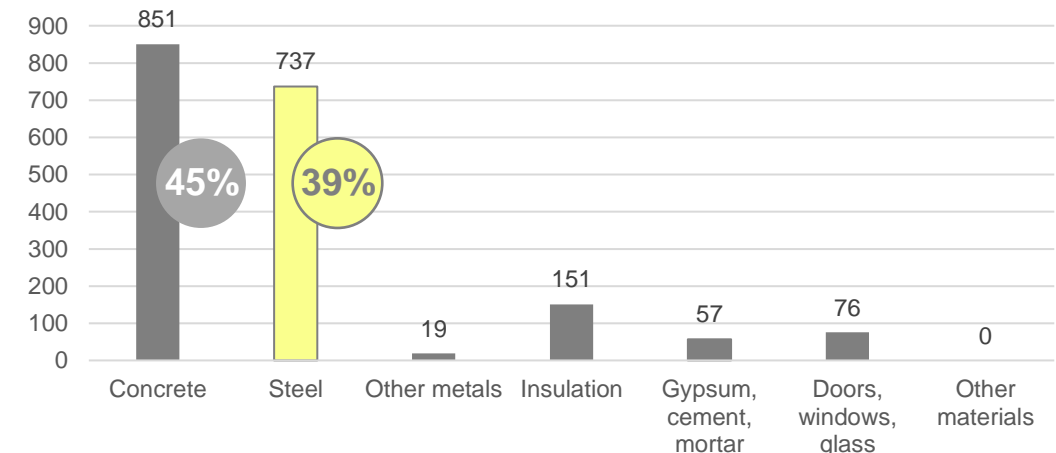
Distribution Warehouse in Stoke-on-Trent, UK (2007)*

8257 ton CO₂e
for the **embodied** carbon footprint



Industrial building in Northern Europe**

1890 ton CO₂e
for the **embodied** carbon footprint



Reflection: Steel stands for 29-39% of the embodied footprint for steel framed industrial buildings.

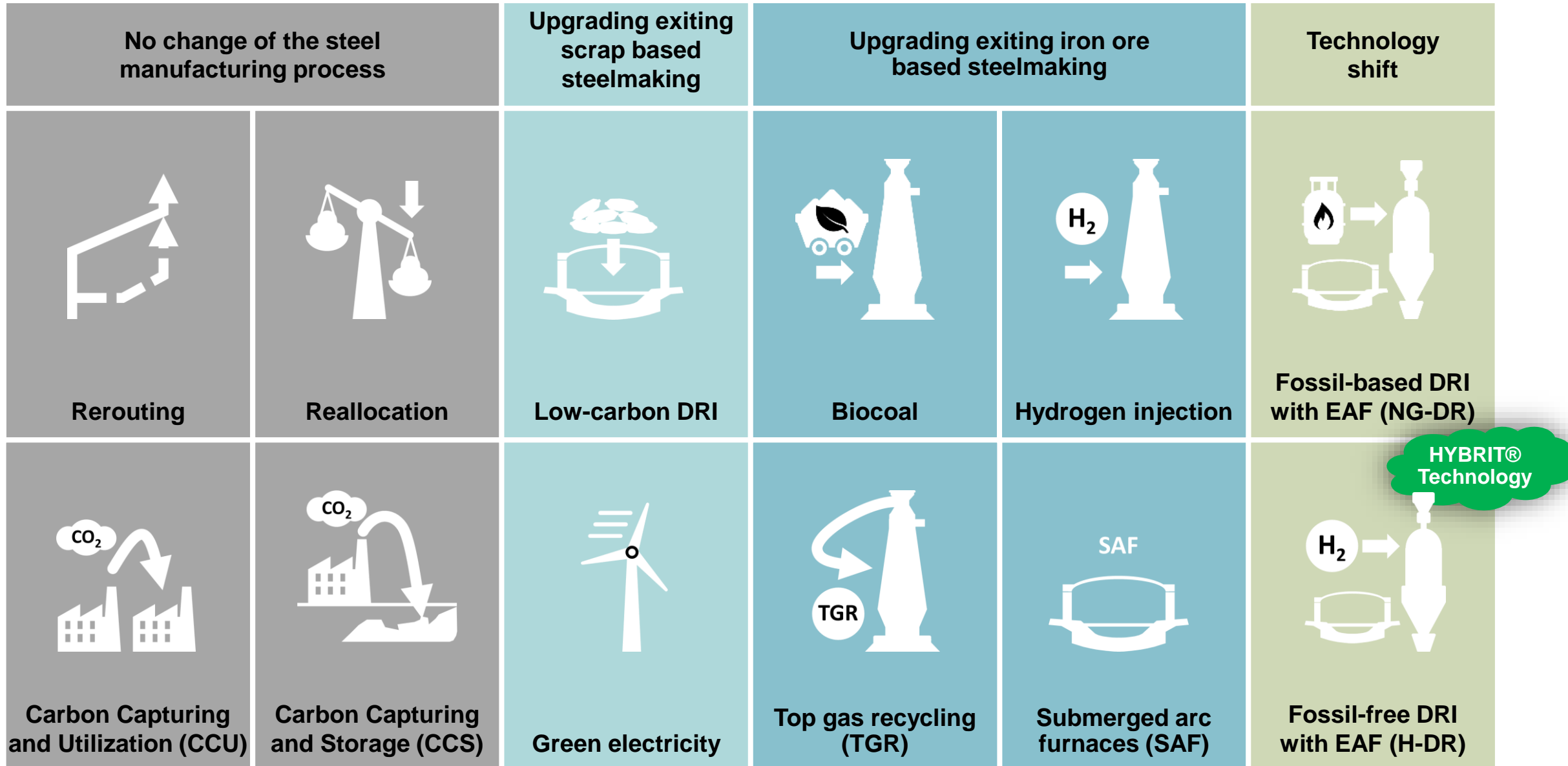


It is not enough to stop heating houses and using diesel. Move on.

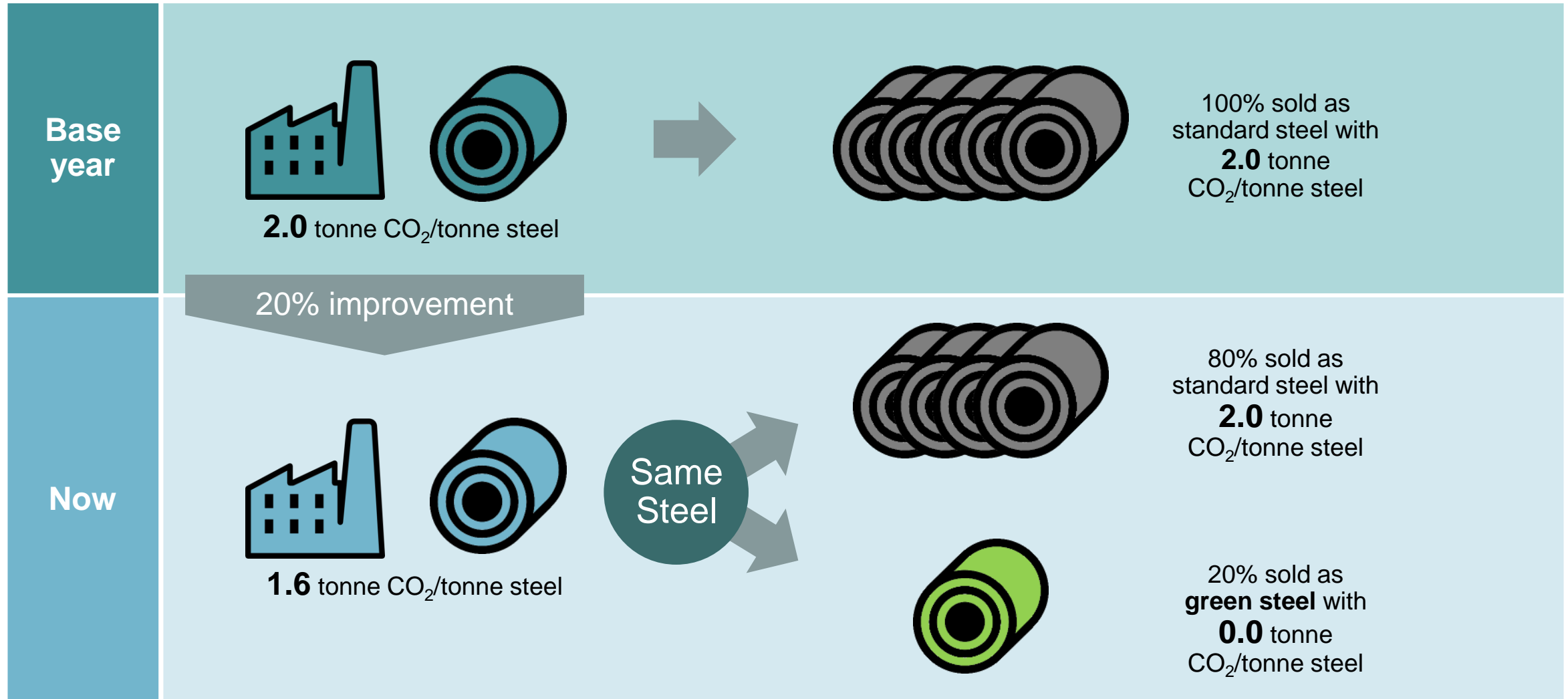


Numbers are King

All “green” steel is not fossil-free

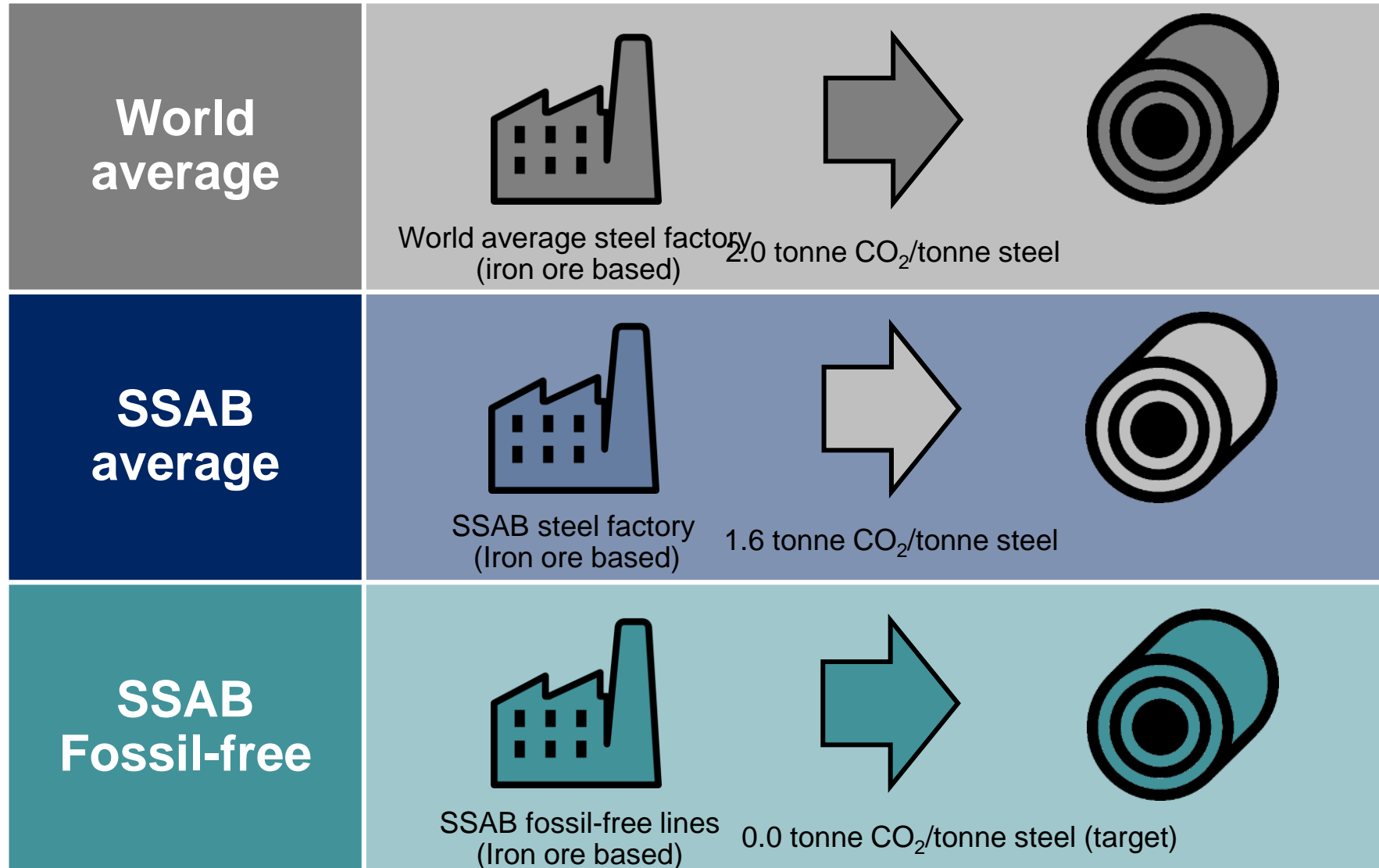


Carbon allocation schemes



Note. SSAB does not practice allocation schemes.

SSAB has separate fossil-free production routes

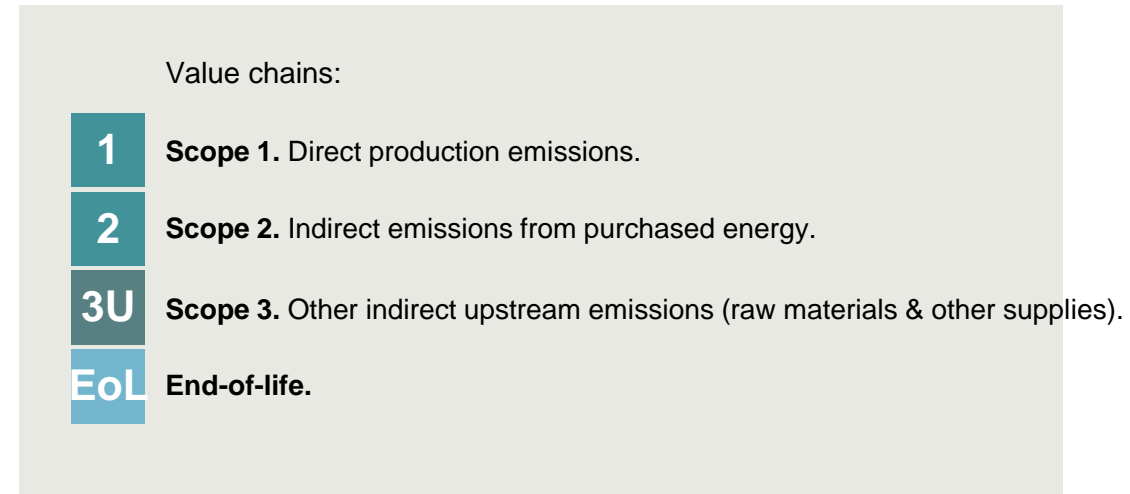
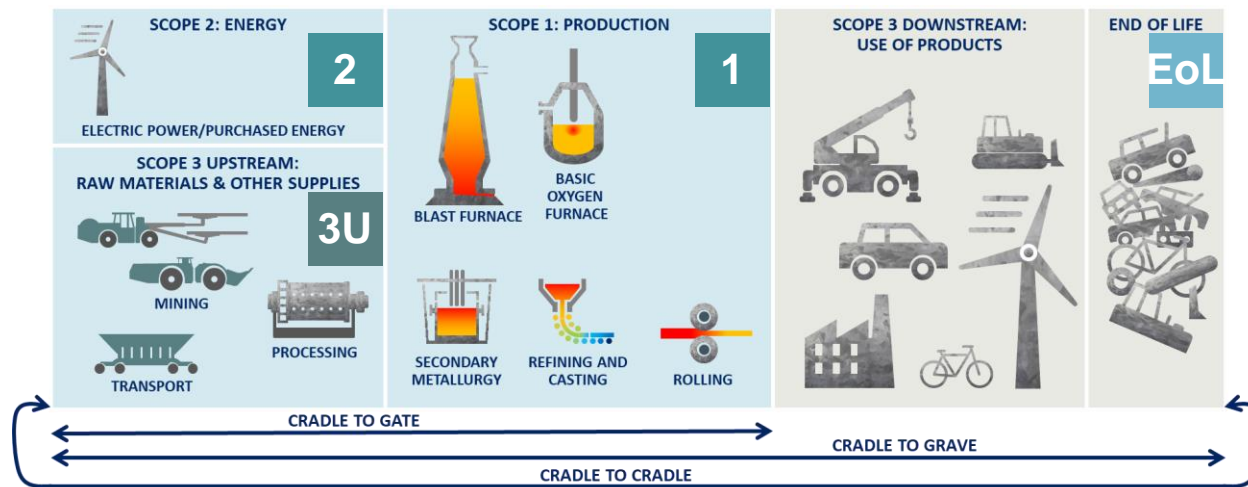


SSAB has separate production routes for fossil-free steel. From mines to customers.

That gives **high transparency** and **true carbon footprint** promises.

SSAB

Calculation of the carbon footprint



Report	Value chains	Methodology for recycling credit at end-of-life	Calculations
Operations	1 2	No	Scope 1 + Scope 2
Cradle-to-Gate	1 2 3U	No, according to Cut-off approach.	Scope 1 + Scope 2 + Scope 3 Upstream
Cradle-to-Gate + End-of-Life (Cradle-to-Cradle)	1 2 3U EoL	Yes, according to End-of-Life approach.	Scope 1 + Scope 2 + Scope 3 Upstream - - End-of-Life credit (net scrap for recycling)
PEF Methodology*	1 2 3U EoL	Yes, according to CFF methodology.	Scope 1 + Scope 2 + Scope 3 Upstream - - End-of-Life credit (net scrap for recycling)

*) Product Environmental Footprint (PEF) with Circular Footprint Formula (CFF).

Numbers

- EPDs reviewed by third party.
- Numbers available for all type of reports:
 - Scope 1-3
 - Module A1-A5, B1-B7, C1-C4, D
 - Cradle-to-Gate
 - Cradle-to-Gate + End-of-Life (Cradle-to-Cradle)
 - PEF Methodology
- Data base:
 - Excel
 - GaBi
 - Other



Life Cycle Steel Paper Clip [Balances] -- Balance

Object Edit View Tools Help

Name: Life Cycle Steel Paper Clip

Quantity/Weight: Mass Unit/Norm: kg

Quantity view In/out aggregation Absolute values Rows: 2 Columns: 1

LCA LCC LCWE

Inputs

Just elementary flows Separate IO tables Diagram

	Life Cycle Steel	End of Life Paper	BF Steel b	DE: Diesel mix	DE: Electricity	DE: Steel wire	GLO: Truck PE	Paper Clip	Ben Use	Phase Site
Flows	513	254	16	0.138	152	90.4				
Resources	513	254	16	0.138	152	90.4				
Energy resources	0.166	0.0684	0.0338	0.000872	0.0329	0.0299				
Non renewable energy resources	0.166	0.0684	0.0338	0.000872	0.0329	0.0299				
Crude oil (resource)	0.00546	0.00149	0.00168	0.000799	0.000608	0.000885				
Hard coal (resource)	0.0655	0.0191	0.0332	5.33E-006	0.00843	0.00478				
Lignite (resource)	0.0664	0.0334	0.000858	9.21E-006	0.021	0.0112				
Natural gas (resource)	0.0285	0.0144	-0.00191	5.86E-005	0.00291	0.0131				
Peat (resource)	6.7E-006	4.53E-006	2.71E-007	6.19E-009	2.49E-006	1.41E-006				

Outputs

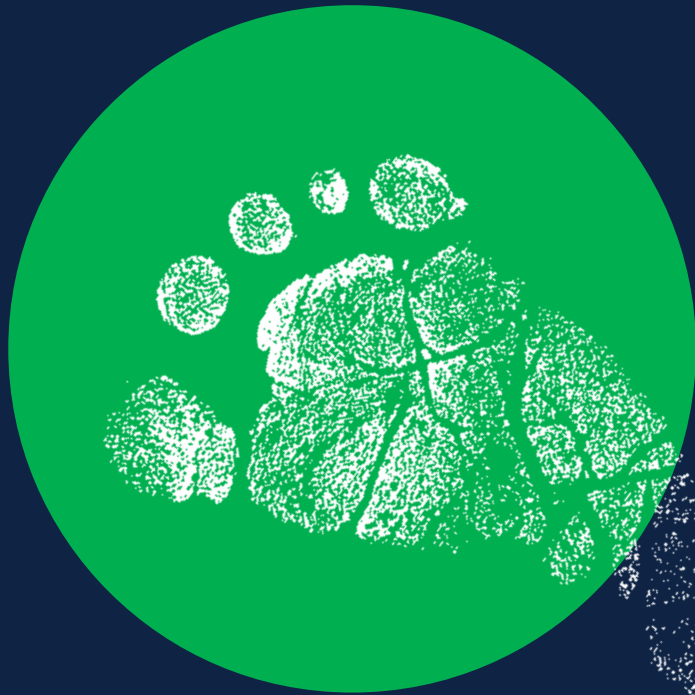
Diagram

	Life Cycle Steel	End of Life Paper	BF Steel b	DE: Diesel mix	DE: Electricity	DE: Steel wire	GLO: Truck PE	Paper Clip	Ben Use	Phase Site
Flows	541	269	15.9	0.141	161	94.8	0.00245			
Emissions to air	3.19	1.35	0.208	0.038	0.638	0.952	0.00245			
Emissions to fresh water	538	268	15.7	0.102	160	93.8				
Emissions to sea water	0.016	0.00676	0.000916	0.000821	0.00164	0.00582				
Emissions to agricultural soil	3.85E-008	7.39E-009	5.74E-009	2E-008	2.77E-009	2.56E-009				
Emissions to industrial soil	6.97E-006	1.45E-006	4.35E-007	1.24E-008	5.99E-007	4.47E-006				

System: Changed. Last change: System: 2/6/2013 6:51:12 PM



Green steel is no
commitment.
It's a non-defined label.
Request numbers.



Carbon footprint
is a design parameter.



Abandoning fossil fuels
is just the start.



Numbers are
King.



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www.linkedin.com/in/johan-anderson

