



Sustainability Indicators
2022 report

Sustainability performance
of the steel industry
2003-2021

December 2022

Introduction

worldsteel members have been providing data for the eight Sustainability Indicators every year since 2004, spending significant resources to measure their performance and collect the accompanying data.

The eight indicators are aligned with the principles outlined in our Sustainability Charter by systematically measuring key aspects of the industry's economic, environmental and social performance.

Sustainability reporting at a global level is one of the major efforts the steel industry undertakes to manage its performance, demonstrate its commitment to sustainability and enhance transparency.

Our Sustainability Indicators inform stakeholders about the steel industry's performance; they aim to show progress in fulfilling our sustainability commitments and demonstrate improved performance trends across the industry over time.

Institutional investors and investment funds increasingly use sustainability indicators to develop high-level evaluations of industry groups and can factor them into NGOs and regulators' decision-making processes.

In 2022, 104 steel companies and associations contributed to the data collection. Crude steel produced by companies that reported on one or more Indicators for the fiscal year 2021 was 1.1 billion tonnes, representing 56% of global crude steel production. 83 organisations voluntarily provided data for one or more of the eight indicators, 33 of which provided data for all eight.

Our Sustainability Indicators aim to show progress in fulfilling our sustainability commitments.

INDICATORS*	UNIT	2019	2020	2021
ENVIRONMENTAL PERFORMANCE				
1. CO₂ emissions intensity	tonnes CO ₂ per tonne crude steel cast	1.85	1.89	1.91**
2. Energy intensity	GJ per tonne crude steel cast	20.08	20.70	21.31**
3. Material efficiency	%	97.49	97.86	97.34
4. Environmental management system	%	97.16	96.13	95.50
SOCIAL PERFORMANCE				
5. Lost time injury frequency rate	injuries per million hours worked	0.83	0.85	0.81
6. Employee training	training days per employee	6.90	7.15	6.71
ECONOMIC PERFORMANCE				
7. Investment in new processes and products	%	7.09	8.03	6.41
8. Economic value distributed	%	98.27	97.77	93.83

* 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

CO₂ emissions and energy intensity

Since 2007, worldsteel has published a single annual global CO₂ 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.

As of this year's publication, for the 2021 data onwards, this 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.

The slight increase in the reported figures is largely explained by this adjustment in the methodology and does not represent an increase in the global trend of CO₂ emissions and energy intensity, both remain largely stable.

We consider that this new approach to calculating the global metric more accurately reflects global steel production today and in the future. Both the CO₂ emissions and energy intensity for previous years have not been recalculated to reflect this change.

Further information on the worldsteel CO₂ data collection methodology (including scope, boundaries and emission factors) can be found here: [Climate Action data collection - worldsteel.org](https://www.worldsteel.org/en/press-releases/2022/04/2022-climate-action-data-collection).

2021 CO₂ emissions and energy intensity

2021 data	CO ₂ emission intensity by production route	Energy intensity by production route
	tonnes CO ₂ per tonne of crude steel cast	GJ per tonne of crude steel cast
Global average	1.91	21.31
BF-BOF	2.32	24.43
Scrap-EAF	0.67	10.04
DRI-EAF*	1.65	25.29

* 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 CO₂ emissions intensity, 2021

$$\text{Global CO}_2 \text{ emissions intensity} = \left[\begin{array}{l} \text{BF-BOF} \\ \text{CO}_2 \text{ intensity} \\ 2.32 \end{array} \right] \times \begin{array}{l} \text{Share of} \\ \text{BOF steel} \\ \text{in global} \\ \text{production} \\ 71\% \end{array} + \left[\begin{array}{l} \text{Scrap-EAF} \\ \text{CO}_2 \text{ intensity} \\ 0.67 \end{array} \right] \times \begin{array}{l} \text{Share of} \\ \text{scrap-EAF steel} \\ \text{in global} \\ \text{production} \\ 22\% \end{array} + \left[\begin{array}{l} \text{DRI-EAF} \\ \text{CO}_2 \text{ intensity} \\ 1.65 \end{array} \right] \times \begin{array}{l} \text{Share of} \\ \text{DRI-EAF steel} \\ \text{in global} \\ \text{production} \\ 7\% \end{array}$$

Calculation approach for Energy intensity, 2021

$$\text{Global energy intensity} = \left[\begin{array}{l} \text{BF-BOF} \\ \text{Energy} \\ \text{intensity} \\ 24.43 \end{array} \right] \times \begin{array}{l} \text{Share of} \\ \text{BOF steel} \\ \text{in global} \\ \text{production} \\ 71\% \end{array} + \left[\begin{array}{l} \text{Scrap-EAF} \\ \text{Energy} \\ \text{intensity} \\ 10.04 \end{array} \right] \times \begin{array}{l} \text{Share of} \\ \text{scrap-EAF-steel} \\ \text{in global} \\ \text{production} \\ 22\% \end{array} + \left[\begin{array}{l} \text{DRI-EAF} \\ \text{Energy} \\ \text{intensity} \\ 25.29 \end{array} \right] \times \begin{array}{l} \text{Share of} \\ \text{DRI-EAF steel} \\ \text{in global} \\ \text{production} \\ 7\% \end{array}$$

Indicators performance 2003 - 2021

	Environmental performance				Social performance		Economic performance	
	CO ₂ emissions intensity	Energy intensity	Material efficiency	Environment management system	Lost time injury frequency rate	Employee training	Investment in new processes and products	Economic value distributed
	(tonnes CO ₂ /tonne crude steel cast)	(GJ/tonne crude steel cast)	(% of solid & liquid materials converted to products & co-products)	(% of employees & contractors working in EMS-registered production facilities)	(injuries/million hours worked)	(training days/employee)	(% of revenue)	(% of revenue)
2021	1.91	21.31	97.34	95.50	0.81	6.71	6.41	93.83
2020	1.89	20.70	97.86	96.13	0.85	7.15	8.03	97.77
2019	1.85	20.08	97.49	97.16	0.83	6.90	7.09	98.27
2018	1.81	19.51	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: CO₂ emissions intensity and Energy intensity are calculated with the worldsteel CO₂ Data Collection methodology, which includes all scopes (1, 2, and some scope 3). The two intensities represent 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.

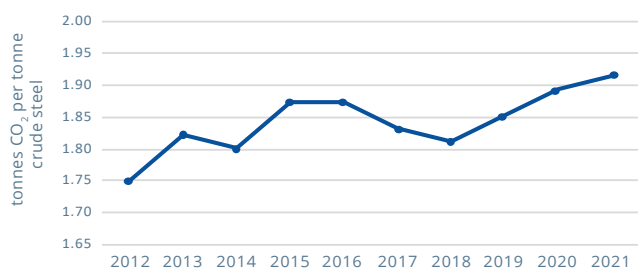
Indicator 5: Lost time injury frequency rate includes fatalities and is calculated based on figures including contractors and employees.

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

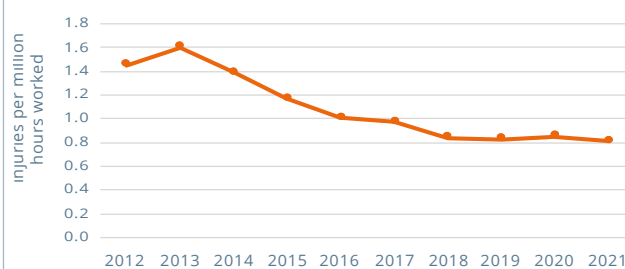
Indicator 7: Investment in new processes and products includes capital expenditure and R&D investment.

Indicators trends 2012 - 2021

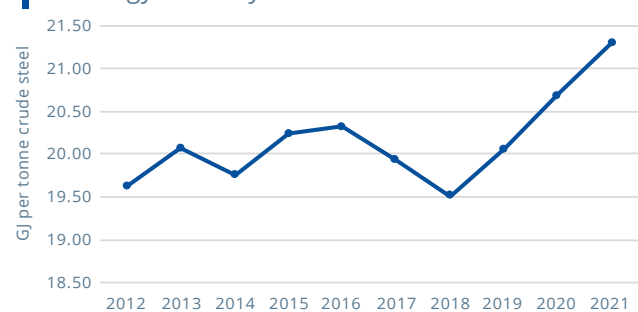
1. CO₂ emissions intensity



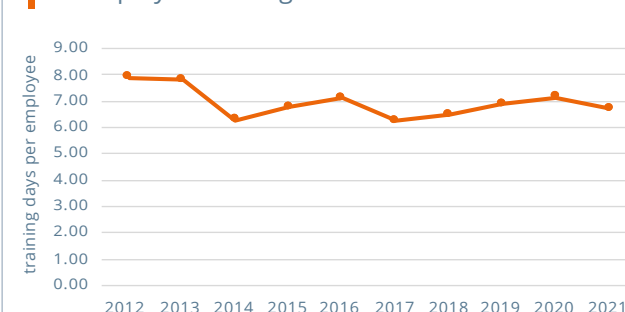
5. Lost time injury frequency rate



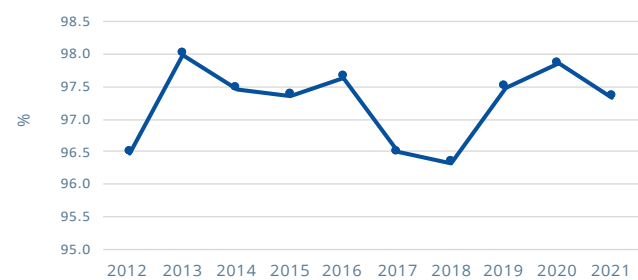
2. Energy intensity



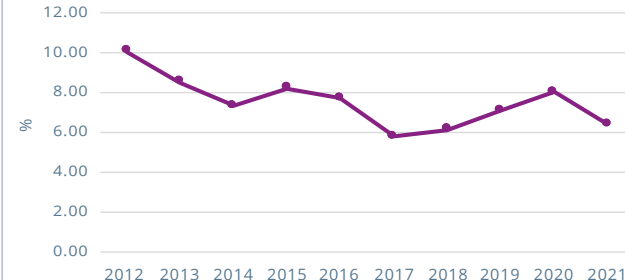
6. Employee training



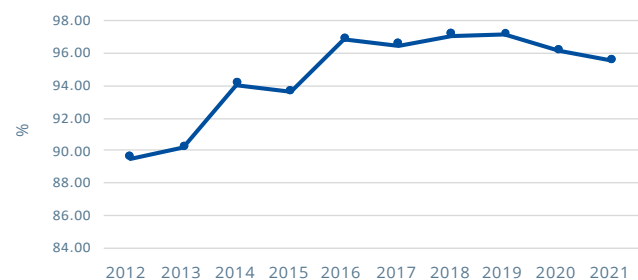
3. Material efficiency



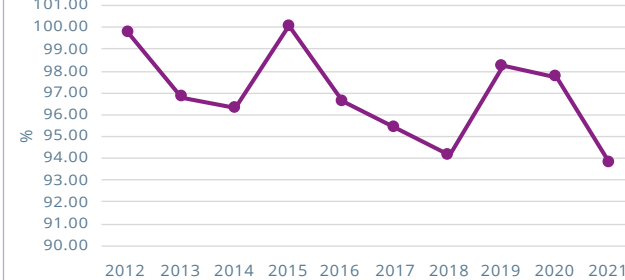
7. Investment in new processes and products



4. Environmental management system



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 - 2022 data collection

83 steel companies and associations listed below provided data for one or more of the 8 indicators.
33 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. ArcelorMittal/Nippon Steel India
7. Ansteel Group Corporation
8. Aperam*
9. ArcelorMittal*
10. Badische Stahlwerke GmbH
11. Bangladesh Steel Re-Rolling Mills Limited
12. BlueScope Steel Limited*
13. Böllinghaus GmbH & Co. KG
14. CELSA Group*
15. China Baowu Steel Group Corporation Limited
16. China Steel Corporation (CSC)
17. CITIC PACIFIC Special Steel Group Co., Ltd
18. Cogne Acciai Speciali Spa*
19. Çolakoğlu Metalurji A.Ş.
20. Compania Siderurgica Huachipato S.A. (CAP ACERO)
21. Daido Steel Co., Ltd.
22. Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG.
23. Diler Iron and Steel Co., Inc.
24. Dragon Steel Corporation
25. Duferco S.A.
26. El Marakby Steel
27. Emirates Steel Industries Company PJSC*
28. Ereğli Demir ve Çelik Fabrikalari TAS (Ereğli Iron and Steel Works, Co.)
29. Evraz Group
30. EZZ Steel*
31. Feng Hsin Steel Co., Ltd.*
32. Gerdau S.A.*
33. HBIS Group Co., Ltd.
34. HYUNDAI BNG STEEL Company Ltd.
35. HYUNDAI Steel Company*
36. IMIDRO
37. Japan Stainless Steel Association (JSSA)
38. JFE Steel Corporation*
39. Jindal Steel and Power Limited (JSPL)
40. JSW Steel Limited*
41. Kaptan Demir Celik Endustrisi Ve Ticaret A.S.
42. Kobe Steel, Ltd*
43. Kroman Çelik Sanayii A.Ş.
44. Liberty Speciality Steel (GFG Alliance)*
45. Liberty Steel Australia (GFG Alliance)*
46. Magnitogorsk Iron & Steel Works
47. Metalloinvest Management Company
48. Metinvest Holding LLC
49. NatSteel Holdings Pte Ltd*
50. Nippon Kinzoku Co., Ltd.
51. Nippon Steel Corporation*
52. Nippon Steel Stainless Steel Corporation (NSSSC)
53. Nippon Yakin Kogyo Co., Ltd.
54. North American Stainless (NAS)
55. Novolipetsk Steel (NLMK Group)
56. Nucor Corporation*
57. Ovako AB
58. POSCO*
59. PT Gunung Raja Paksi Tbk
60. Qatar Steel Company (Q.P.S.C.)*
61. Rashtriya Ispat Nigam Ltd (VIZAG Steel)
62. SABIC-Saudi Basic Industries Corporation (HADEED)*
63. Sahaviriya Steel Industries Public Company Limited (SSI)
64. Severstal (PAO)
65. Siam Yamato Steel Company Corporation (SYS)
66. Sidenor S.A.
67. SIJ (Slovenian Steel Group)
68. Stahlbeteiligungen Holding S.A.
69. Steel Authority of India Ltd. (SAIL)*
70. SULB Company
71. Tang Eng Iron Works Co. Ltd. , Taiwan
72. Tata Steel*
73. Tenaris*
74. Ternium*
75. The Japan Iron and Steel Federation (JISF)
76. TMK PAO
77. TRINECKÉ ŽELEZÁRNY, a.s
78. Tung Ho Steel Enterprise Corporation*
79. UGITECH SA
80. United States Steel Corporation*
81. Usinas Siderúrgicas de Minas Gerais S.A. (USIMINAS)*
82. Vallourec
83. voestalpine AG*

Publicly available data was used for the 21 companies below:

1. Anyang Steel
2. Benxi
3. Baotou Iron & Steel (Group) Co., Ltd
4. Fangda Steel
5. Formosa Ha Tinh
6. Hoa Phat
7. Jiangsu Shagang Group Co., Ltd.
8. Jinxi steel
9. Jiuquan steel
10. Krakatau Steel
11. Lingyuan steel
12. Liuzhou Steel
13. Nanjing Steel
14. Outokumpu Oyj
15. Salzgitter AG Stahl und Technologie, Germany
16. Sanming Steel
17. Shandong
18. SSAB AB
19. thyssenkrupp A.G.
20. Valin Group
21. Xinyu Steel

Definitions and calculation

Environmental performance			
	INDICATOR	DEFINITION	CALCULATION
1.	CO₂ emissions intensity	This indicator calculates tonnes of CO ₂ emissions per tonne crude steel production as cast. It is calculated with the worldsteel CO ₂ Data Collection methodology, which includes all scopes (1, 2, and some scope 3). Global CO ₂ 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 ₂ emitted / tonnes of crude steel cast
2.	Energy intensity	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.	Material efficiency	This indicator calculates the percentage of crude steel and co-products (by-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.	Environmental management system	This indicator measures the percentage of employees and contractors working in environment 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.	Lost time injury frequency rate	This indicator measures the number of Lost time injuries per million man-hours, including fatalities.	(lost-time injuries + fatalities) / million hours worked
6.	Employee training	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.	Investment in new processes and products	This indicator measures the value of investments made on capital expenditure, and research and development.	Capital expenditure + Research & Development expenditure) / annual revenue (consolidated)
8.	Economic value distributed	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)

Relevance and Sustainability Principles

Environmental performance					
	INDICATOR	RELEVANCE	SUSTAINABILITY PRINCIPLES		RELEVANT UN SDG*
1.	CO₂ emissions intensity	To achieve the significant CO ₂ emissions reductions needed, an entirely new, transformative approach to iron & steel making is required. Several promising approaches to reduce CO ₂ 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.	Energy intensity	Steel production remains energy-intensive. The steel industry is focusing on increasing the energy efficiency of its operations and the proportion of low-carbon resources used.			
3.	Material efficiency	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.	Environmental management system	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.	Lost time injury frequency rate	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.	Employee training	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.	Investment in new processes and products	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.	Economic value distributed	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.			

* United Nations Sustainable Development Goals

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