Nerves of steel

Who's ready to get tough on emissions?
Executive Summary

Authors: Drew Fryer, Chloe Chan and Tom Crocker

CDP's sector research for investors provides the best and most tailored environmental data in the market. CDP's team of analysts, voted no. 1 climate change research provider in 2015 by institutional investors, takes an in-depth look at high emitting industries one-by-one, starting with the automotive industry, electric utilities, diversified chemicals, metals & mining, cement, and now steel. Forthcoming is research on the oil & gas industry.

The full report is available to CDP investor signatories and includes detailed analysis, methodology and recommended areas of engagement for investors to raise with company management teams. In addition, a separate engagement booklet providing further detail on company specific engagement ideas is available to CDP signatories on request.

For more information see:
https://www.cdp.net/en/investor/sector-research

Linking emissions-related metrics to earnings for steel companies

▼ With governments globally agreeing to limit climate change to 2 degrees Celsius at COP21, the global steel industry will face increasing pressure to reduce its significant emissions profile. The steel industry contributes 6-7% of global anthropogenic greenhouse gas emissions, and has limited potential to reduce its emissions based on currently available technology.

▼ This report introduces CDP's League Table for steel, highlighting company performance across a range of emissions and water-related metrics which in aggregate could have a material impact on company performance.

▼ Highest ranked companies are POSCO, SSAB, ThyssenKrupp, and Hyundai Steel.

▼ Lowest ranked companies are United States Steel, Tata Steel, CSN, and Evraz.

Overview

This report, covering steelmaking companies, is the latest in a series of investor-focused reports covering high emitting sectors. CDP has previously published reports on auto manufacturers (February 2015 and March 2016), European electric utilities (May 2015), chemicals companies (August 2015), diversified miners (November 2015), and cement companies (June 2016). The oil & gas sector will be the next in CDP's sector research series. Each report features a CDP League Table that ranks companies in an industry grouping on a number of emissions and water-related metrics relevant to that industry. When taken in aggregate, we believe these metrics could have a material impact on company's earnings and therefore investment decisions. In this report, we launch a CDP League Table for steel companies that ranks 14 of the largest and highest emitting steelmakers.

Scope of report: key areas

There are six key areas in our League Table:

▼ **Emissions and energy management:** steel companies report that energy costs can represent over 40% of operating costs. Using company emissions and energy intensity profiles, this key area assesses which steelmakers are currently the most efficient and which may be least exposed to potential rises in energy and carbon costs.

▼ **Emissions targets and pathways:** we examine companies' forward-looking emissions reduction targets, comparing companies' targets and their progress against them with science-based targets under the Sectoral Decarbonization Approach[1].

▼ **Carbon cost exposure:** examines the potential earnings impacts on the companies in our study under different carbon pricing regulation scenarios including emissions allowances allocated under intensity benchmarking, and under full global auctioning. We also assess whether companies make use of an internal carbon price.

▼ **Low carbon technology development:** to meet global goals to limit global warming to 2 degrees Celsius, emissions intensive steelmaking processes will have to undergo a technology transformation. This key area identifies company involvement and progress in breakthrough emissions reduction projects, and compares the level of focus on research and development between companies.

▼ **Water resilience:** we assess steel companies' exposure to risks from water stress, undertaking facility-level analysis to assess which companies are at greater risk of business interruption due to water stress. We also compare their respective levels of water consumption and water recycling.

▼ **Climate governance:** we use proprietary analysis by InfluenceMap[2] to assess each company's actions in supporting or opposing meaningful carbon regulation, and information on the alignment of executive and employee remuneration with climate risk management actions.

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1. The Sectoral Decarbonization Approach is a method for setting corporate emissions reduction targets in line with climate science. See the chapter "Emissions targets and pathways" for more details.
2. A UK-based not-for-profit whose remit is to map, analyse and score the extent to which corporations are influencing climate policy and legislation. http://influencemap.org/

Condensed summary of the League Table for steel companies

League table rank	Company	Country	Market cap 2015 average (US$m)	2015 steel production (m tonnes)	League Table score	Emissions & energy management	Emissions pathways & targets	Carbon cost exposure	Low carbon technology development	Water resilience	Climate governance
1	POSCO	South Korea	16,984	42	4.5	A	C	B	A	A	B
2	SSAB	Sweden	2,437	8	4.9	B	A	B	A	B	C
3	ThyssenKrupp	Germany	13,570	17	5.2	C	B	A	C	A	B
4	Hyundai Steel	South Korea	6,841	20	5.4	A	A	A	D	D	C
5	ArcelorMittal	Luxembourg	14,115	97	5.6	A	C	C	A	B	E
6	Nippon Steel & Sumitomo Metal Corp (NSSMC)	Japan	22,272	46	6.0	B	B	C	B	C	E
7	China Steel	Taiwan	11,314	15	6.3	B	C	D	B	B	A
8	JFE Holdings	Japan	12,097	30	6.9	C	C	D	B	C	D
9	Kobe Steel	Japan	5,713	8	7.8	D	E	C	B	C	C
10	JSW Steel	India	3,506	12	8.1	C	D	D	D	E	A
11	Evraz	UK	2,890	14	9.1	D	E	C	E	D	C
12	Cia. Siderurgica Nacional (CSN)	Brazil	2,222	5	9.2	D	E	C	E	D	B
13	Tata Steel	India	4,517	26	10.0	E	D	E	C	E	C
14	US Steel	US	2,715	15	10.3	E	E	E	E	D	D
Weighting for each key area						**30%**	**17.5%**	**10%**	**17.5%**	**15%**	**10%**

The summary League Table above initiates CDP investor coverage on the steel industry. It is based on detailed analysis across a range of carbon and water-related metrics, which are aggregated to assign an A to E-grade to each company across each key area.

We also highlight the largest non-responding steelmakers to CDP's 2016 climate change questionnaire in the following table, which has resulted in them not being included in this report. We encourage investors to raise this lack of transparency over reporting practices in discussions with company management.

We note that United States Steel has also not responded to CDP's 2016 climate change questionnaire, but has replied for previous years, on the basis of which we have included it in this report.

Key findings

▼ Progress in reducing emissions and energy use is limited and uneven across the industry. In our sample, more companies increased their emissions intensity and energy intensity than reduced them in the past seven years. Based on figures reported by the World Steel Association covering a wider sample and longer period, there has been no industry-wide progress in improving emissions and energy efficiency levels in a decade (Graph A overleaf).

▼ The steel industry will need to make sharp reductions in emissions levels to achieve science-based targets for a 2 degree transition. The sectoral decarbonization approach (SDA) suggests the need for an emissions intensity reduction of over 70% by the steel industry by 2050 to achieve 2 degrees (Graph B overleaf). While several steel companies have emissions reduction targets that track or better the 2 degrees SDA pathway in coming years, all

Non-responders to CDP

| Company	Country	Market cap 2015 average (US$m)	2015 crude steel production (million tonnes)	First year approached by CDP	Public disclosure of carbon emissions
Wuhan Iron and Steel (A)	China	7,477	26	2009	No quantitative data
Nucor Corporation	USA	14,247	20	2006	No quantitative data
Novolipetsk Steel OJSC	Russia	7,410	16	2010	Partial (emissions intensity)
Steel Authority of India	India	3,968	14	2007	Partial (emissions intensity)
Inner Mongolian Baotou Steel Union (A)	China	19,845	12	2009	None
SeverStal PAO	Russia	9,019	12	2009	No quantitative data

Source: CDP, Bloomberg, World Steel Association

these targets expire by 2020. Six out of fourteen companies in our sample have not published forward looking targets, or have targets that expire in 2016.

▼ A range of projects are underway to develop technologies that could provide the deep decarbonization needed by the industry to achieve a 2 degree transition. However, most are at feasibility or piloting stages and not technically or commercially proven. With current low industry profitability, research and development expenses have been cut in recent years. With the timeframe for most technology transitions spanning multiple decades, slow progress now puts at risk efforts toward long-term global and country targets for decarbonization.

▼ Adequate levels of funding for incremental and breakthrough emissions reduction needs to be a priority by companies and governments to ensure long term decarbonization targets are not missed. In particular, progress has been slow in realising the potential for carbon capture and sequestration (CCS), with no CCS pilots underway in the steel industry and little signs of near term progress. Recent investment announcements suggest several steelmakers currently see more potential in carbon capture and utilization (CCU) for steelmaking, though the scale of its emissions reduction potential remains unproven.

▼ Over 70% of world steel production will be subject to a carbon price by end 2017, including from emissions trading schemes, carbon taxes or climate-focused coal taxes. Without success in realizing the potential of breakthrough low emissions technologies, steelmakers could face a continuously rising burden of carbon permit obligations.

▼ Debate between industry and regulators over 'carbon leakage' will enter a new phase in coming years as more countries introduce carbon prices. The steel industry, while generally supportive of climate change regulation in principle, has sometimes obstructed it in practice, arguing it could create distortions in production decisions between regions with and without carbon prices. The largest steelmakers in developed countries and their trade associations have been active in demanding free permit allocations and other concessions, which some have argued blunt the effectiveness of carbon prices in their current form.

▼ Steelmakers are projected to face increasing water stress that could cause future localised disruption to operations. In 2015, 3% of steelmaking sites assessed were based in high water stress areas according to our analysis using WRI Aqueduct. By 2030, 20% of sites assessed are projected to be in high risk areas and 8% in extremely high risk areas.

▼ Most Chinese steelmakers provide much less transparency on climate change strategies and greenhouse gas emissions than their global peers. Only one of China's largest fifteen steelmakers, which represent 40% of Chinese production, discloses emissions. Steelmaking in China now accounts for 50% of global production, and steelmakers there face growing carbon risks, with a national emissions trading scheme to be introduced in 2017, and indications that environmental factors could frame regulator's decisions on how to reduce China's steel overcapacity. Investors currently lack adequate climate-related disclosures to assess individual company risk and preparedness, and make informed investment decisions.

Graph A: Steel industry emissions and energy use
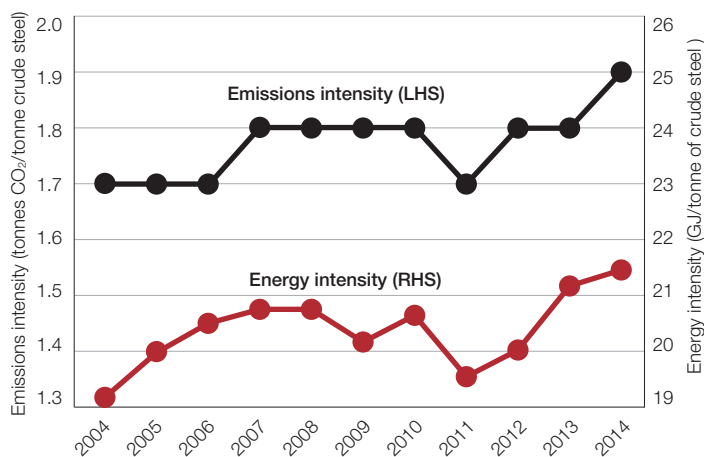
Source: World Steel Association

Graph B: Steel industry 2 degree transition pathway
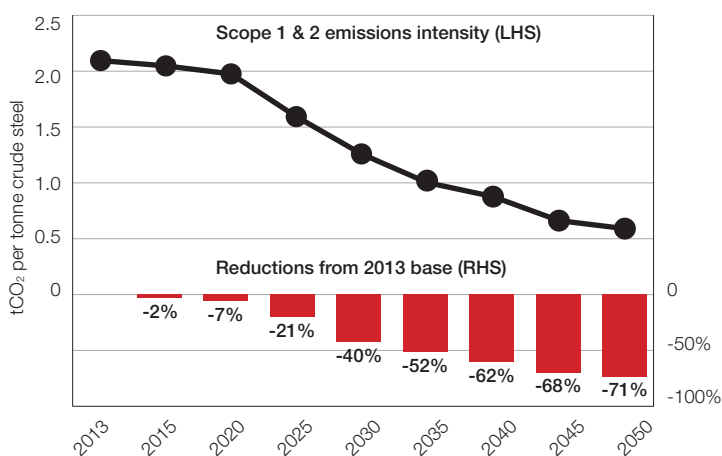
Source: Aligning corporate greenhouse-gas emissions targets with climate goals' in Nature Climate Change (2015), updated using IEA Energy Technology Perspectives 2016

Company findings

Top-ranked companies

▼ **POSCO** is ranked first and performs strongly across most key areas. It has a below average emissions intensity, and unlike several other steelmakers has demonstrated an ability to reduce its emissions intensity significantly in recent years. Its targets are consistent with a 2-degree sectoral decarbonization pathway as far as its target expiry in 2020. It has developed and commercialized a technology FINEX, providing incremental emissions reductions from steelmaking by eliminating sintering and coke oven processes. The technology has potential to be combined with CCS due to high concentrations of CO_2 in waste gases. It also has other active projects to separate and capture CO_2, and has undertaken early stage work on CCU and hydrogen-based steelmaking.

▼ **SSAB** ranks second. Its emissions intensity is low, driven by significant electric arc furnace (EAF) operations, and Europe-based blast furnace-basic oxygen furnace (BF-BOF) plants that it states benchmark as among the most carbon efficient globally. SSAB's emissions reduction target is among the strongest of companies assessed. It recently announced a long term breakthrough emissions reduction project, HYBRIT, working toward a hydrogen-based steelmaking process using renewable energy that envisages elimination of almost all the process emissions of steelmaking. It is aiming for a working demonstration plant around 2025, with potential for commercialisation envisaged a further one to two decades after that.

▼ **ThyssenKrupp** is ranked third. Its emissions intensity is the lowest of companies we assessed that focus on the blast furnace steelmaking route – only Hyundai Steel and SSAB with significant electric arc furnace operations have lower emissions intensities. Its water consumption intensity and water stress risk are also among the lowest we observed. It is pursuing a CCU project, Carbon2Chems, seeking to create usable chemicals from CO and CO_2 waste gases from steelmaking, and has also participated in other collaborative breakthrough emissions technology initiatives. ThyssenKrupp's executive remuneration framework shows the greatest alignment with low carbon goals among companies in our sample.

▼ **Hyundai Steel** ranks fourth. It is the least emissions and energy intensive steelmaker assessed, driven by around half of its production being from the EAF route. Helped by these factors it also performs strongly on benchmarking of carbon pricing scenarios, and its emissions reduction target is proactive relative to peers. Limiting its overall ranking though, it does not disclose details of research into breakthrough emissions reduction technologies, and faces higher exposure to water stress than many others.

Bottom-ranked companies

▼ **US Steel** ranks last, driven by a high emissions intensity relative to peers, as well as the lack of any emissions reduction target, or recent progress in reducing its emissions intensity. Unlike most companies assessed, it lacks transparency on energy and water consumption, resulting in poor rankings on those factors. It was one of only a few steelmakers assessed not to provide evidence of actively pursuing research or pilot programs for breakthrough emissions reduction technologies.

▼ **Tata Steel** ranks second last. It provides limited transparency relative to other companies, only providing substantive environmental data for its India-based operations, representing only one-third of its operations by tonnes of steel produced globally. This lack of fully consolidated environmental disclosure provides investors with limited perspective of its environmental risks and performance and resulted in its omission from several quantitative benchmarking exercises. If it were included, its disclosed India-only emissions and energy intensities rank worse than average. It is also subject to a higher level of water stress than most companies assessed. Positively influencing its ranking, it has piloted a new bath smelting steelmaking technology, HIsarna, stated as capable of reducing steelmaking emissions by 20%, or up to 80% if able to be combined with CCS in future. However, significant additional funding will be required to achieve commercialization.

▼ **CSN** ranks third last. It has the highest emissions intensity among companies assessed, and does not disclose any emissions reduction target. It has a relatively high exposure to water stress, and higher than average water consumption. It has not participated in major announced breakthrough emissions reduction research projects.

▼ **Evraz** ranks fourth from last. It performs among the bottom companies on our emissions and energy benchmarking, and does not disclose forward-looking reduction targets, or any participation in research toward breakthrough emissions reduction technologies.

Mid-ranked companies

ArcelorMittal ranks fifth. Its emissions and energy intensities are better than average and most other quantitative KPIs are in the average range overall, reflecting a diverse spread of operations worldwide. It ranks highly on breakthrough emissions reduction technology development, with a demonstration sized Lanzatech CCU plant to start operating in 2017 to convert steel waste gases into usable by-products. It also made some progress toward a CCS pilot, before putting plans on hiatus and withdrawing its application for EU funding in late 2012, but emphasizes that work continues toward realising this ambition. Analysis by InfluenceMap indicates that ArcelorMittal has been the most active in opposing unilateral carbon pricing in countries where it operates, including lobbying against strengthening the carbon price signal in Europe.

Nippon Steel & Sumitomo Metal Corp (NSSMC) ranks sixth. Its emissions intensity is slightly better than average and it has a relatively strong emissions reduction target, though it is demonstrating little progress in reducing actual emissions. Like other Japanese steelmakers it is part of the COURSE50 consortium to develop breakthrough technologies involving hydrogen-based reduction and carbon capture. InfluenceMap analysis identifies it as among the companies most obstructive to incremental carbon regulation and pricing in the steel industry.

China Steel ranks seventh. It ranks poorly on emissions transparency, failing to disclose consolidated environmental data based on its full operational footprint, excluding a key 100% owned steelmaking subsidiary that accounts one-third of its steel production. Once manually consolidated, its environmental efficiency metrics generally fall in the mid-range for companies assessed. It is an early adopter of CCU technology, building one of the first demonstration sized Lanzatech plants.

JFE Holdings ranks eighth. Its environmental efficiency metrics fall within the average range relative to its industry. With other Japanese steelmakers it is part of the COURSE50 consortium to develop breakthrough technologies involving hydrogen-based reduction and carbon capture.

Kobe Steel ranks ninth. Its emissions and energy intensities are above average and higher than other Japanese steelmakers. It does not have a public emissions reduction target. With other Japanese steelmakers it is part of the COURSE50 consortium to develop breakthrough technologies involving hydrogen-based reduction and carbon capture.

JSW Steel ranks tenth. It has high emissions and energy intensities, though has demonstrated progress in reducing them in recent years. Its emissions reduction target runs only to 2016, and it does not appear to be involved in significant breakthrough emissions reduction technology research.

Scope of report: Company selection

We selected the group of companies for our study as follows:

▼ Started with the 31 steel companies that responded to CDP's 2016 climate change questionnaire.

▼ Reviewed the ownership and nature of business activities of these companies.

▼ Excluded subsidiaries and privately owned companies.

▼ Excluded remaining companies whose primary business activity is iron ore mining or steel recycling not steelmaking – these companies had much lower emissions and emissions intensities than steelmakers. One company, Vale, with primarily mining operations was also already included in CDP's sector report on diversified miners.

▼ Excluded the steel companies that focused on downstream processing and value-added products, without significant crude steelmaking operations.

▼ Excluded one remaining company, Salzgitter AG, which provided its first full response to the CDP climate change questionnaire during the course of our research process.

▼ Added US Steel which did not respond in 2016 but did so for 2015 and many years prior.

Following this process we were left with a set of 14 companies, which together represent approximately US$118 billion in market capitalization and account for 92% of the combined operational (Scope 1 and 2) emissions of the 31 steel companies that responded to CDP. The activities of the 14 companies are all significantly focused on steelmaking using the blast furnace-basic oxygen furnace (BF-BOF) or electric arc furnace (EAF) routes of production.

Linking our findings to investment choices

We recognise that investment decisions are based on a multitude of different factors and that some of these can be misaligned with emissions reduction efforts.

Our League Table is not intended as definitive winners and losers for investment purposes, but more as a proxy for business-readiness in an industry likely to be impacted by more stringent carbon regulations needed to meet long-term climate objectives.

We would flag that companies towards the bottom of our League Table may be higher risk investments from a sustainability perspective than those towards the top.

Methodology

We score each steel company based on a number of different metrics which are first ranked and then weighted within each key area (see table overleaf for metric weightings within each key area) to give a weighted rank for each area. We then grade each area from A to E based on these weighted ranks. We calculate the overall League Table score by weighting the weighted ranks for each key area.

Each of the key areas has a separate chapter within this report. We disclose the precise methodology for how we rank and grade each metric in an appendix.

A summary of key areas, associated metrics and relative weightings within the League Table

Key area in League Table	Link to company earnings	Metrics	Metric weighting within key area	Key area weighting
Emissions and energy management	Measures to reduce emissions deliver cost benefits, and are a proxy for wider operational efficiency measures. Energy costs account for a significant share of total steel manufacturing costs. Energy efficiency efforts can yield significant cost savings and higher profit margins.	i) Emissions intensity per tonne of crude steel produced (2013-15) ii) Reduction in emissions intensity per tonne crude steel (2009-15) iii) Emissions data transparency iv) Energy intensity per tonne crude steel (2013-15) v) Reduction in energy intensity per tonne crude steel (2010-15)	35% 10% 15% 30% 10%	30%
Emissions targets and pathways	Announced emissions reductions targets and companies' progress toward them provide a forward-looking indicator of progress and commitment to lowering climate change-related risks.	i) Quality of emissions reduction target (vs. science-based levels) ii) Company performance against own target	75% 25%	17.5%
Carbon cost exposure	The financial exposure of meeting costs of carbon pricing schemes across a number of simplified scenarios. This is a direct financial cost to companies and thus impacts earnings.	i) Carbon cost exposure under intensity benchmarking ii) Potential carbon cost exposure under full emissions allowance auctioning iii) Company use of internal carbon price	50% 30% 20%	10%
Low carbon technology development	Parts of the steel industry operate close to theoretical maximum efficiency and large emissions reductions are infeasible without technological breakthroughs. Focus on R&D and participation in announced new low emissions technology development is an indicator of which companies may gain future competitive advantage through technological breakthroughs.	i) Participation in announced breakthrough emissions reduction technology projects. Projects' expected potential to reduce emissions, projected timing of commercialisation of technologies, announced dollar investments ii) Research & development expense / Sales	75% 25%	17.5%
Water resilience	Localised water issues at steel production sites can pose risks to operational continuity.	i) Water stress risk exposure (using WRI Aqueduct) ii) Water consumption intensity iii) Water recycling rate	50% 40% 10%	15%
Climate governance	Companies that are supportive of regulation which facilitates a low-carbon transition are likely to be better placed to benefit from it. Remuneration structures incentivizing management of climate change issues contribute to their priority versus other corporate goals.	i) InfluenceMap score ii) Remuneration structures providing incentives for the management of climate change issues	75% 25%	10%

Source: CDP

For further study

Areas for further research include:

▼ Analysis of the potential for production route substitution opportunities, from blast furnace to electric arc furnace-based steelmaking, and market and regulatory dynamics that may create opportunities for greater use of scrap steel.

▼ Advanced carbon price modeling, developing and integrating exposure factors currently analyzed under separate scenarios. Analyzing potential for carbon cost pass-through to end product prices as further countries adopt carbon pricing.

▼ Enhanced analysis of company innovation activities, including R&D expenditures specific to emissions and energy reduction activities, and more detailed analysis of technological progress and prospects.

▼ Extending innovation analysis from process innovation to also include product innovation, such as sales of high strength, lightweight steel, and life cycle analysis of products.

▼ Investigate if the concept of 'stranded assets' could apply to the steel industry – in particular if the timing of refurbishment or replacement of steel facilities based on a need to lower emissions could result in significant asset writedowns.

CDP UK
Level 3
71 Queen Victoria Street
London
EC4V 4AY
Tel: +44 (0) 20 3818 3900

@cdp
www.cdp.net
info@cdp.net