



# Sustainability Indicators 2023 report

Sustainability performance  
of the steel industry  
2004-2022

November 2023

# Introduction

**Sustainability is everybody's responsibility and the collective goal of our society to make sure that our needs at the current time are met without compromising the ability of future generations to meet their own needs. The steel industry recognises the need to act on sustainability topics and has been undertaking various initiatives and programmes to deliver its commitment to a sustainable society.**

Measuring key aspects of the industry's economic, environmental and social performance and reporting at a global level on a yearly basis is one of the major and long-standing efforts that the steel industry undertakes to manage its performance, demonstrate its commitment to sustainability and to enhance transparency.

These Sustainability Indicators of the steel industry are directly related to the worldsteel Sustainability Principles and are also closely aligned with the UN Sustainable Development Goals, reflecting the evolving business environment as well as the expectations and requirements of society.

worldsteel members have been providing data for the 8 Sustainability Indicators, spending significant resources to collect and measure their performance every year since 2004 for worldsteel and the many reporting frameworks that require such information.

In 2023, 94 steel companies and associations contributed to the data collection. Crude steel produced by companies that reported on one or more indicators for fiscal year 2022 was 990.2 million tonnes, representing 53% of global crude steel production. 77 organisations voluntarily provided data for one or more of the 8 indicators, 41 of which provided data for all 8 indicators.

Harmonised measurement standards and reporting are critical to managing the steel industry's sustainability performance.

INDICATORS*	UNIT	2020	2021	2022
<b>ENVIRONMENTAL PERFORMANCE</b>				
1. <b>CO<sub>2</sub> emissions intensity</b>	tonnes CO <sub>2</sub> per tonne crude steel cast	1.88	1.91	1.91**
2. <b>Energy intensity</b>	GJ per tonne crude steel cast	20.38	21.02	20.99**
3. <b>Material efficiency</b>	%	97.86	97.56	97.65
4. <b>Environmental management system</b>	%	96.13	95.66	96.15
<b>SOCIAL PERFORMANCE</b>				
5. <b>Lost time injury frequency rate</b>	injuries per million hours worked	0.85	0.85	0.65
6. <b>Employee training</b>	training days per employee	7.15	6.72	7.78
<b>ECONOMIC PERFORMANCE</b>				
7. <b>Investment in new processes and products</b>	%	8.03	6.29	6.29
8. <b>Economic value distributed</b>	%	97.77	93.78	96.57

\* For details on the calculation methodology for each of these indicators, please refer to page 7 of this report

\*\* For details on indicators 1 and 2, please refer to page 3 of this report

# CO<sub>2</sub> emissions and energy intensity

Since 2007, worldsteel has published a single annual global CO<sub>2</sub> emissions intensity together with an energy intensity metric. These numbers are weighted based on the % split between the blast furnace–basic oxygen furnace (BF-BOF) and scrap-based electric arc furnace (EAF) global steel production routes.

Since 2022, the global average value for both intensities now also incorporates a contribution from direct reduced iron (DRI)-based EAF steel production, given its rising importance as a key steel making process.

We consider that this new approach to calculating the global metric more accurately reflects global steel production today and in the future. Both the CO<sub>2</sub> emissions and energy intensity for previous years have not been recalculated to reflect this change.

Further information on the worldsteel CO<sub>2</sub> data collection methodology (including scope, boundaries and emission factors) can be found here: [Climate Action Data Collection - worldsteel.org](https://www.worldsteel.org/Climate-Action-Data-Collection).

## 2021-2022 CO<sub>2</sub> emissions and energy intensity

	CO <sub>2</sub> emissions intensity by production route		Energy intensity by production route	
	tonnes CO <sub>2</sub> per tonne of crude steel cast		GJ per tonne of crude steel cast	
	2021	2022	2021	2022
<b>Global average</b>	<b>1.91</b>	<b>1.91</b>	<b>21.02</b>	<b>20.99</b>
BF-BOF	2.33	2.33	24.13	23.98
Scrap-EAF	0.66	0.68	10.07	10.20
DRI-EAF*	1.39	1.37	22.58	22.37

\* Data concerning global crude steel production using DRI is not currently collected, the denominator in this calculation is therefore calculated by the worldsteel data management team based on information contained in worldsteel's collective databases.

## Calculation approach for global CO<sub>2</sub> emissions intensity, 2022 onwards

$$\text{Global CO}_2 \text{ emissions intensity} = \left[ \begin{array}{c} \text{BF-BOF} \\ \text{CO}_2 \text{ intensity} \\ 2.33 \end{array} \right] \times \begin{array}{c} \text{Share of} \\ \text{BOF steel} \\ \text{in global} \\ \text{production} \\ 72\% \end{array} + \left[ \begin{array}{c} \text{Scrap-EAF} \\ \text{CO}_2 \text{ intensity} \\ 0.68 \end{array} \right] \times \begin{array}{c} \text{Share of} \\ \text{scrap-EAF steel} \\ \text{in global} \\ \text{production} \\ 21\% \end{array} + \left[ \begin{array}{c} \text{DRI-EAF} \\ \text{CO}_2 \text{ intensity} \\ 1.37 \end{array} \right] \times \begin{array}{c} \text{Share of} \\ \text{DRI-EAF steel} \\ \text{in global} \\ \text{production} \\ 7\% \end{array}$$

## Calculation approach for energy intensity, 2022 onwards

$$\text{Global energy intensity} = \left[ \begin{array}{c} \text{BF-BOF} \\ \text{Energy} \\ \text{intensity} \\ 23.98 \end{array} \right] \times \begin{array}{c} \text{Share of} \\ \text{BOF steel} \\ \text{in global} \\ \text{production} \\ 72\% \end{array} + \left[ \begin{array}{c} \text{Scrap-EAF} \\ \text{Energy} \\ \text{intensity} \\ 10.20 \end{array} \right] \times \begin{array}{c} \text{Share of} \\ \text{scrap-EAF-steel} \\ \text{in global} \\ \text{production} \\ 21\% \end{array} + \left[ \begin{array}{c} \text{DRI-EAF} \\ \text{Energy} \\ \text{intensity} \\ 22.37 \end{array} \right] \times \begin{array}{c} \text{Share of} \\ \text{DRI-EAF steel} \\ \text{in global} \\ \text{production} \\ 7\% \end{array}$$

# Indicators performance 2003 - 2022

	Environmental performance				Social performance		Economic performance	
	CO <sub>2</sub> emissions intensity	Energy intensity	Material efficiency	Environmental management system	Lost time injury frequency rate	Employee training	Investment in new processes and products	Economic value distributed
	(tonnes CO <sub>2</sub> /tonne crude steel cast)	(GJ/tonne crude steel cast)	(% of materials converted to solid and liquid products and co-products)	(% of employees & contractors working in EMS-registered production facilities)	(injuries/million hours worked)	(training days/employee)	(% of revenue)	(% of revenue)
2022	1.91	20.99	97.65	96.15	0.65	7.78	6.29	96.57
2021	1.91	21.02	97.56	95.66	0.85	6.72	6.29	93.78
2020	1.88	20.38	97.86	96.13	0.85	7.15	8.03	97.77
2019	1.82	19.81	97.49	97.16	0.83	6.90	7.09	98.27
2018	1.81	19.53	96.33	97.07	0.84	6.48	6.12	94.18
2017	1.83	19.93	96.49	96.49	0.97	6.26	5.79	95.43
2016	1.87	20.32	97.64	96.85	1.01	7.11	7.71	96.64
2015	1.87	20.25	97.36	93.59	1.17	6.75	8.22	100.09
2014	1.80	19.76	97.47	94.05	1.39	6.27	7.32	96.31
2013	1.82	20.08	98.00	90.18	1.60	7.80	8.53	96.83
2012	1.75	19.63	96.48	89.53	1.45	7.88	10.05	99.77
2011	1.76	19.81	96.11	89.93	1.91	7.74	8.28	95.65
2010	1.80	20.13	97.48	87.60	2.29	6.95	8.80	93.46
2009	1.81	20.49	97.94	88.89	2.46	8.47	10.22	90.52
2008	1.79	20.13	98.03	86.62	3.09	8.02	8.24	78.30
2007	1.80	20.10	97.94	85.07	4.44	11.10	7.76	78.18
2006			96.49	84.78	4.55	10.52	7.90	
2005			96.96	82.69	4.15	12.28	6.91	
2004			96.78	92.40	4.81	11.62	6.96	
2003			96.09	90.92		7.46	6.37	

## Notes:

**Indicators 1 and 2:** CO<sub>2</sub> emissions intensity and energy intensity are calculated with the worldsteel CO<sub>2</sub> Data Collection methodology, which includes all scopes (1, 2, and some scope 3). The two intensities represent production weighted averages between blast furnace-basic oxygen furnace (BF-BOF), scrap-based electric arc furnace (EAF) and direct reduced iron (DRI)-based EAF steel production.

**Indicator 3:** Only solid and liquid residues are included in this calculation, and process gases are not included.

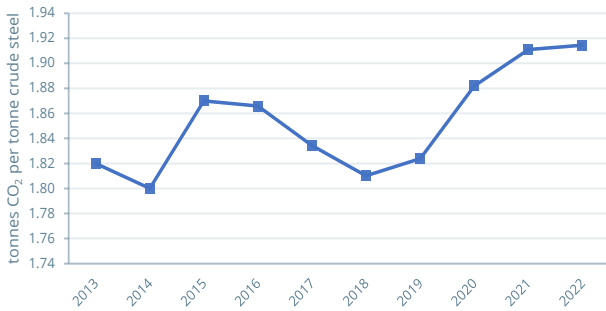
**Indicator 5:** Lost time injury frequency rate includes fatalities and is calculated based on figures including contractors and employees.

**Indicator 6:** Employee training includes production and non-production facilities.

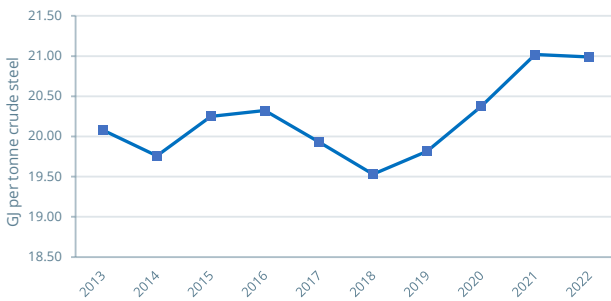
**Indicator 7:** Investment in new processes and products includes capital expenditure and R&D investment.

# Indicators trends 2013 - 2022

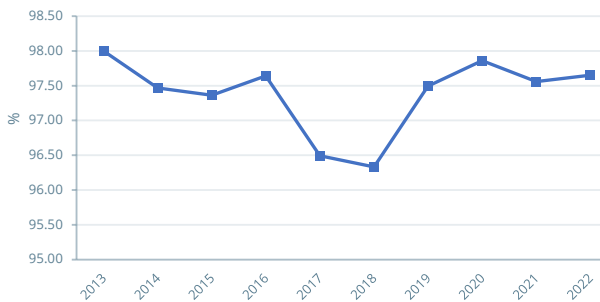
## 1. CO<sub>2</sub> emissions intensity



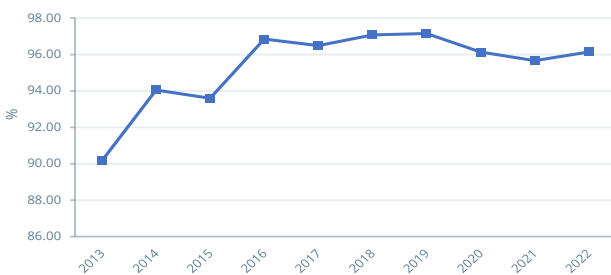
## 2. Energy intensity



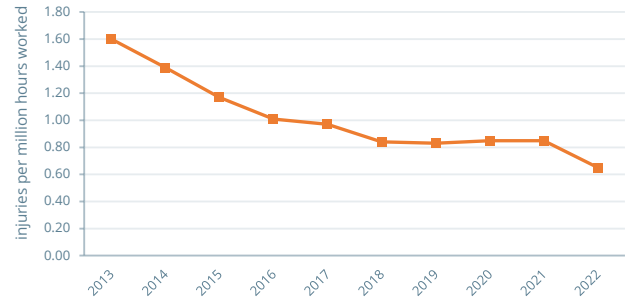
## 3. Material efficiency



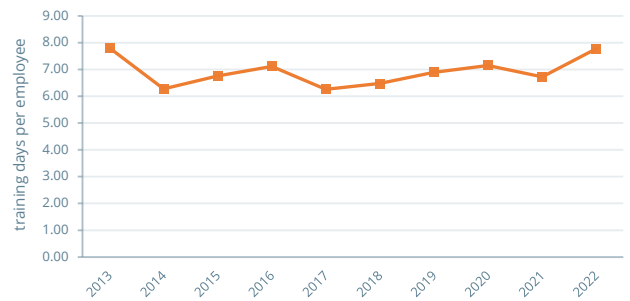
## 4. Environmental management system



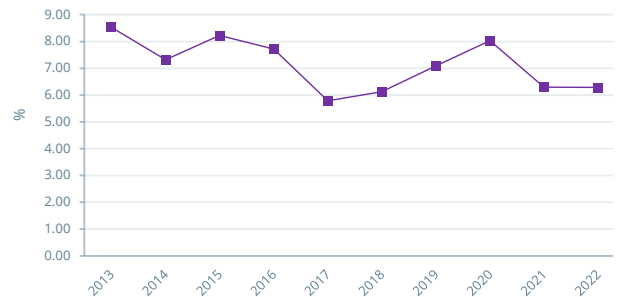
## 5. Lost time injury frequency rate



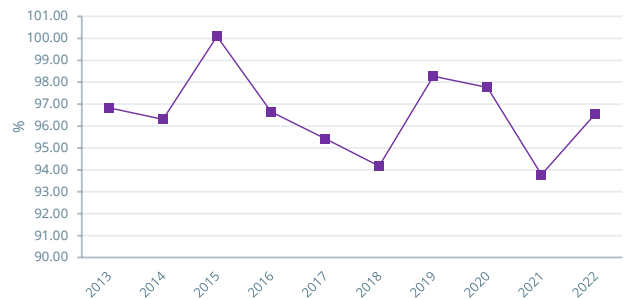
## 6. Employee training



## 7. Investment in new processes and products



## 8. Economic value distributed



### Notes:

**Indicators 1, 2 and 5:** A descending curve demonstrates sustainability progress.  
**Indicators 3, 4, 6, 7 and 8:** An ascending curve demonstrates sustainability progress.

# Contributing organisations - 2023 data collection

77 steel companies and associations listed below provided data for one or more of the 8 indicators.

41 companies (\*) provided data for all 8 indicators.

1. Acciaierie Bertoli Safau S.p.A.\*
2. ACERINOX S.A.\*
3. Aceros AZA S.A.\*
4. Aço Verde do Brasil (AVB)\*
5. Aichi Steel Corporation
6. Algerian Qatari Steel (AQS)
7. AM/NS India (ArcelorMittal/Nippon Steel India)
8. Ansteel Group Corporation Limited
9. Aperam\*
10. ArcelorMittal\*
11. Badische Stahlwerke GmbH
12. Bangladesh Steel Re-Rolling Mills Limited
13. Baotou Iron & Steel (Group) Co., Ltd
14. BlueScope Steel Limited\*
15. CELSA Group\*
16. China Baowu Steel Group Corporation Limited
17. China Steel Corporation (CSC)\*
18. CITIC PACIFIC Special Steel Group Co., Ltd
19. Cogne Acciai Speciali Spa\*
20. Çolakoğlu Metalurji A.Ş.
21. Daido Steel Co., Ltd.
22. Diler Iron and Steel Co., Inc.
23. Duferco S.A.
24. elmarakbysteel\*
25. Emirates Steel Arkan\*
26. EZZ Steel\*
27. Feng Hsin Steel Co., Ltd.\*
28. Gerdau S.A.\*
29. HBIS Group Co., Ltd.
30. HYUNDAI Steel Company\*
31. Japan Stainless Steel Association (JSSA)
32. JFE Steel Corporation\*
33. Jindal Shadeed Iron & Steel LLC\*
34. Jindal Steel and Power Limited (JSPL)
35. JSW Steel Limited\*
36. KAPTAN DEMİR CELİK ENDUSTRISI VE TICARET A.S.
37. Kobe Steel, Ltd\*
38. Kroman Çelik Sanayii A.Ş.
39. Liberty Speciality Steel (GFG Alliance)\*
40. Liberty Steel Australia (GFG Alliance)\*
41. Metinvest Holding LLC\*
42. Mobarakeh Steel Company (MSC)
43. NatSteel Holdings Pte Ltd\*
44. Nippon Kinzoku Co., Ltd.
45. Nippon Steel Corporation\*
46. Nippon Steel Stainless Steel Corporation (NSSSC)
47. Nippon Yakin Kogyo Co., Ltd.
48. Nucor Corporation\*
49. Ovako AB
50. POSCO Holdings\*
51. PT Gunung Raja Paksi Tbk
52. Qatar Steel Company (Q.P.S.C.)\*
53. Rashtriya Ispat Nigam Ltd (VIZAG Steel)
54. SABIC-Saudi Basic Industries Corporation (HADEED)\*
55. Sahaviriya Steel Industries Public Company Limited (SSI)
56. SeAH Besteel Corporation\*
57. SeAH Changwon Integrated Special Steel Corp.\*
58. Shougang Group Co.,LTD
59. Siam Yamato Steel Company Corporation (SYS)
60. SIDENOR S.A.\*
61. SJJ (Slovenian Steel Group)\*
62. Steel Authority of India Ltd. (SAIL)\*
63. ŠTÖRE STEEL d.o.o.
64. SULB Company
65. Tang Eng Iron Works Co. Ltd.
66. Tata Steel\*
67. Tenaris\*
68. Ternium\*
69. The Japan Iron and Steel Federation (JISF)
70. thyssenkrupp AG
71. TRINECKÉ ŽELEZÁRNY, a.s
72. Tung Ho Steel Enterprise Corporation\*
73. UGITECH SA
74. United States Steel Corporation\*
75. Usinas Siderúrgicas de Minas Gerais S.A. (USIMINAS)\*
76. voestalpine AG\*
77. Wei Chih Steel Industrial Co.,Ltd.

Publicly available data was used for the 17 companies, including non-members, below:

1. Anyang Steel
2. Eregli Demir ve Çelik Fabrikalari TAS (Eregli Iron and Steel Works, Co.)
3. Fangda Steel
4. Hoa Phat
5. Hunan Steel Group
6. Jinxi steel
7. Jiuquan steel
8. Krakatau steel
9. Lingyuan steel
10. Liuzhou Steel
11. Nanjing Steel
12. Outokumpu Oyj
13. Salzgitter AG Stahl und Technologie
14. Sanming Steel
15. Shagang Group
16. Shandong Steel Group
17. SSAB AB

# Definitions and calculation

Environmental performance			
	INDICATOR	DEFINITION	CALCULATION
1.	<b>CO<sub>2</sub> emissions intensity</b>	This indicator calculates tonnes of CO <sub>2</sub> emissions per tonne crude steel production as cast. It is calculated with the worldsteel CO <sub>2</sub> Data Collection methodology, which includes all scopes (1, 2, and some scope 3). Global CO <sub>2</sub> emissions intensity represents a weighted average between blast furnace–basic oxygen furnace (BF-BOF), scrap-based electric arc furnace (EAF) and direct reduced iron (DRI)-based EAF steel production.	Tonnes of CO <sub>2</sub> emitted / tonnes of crude steel cast
2.	<b>Energy intensity</b>	This indicator measures the energy used to process the crude steel volume in GJ per tonne crude steel production as cast. Global energy intensity represents weighted average between blast furnace–basic oxygen furnace (BF-BOF), scrap-based electric arc furnace (EAF) and direct reduced iron (DRI)-based EAF steel production.	GJ of energy used / tonnes of crude steel cast
3.	<b>Material efficiency</b>	This indicator calculates the percentage of crude steel and co-products compared to total solid and liquid output material (i.e. crude steel, co-products and waste landfilled or incinerated). Process gases are not included in the calculation.	(crude steel + co-products) / (crude steel + co-products + waste)
4.	<b>Environmental management system</b>	This indicator measures the percentage of employees and contractors working in environmental management system-registered steel production facilities.	Number of employees and contractors working in registered production facilities / total number of employees and contractors working in production facilities
Social performance			
	INDICATOR	DEFINITION	CALCULATION
5.	<b>Lost time injury frequency rate</b>	This indicator measures the number of lost time injuries per million hours worked, including fatalities.	(lost time injuries + fatalities) / million hours worked
6.	<b>Employee training</b>	This indicator measures the total days of training per employee per year.	Total days of training / total number of employees
Economic performance			
	INDICATOR	DEFINITION	CALCULATION
7.	<b>Investment in new processes and products</b>	This indicator measures the value of investments made on capital expenditure, and research and development.	Capital expenditure + research & development expenditure) / annual revenue (consolidated)
8.	<b>Economic value distributed</b>	This indicator measures the economic value distributed to society by the steel industry, including direct and indirect contributions.	(Operating costs + employee wages and benefits + dividends paid + Interest payments + payments to government + community investments) / annual revenue (consolidated)

# Indicator relevance and worldsteel Sustainability Principles

Environmental performance					
	INDICATOR	RELEVANCE	WORLDSTEEL SUSTAINABILITY PRINCIPLES		RELEVANT UN SDG*
1.	<b>CO<sub>2</sub> emissions intensity</b>	To achieve the significant CO <sub>2</sub> emissions reductions needed, an entirely new, transformative approach to iron & steel making is required. Several promising approaches to reduce CO <sub>2</sub> emissions at an industrial scale are being explored.	Climate action	Proactively address climate change and take effective actions to minimise the industry's GHG emissions.	7. Affordable & clean energy 13. Climate Action
2.	<b>Energy intensity</b>	Steel production remains energy-intensive. The steel industry is focusing on increasing the energy efficiency of its operations and the use of renewable energy.			
3.	<b>Material efficiency</b>	The recovery and use of co-products within and outside the steel industry combined with the responsible management of natural resources contribute to material efficiency and a circular economy.	Circular economy	Maximise the efficient use of resources throughout the life cycle of steel products and support society to achieve a circular economy.	12. Responsible consumption & production
4.	<b>Environmental management system</b>	Registered environmental management systems are an effective way to manage environmental performance and to ensure legal compliance.	Environmental care	Conduct operations in an environmentally responsible manner.	3. Good health & well-being 6. Clean water & sanitation 11. Sustainable cities & communities 12. Responsible consumption & production 14. Life below water 15. Life on land
Social performance					
	INDICATOR	DEFINITION	SUSTAINABILITY PRINCIPLES		RELEVANT UN SDG*
5.	<b>Lost time injury frequency rate</b>	All injuries and work-related illness can and must be prevented. Measuring safety performance is one aspect of achieving good safety and health standards.	Safety and health	Maintain a safe and healthy workplace and act on health and safety incidents, risks and opportunities.	3. Good health & well-being 8. Decent work & economic growth
6.	<b>Employee training</b>	Human capital is a key asset for all organisations and a main driver for the creation of value. Training programmes aim to expand the knowledge and skills of employees and help them to make the best use of their talents.	Our people	Enable our people to realise their potential while providing them with an inclusive and fair working environment.	4. Quality education 8. Decent work & economic growth
Economic performance					
	INDICATOR	DEFINITION	SUSTAINABILITY PRINCIPLES		RELEVANT UN SDG*
7.	<b>Investment in new processes and products</b>	Investments in new processes and R&D contribute to a sustainable steel industry.	Innovation and prosperity	Pursue innovations for technologies and products to achieve sustainable economic development.	1. No poverty 8. Decent work & economic growth 9. Industry, innovation & infrastructure
8.	<b>Economic value distributed</b>	Steel is critical to economic growth. It is important to quantify the value companies create and to establish how much of this wealth is distributed to society.			



World Steel Association

Avenue de Tervueren 270  
1150 Brussels  
Belgium

T: +32 (0) 2 702 89 00  
F: +32 (0) 2 702 88 99  
E: [steel@worldsteel.org](mailto:steel@worldsteel.org)

C413 Office Building  
Beijing Lufthansa Center  
50 Liangmaqiao Road  
Chaoyang District  
Beijing 100125  
China

T : +86 10 6464 6733  
F : +86 10 6468 0728  
E : [china@worldsteel.org](mailto:china@worldsteel.org)

[worldsteel.org](http://worldsteel.org)

