IRON & STEEL PRODUCERS

Research Brief

SASB’s Industry Brief provides evidence for the material sustainability issues in the industry. The brief opens with a summary of the industry, including relevant legislative and regulatory trends and sustainability risks and opportunities. Following this, evidence for each material sustainability issue (in the categories of Environment, Social Capital, Human Capital, Business Model and Innovation, and Leadership and Governance) is presented. SASB’s Industry Brief can be used to understand the data underlying SASB Sustainability Accounting Standards. For accounting metrics and disclosure guidance, please see SASB’s Sustainability Accounting Standards. For information about the legal basis for SASB and SASB’s standards development process, please see the Conceptual Framework.

SASB identifies the minimum set of sustainability issues likely to be material for companies within a given industry. However, the final determination of materiality is the onus of the company.

Related Documents

- Non-Renewable Resources Sustainability Accounting Standards
- Industry Working Group Participants
- SASB Conceptual Framework

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At the same time, while the industry has made significant strides in improving resource efficiency, steel production remains resource-intensive. With the worldwide growth in steel production, companies in the industry will need to continue working to reduce their environmental externalities. Regulatory action and public expectations for environmental performance and worker health and safety are intensifying in the face of global challenges such as climate change and economic development in many parts of the world. Therefore, management (or mismanagement) of material sustainability issues has the potential to affect company valuation through impacts on profits, assets, liabilities, and cost of capital.

If iron and steel companies reported metrics on the material sustainability risks as well as opportunities that could affect value in the near- and long-term in their regulatory filings, then investors would obtain a more holistic and comparable view of performance. This would include both positive and negative externalities, and the non-financial forms of capital that the industry relies on for value creation.

Specifically, performance on the following sustainability issues will drive competitiveness within the Iron & Steel Producers industry:

- Reducing direct greenhouse gas (GHG) emissions and harmful air pollutants;
- Managing the efficiency and sourcing of energy used in operations;
- Ensuring efficiency in water use, particularly in areas with water scarcity;
- Reducing and managing hazardous and solid waste generated during operations;

INTRODUCTION

The Iron and Steel industry provides the essential building blocks of modern society, with the versatility of steel enabling its use in construction, automobiles, appliances, and machinery. Much of the economic growth in emerging markets today is accompanied by an expansion in construction activity, requiring greater steel production. Innovations in the industry are creating lighter, more durable products, enabling environmental efficiency of automobiles and other modes of transport. High recycling rates and new technologies are reducing the need for extracting virgin materials.
• Ensuring a safety culture and reducing incidents leading to worker injuries or fatalities;

• Working with suppliers to focus on minimizing their environmental and social impacts.

INDUSTRY SUMMARY

The Iron & Steel Producers industry consists of steel producers with iron and steel mills and companies with iron and steel foundries. The steel producers segment consists of companies that produce iron and steel products from their own mills. These products include flat-rolled sheets, tin plates, pipes, tubes, and products made of stainless steel, titanium, and high alloy steels. Iron and steel are also cast into various products at foundries, which typically purchase iron and steel from other firms. The industry also includes metal service centers and other metal merchant wholesalers, which distribute, import and/or export ferrous products.1

Most companies in the industry do not mine their own ore to manufacture iron and steel products. There are only a few major vertically-integrated steel producers; they include United States Steel and ArcelorMittal.

N.B.: For further information concerning sustainability issues relevant to integrated iron and steel companies that operate their own mines, see SASB’s Metals & Mining Industry Brief.

Global annual industry revenues are around $1.3 trillion, with the steel producers segment accounting for over 75 percent of the revenues.5 The Iron & Steel Producers industry is characterized by numerous companies producing a bulk commodity with prices dictated by global demand and supply of inputs. Steel demand is closely correlated with economic activity, specifically industrial output, commercial construction, and automobile manufacturing. The construction industry accounts for slightly more than half of steel consumption. The automotive, transport, and machinery industries together account for over 30 percent of consumption.6

1 Industry composition is based on the mapping of the Sustainable Industry Classification System (SICS™) to the Bloomberg Industry Classification System (BICS). A list of representative companies appears in Appendix I.

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Steel production in South and East Asia began a period of rapid expansion in the early 2000s as Chinese and Indian demand soared. In 2012, a record 1,548 megatons of crude steel were produced — 76 percent more than in 2000. High production volumes combined with the global recession beginning in 2008 caused a sharp collapse in steel demand, prices, and industry profitability. The slowdown in the U.S. auto and construction markets was a significant factor. However, global demand recovered quickly from the recession because of rapid economic growth rates in emerging markets. Steel prices have remained flat in the past few years due to continued economic weakness in Europe and the U.S. The industry continues to suffer from excess capacity, with capacity utilization rates below 80 percent.

The Iron & Steel Producers industry is capital-intensive, with expenditures focused on machinery and equipment. A majority of industry costs are for materials purchases, accounting for about 65 percent of industry revenue in 2014 for U.S. producers. Iron ore and coal, the industry’s main raw materials, account for the majority of these purchases. Wages account for around 6 percent of industry revenue. The steel industry employs more than two million people globally, and an additional two million contractors. Lower wages in emerging markets put steel producers in developed countries at a disadvantage. This has led to higher import volumes of cheaper steel into developed countries. Other significant costs for the industry include fuel and electricity costs, due to the energy-intensity of production. Utilities account for around 5.6 percent of industry revenue.

With increasing costs of iron ore, coking coal, scrap steel, and the globalization of the industry in the past few years, there have been high levels of consolidation and merger and acquisition (M&A) activity for steel producers around the world.

Profit margins generally fluctuate widely due to high fixed and variable costs. Industry margins today are squeezed due to low steel prices and high costs for labor, debt, energy, and raw materials. Gross margins were at an average of 10.7 percent in 2013 for global steel producers, while net profit margins were at an average of 1.2 percent. Several U.S. producers including United States Steel are operating in the red when considering net margins.

Steel, which is an alloy of iron and carbon, is produced via two major processes: the electric arc furnace (EAF) and the basic oxygen furnace (BOF). The BOF route utilizes primarily iron ore and recycled steel as raw materials, while EAF uses only recycled steel. The BOF and EAF processes comprise approximately 70 percent and 29 percent of global production, respectively. However, in the U.S., the BOF process accounts for only around 39 percent of production, whereas the EAF process accounts for 61 percent. The remaining one percent of global production is generated through a method called Open Hearth Furnace (OHF). This method is in decline as it is energy-intensive and economically challenging.

In the past few years, mini-mill production of steel using the EAF method has provided higher pre-tax profit margins compared to integrated mills using blast oven furnaces. EAF
production involves lower capital and maintenance expenditures and labor costs compared to blast oven furnaces. Furthermore, steel scrap costs are more variable compared to the high fixed costs of iron ore and metallurgical coal used in the BOF process. In the U.S., rising iron ore and coking coal prices are leading to a shift from the BOF method to the EAF method. However, there is currently not enough recycled steel to meet overall steel demand, even though steel is the most recycled industrial material in the world, with over 500 million metric tons reprocessed per year. Thus, raw iron ore is still the dominant source of new steel globally.

LEGISLATIVE AND REGULATORY TRENDS IN THE IRON & STEEL PRODUCERS INDUSTRY

Iron & steel producers operate under a range of federal, state, and local regulations related to environmental performance and worker health and safety. Environmental laws and regulations are evolving and becoming more stringent globally in the context of increasing resource constraints, greater urbanization, global challenges like climate change, and greater public awareness. The following section provides a brief summary of key regulations and legislative efforts related to this industry.

Major legislation in the U.S. with the potential to impact company value in the Iron & Steel Producers industry includes the Clean Water Act (CWA), Clean Air Act (CAA), the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The industry is also subject to regulations by the Occupational Safety and Health Administration (OSHA). Furthermore, EAF facilities, integrated iron and steel production, and iron and steel foundries are all covered by the National Emission Standards for Hazardous Air Pollutants (NESHAP).

The RCRA governs solid and hazardous waste treatment, storage, and disposal, while CERCLA provisions can hold companies responsible for remediation of hazardous substances. However, the EPA considers most mining wastes “special wastes” under Subtitle C of the RCRA, which exempts them from federal hazardous waste regulation. This includes slags and sludges from blast furnaces in the Iron & Steel Producers industry. Nevertheless, dust from EAF production and spent pickle liquor generated by steel finishing operations are currently classified as hazardous under Subtitle C.

Furthermore, the U.S. Environmental Protection Agency (EPA) requires reporting of GHG emissions from large emissions sources in the U.S. under its Greenhouse Gas Reporting Program (GHGRP). The GHGRP includes reporting by 41 source categories, including iron and steel production.

In some regions of the world, existing regulations to reduce GHG emissions are becoming more stringent. The European Union (E.U.)’s Emission Trading System (ETS) is a GHG emissions cap-and-trade system designed to gradually reduce total GHG emissions in the 28 E.U.

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1 This section does not purport to contain a comprehensive review of all regulations related to this industry, but is intended to highlight some ways in which regulatory trends are impacting the industry.
member states. The target is to reduce emissions by 21 percent from 2005 levels by 2020. The ETS today covers approximately 45 percent of total E.U. GHG emissions. In 2009, emissions allowances began to be auctioned instead of allocated for free, in order to encourage carbon price stability. In 2013, 40 percent of allowances will be auctioned. Over time, it is predicted that prices for allowances will increase, further compelling companies to reduce emissions. The scope of the ETS includes iron and steel plants and factories, as well as power and heat generation, combustion plants, oil refineries, and coke ovens. International offset credits are still available under the E.U. ETS, but they cannot account for more than 50 percent of GHG reduction efforts from 2008 to 2020.

In developed countries with strong environmental laws, regulatory compliance can be expensive and violations can lead to regulatory penalties or remediation liabilities. Emerging rules also have the potential to delay or halt production. Therefore, companies in the Iron & Steel Producers industry in these countries invest in technologies and processes to reduce their environmental and worker safety impacts.

Incidentally, a significant competitive advantage for steelmakers in emerging markets has been generally less strict environmental standards. However, as environmental and social impacts become apparent and public concerns increase in such countries, industries are likely to face higher compliance costs and stricter enforcement of regulations. For example, in China, public outcry over air pollution led the government to reopen the amendment process in 2013 for its national Air Pollution Prevention and Control Law, which had not been amended since 2000. The government is also focusing on the steel industry for emergency measures, and ordering the shutdown of plants or suspension of operations to control pollution.

China also introduced GHG emissions trading pilot programs in several regions in 2013 and 2014, affecting iron and steel producers. With iron and steel production accounting for a significant share of the country’s total GHG emissions, a wider scope of GHG regulations in the country could affect profitability of iron and steel producers significantly.

SUSTAINABILITY-RELATED RISKS & OPPORTUNITIES

Industry drivers and recent regulations suggest that while traditional value drivers will continue to impact financial performance, intangible assets such as environmental and social capitals, company leadership and governance, and the company’s ability to innovate to address environmental and social issues are likely to contribute increasingly to financial and business value.

Broad industry trends and characteristics are driving the importance of sustainability performance in the Iron & Steel Producers industry:
• **Resource-intensity and use of common capitals:** Iron and steel companies use large amounts of natural capital inputs such as energy, water, iron ore, and coal feedstock in the production process. Resource efficiency can help avoid higher costs or unstable supply of these inputs due to environmental pressures such as climate change and water scarcity. Furthermore, human capital continues to be important for the industry. A strong safety culture can help mitigate and manage the workplace dangers characteristic of heavy industry manufacturing, which can affect worker health and safety.

• **Negative externalities:** The iron and steel production process has the potential to create negative environmental externalities such as GHG emissions and air pollution, which can harm human health and the ecology. Increasingly stringent environmental regulations have the potential to increase operating costs and affect the profitability of companies seen as contributing to these externalities.

• **Continuous innovation:** The Iron & Steel Producers industry has been characterized by innovation, leading to increased recycling, collection, and sale of valuable by-products to other industries. Continued environmental and social pressures on profitability require companies to drive environmental efficiencies further, through innovative technologies and processes.

As described above, the regulatory and legislative environment surrounding the Iron & Steel Producers industry emphasizes the importance of sustainability management and performance. Specifically, recent trends suggest a regulatory emphasis on environmental protection, which will serve to align the interests of society with those of investors.

The following section provides a brief description of each sustainability issue that is likely to have material implications for companies in the Iron & Steel Producers industry. This includes an explanation of how the issue could impact valuation and evidence of actual financial impact. Further information on the nature of the value impact, based on SASB’s research and analysis, is provided in Appendix II A and II B. Appendix II A also provides a summary of the evidence of investor interest in the issues. This is based on a systematic analysis of companies’ 10-K and 20-F filings, shareholder resolutions, and other public documents, as well as the results of consultation with experts participating in an industry working group convened by SASB.

A summary of the recommended disclosure framework and accounting metrics appears in Appendix III. The complete SASB standards for the industry, including technical protocols, can be downloaded from www.sasb.org.

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**ENVIRONMENT**

The environmental dimension of sustainability includes corporate impacts on the environment. This could be through the use of non-renewable natural resources as inputs to the factors of production (e.g., water, minerals, ecosystems, and biodiversity) or environmental externalities and harmful releases in the environment, such as air and water pollution, waste disposal, and GHG emissions.
Of primary concern to iron & steel producers are the environmental impacts of raw material inputs such as coking coal, energy, and water, due to regulatory and operational risks and cost considerations. While technological improvements have reduced the environmental impact of each ton of steel produced, overall industry output is growing rapidly, and steel production remains resource-intensive relative to many other industries.

Greenhouse Gas Emissions

GHG emissions are a source of regulatory risk for companies, which arises from current and potential future regulations in the U.S. and abroad. While technological improvements have reduced the GHG emissions per ton produced, overall steel output is growing, fueled by demand from emerging economies. Furthermore, steel production remains a carbon-intensive process relative to other industries. Companies focused on mitigating GHG emissions from operations under their control likely will be better able to manage regulatory risks over the long-term.

Iron and steel production is energy-intensive and generates significant direct GHG emissions, primarily of carbon dioxide (CO₂) and methane. Integrated mills produce steel from ore using blast furnaces, which consume carbon primarily in the form of coke or natural gas. This converts iron ore into molten iron, commonly known as “pig iron.” Pig iron is then refined into steel using a basic oxygen furnace. As mentioned earlier, companies in the industry also use EAFs to melt recycled ferrous scrap and produce new steel. In general, CO₂ emissions are generated in these production processes through the reduction and consumption of various carbon-containing inputs, such as ore, scrap, flux, and coke byproducts. CO₂ accounts for a majority of industry emissions. There are also releases of fugitive methane emissions along some of these processes.

Companies that cost-effectively reduce GHG emissions from their operations by implementing industry-leading technologies and processes can create operational efficiency. They can mitigate the effect of increased fuel costs and regulations that limit — or put a put a price on — carbon emissions. A number of improved steelmaking techniques focused on lowering GHG emissions are under development. Existing and emerging methods for reducing GHG emissions include recycling CO₂ from the blast furnace fumes, using biomass fuel and carbon-lean electricity and fuels, and technologies and processes to reduce fuel consumption.

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Global Scope I emissions, percentage covered under a regulatory program; and
- Long- and short-term strategy to manage Scope 1 emissions.
Evidence

The Iron & Steel Producers industry has a significant GHG footprint compared to other industries. According to the International Energy Agency, the industry accounted for approximately 6.7 percent of total world CO₂ emissions in 2010.\(^3\)

In the U.S., iron and steel production and metallurgical coke production accounted for GHG emissions of around 54 million metric tons of CO₂ equivalent (CO₂-e) in 2012. To put this figure in context, this number represents the third highest source of emissions after fossil fuel combustion (which includes electricity generation, transportation, industrial, residential, and commercial) and non-energy use of fossil fuels. Moreover, this figure represents the highest among other industrial processes in the extractives sector including cement, lime, and petrochemical production.\(^3\)

While recent trends have seen overall carbon emissions fall sharply thanks to the restructuring of the industry, technological improvements, and increased scrap utilization (emissions declined 45.6 percent between 1990 and 2012\(^3\)), growing steel production and stricter regulations are important considerations for the industry’s business model moving forward.

The relative magnitude of emissions from the industry puts it under the scope of existing GHG regulations at the state, national, and regional levels and exposes it to higher operating and capital expenditures. GHG regulations at present vary based on region, creating operational risks for iron and steel producers. Furthermore, there is a high degree of uncertainty about the nature of future regulations, which, if implemented, are likely to be more stringent.

In the U.S., the EPA has published rules that regulate GHG emissions for certain facilities. Since 2011, new projects that increase GHG emissions by more than 75,000 tons per year face new requirements under the Clean Air Act’s Prevention of Significant Deterioration rules, which include permitting and evaluation policies based on Best Available Control Technologies. In Canada, the federal and Ontario governments have committed to reduce GHG emissions levels and are currently seeking input from different stakeholders to develop and implement carbon emission reduction programs.

In SEC filings, some companies in the industry have identified the uncertainty stemming from these specific regulations as a material concern. United States Steel, for example, mentions in its fiscal year (FY) 2013 Form 10-K, “if federal or provincial GHG reduction legislation for the steel sector becomes law in Canada, it could have economic and operational consequences” for the company. In Europe, starting in 2013, the ETS began using centralized emissions allowance allocation plans – rather than national allocation plans – that are more stringent than previous requirements.\(^3\) Pilot GHG emissions trading programs in China cover iron and steel facilities, creating risks from both current and future, potentially national, GHG regulations.\(^3\)

A study on the impact of climate change on institutional investment portfolios identifies the primary metals industry as highly sensitive to climate change regulations due to “the fact that these sectors face a direct cost due to their own greenhouse gas emissions, and an indirect cost due to their high energy consumption.”\(^3\)

Companies are implementing innovative technologies to lower their GHG emissions. Many
of these have payback periods of less than three years. The Ultra-low CO\textsubscript{2} Steelmaking (ULCOS) process is the product of a consortium of 48 European companies and organizations that are cooperating to reduce steelmaking CO\textsubscript{2} emissions by at least 50 percent. One of the primary technologies of the ULCOS process is carbon capture and storage using top gas recycling of blast furnace gas. This involves recycling of carbon monoxide (CO) and hydrogen (H\textsubscript{2}) from the gas leaving the blast furnace top. The re-use of reducing agents CO and H\textsubscript{2} after removing CO\textsubscript{2} from the top gas lowers the usage of coke, leading to reduced energy requirements and lower GHG emissions.

The Direct Reduce Iron (DRI) EAF integrated steel-making process is another innovative method that requires less energy and produces lower emissions than the traditional BOF process. A 2008 Department Of Energy (DoE) report highlights significant emission reductions from the method, around 41 percent for CO\textsubscript{2}, compared to traditional steelmaking. In 2009, in a joint venture with Nippon Steel (Japan), POSCO installed a Rotary Hearth Furnace (RHF) that recycles dust and sludge by-products to manufacture direct reduced iron. The project was expected to reduce GHG emissions from coke consumption by 599,830 metric tons of CO\textsubscript{2}-e over a ten-year period, and produce 140,000 tons of reduced iron per year.

**Value Impact**

Managing GHG emissions can provide operational efficiency and affect the cost structure of companies in the industry, with a direct, ongoing impact on value. GHG emission caps or other regulatory restrictions on emissions could pose a long-term threat to the industry, as companies could be forced to curb production, lowering revenues, or face significant operating expenses if caps are exceeded. Companies could also face fines if GHG emissions rules are violated, affecting one-time costs. Mandated emissions reductions will likely require capital expenditures and impact cash flows and liquidity, potentially in unanticipated ways. Given the relative magnitude of emissions from the industry and uncertainty around GHG regulations, companies could face a higher risk profile and therefore cost of capital.

While regulatory development in this area is an inherently slow and politically-charged process whose outcome is nearly impossible to predict, the probability and magnitude of the impact of GHG emissions on the industry are likely to increase in the near- to medium-term, given the trend towards greater regulation of GHGs.

**Air Quality**

Air pollutants released during iron- and steel-making operations have historically been an environmental concern in the context of the localized public health impacts that the industry can have on densely populated areas. Across North America, Western Europe and Japan, technological innovation and continuous improvements in steel-making processes have significantly reduced the emissions of air pollutants from the Iron & Steel Producers industry. However, air pollutants remain
a material sustainability concern for iron and steel producers due to heightened regulatory and public concern about air pollution globally, as well as expansion of steel production in emerging markets. In particular, iron and steel production in countries such as China and India is affected by new regulatory efforts aimed at curbing alarming levels of air pollution.

Emissions from the industry can vary depending on the process employed, engineering and construction of the plant, raw material and energy inputs, and effectiveness of pollution control equipment. Iron and steel production typically generates criteria air pollutants (CAPs), Volatile Organic Compounds (VOCs), and emissions of chemicals reported to the EPA’s Toxics Releases Inventory (TRI). Furthermore, emissions of Hazardous Air Pollutants (HAPs) occur through blast furnaces, co-located coke ovens, and EAFs. In particular, the production process releases sulfur oxides, nitrogen dioxide, lead, and carbon monoxide, as well as particles such as soot and dust. These particles are known to carry iron oxides that are detrimental to human health. Zinc, ammonia, manganese, and hydrochloric acid are emitted to air in relatively significant quantities, according to U.S. data from 2005. In the past, mercury switches from vehicles that were at the end of life and used as scrap metal in the EAF process led to significant mercury emissions. However, several industries have worked together to promote recovery of mercury switches.44,45

Companies face regulatory compliance costs, and higher operating and capital expenditures for technological and process improvements to keep emissions under control. Active management of facility emissions through implementation of industry best practices across global operations can facilitate the transition to sustainable steel production, lowering costs and potentially enhancing operational efficiency.

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Air emissions from industry-specific pollutants.

**Evidence**

Despite technological improvements, the industry is still a significant source of certain harmful air pollutants, and thus it faces substantial regulatory risks. For example, 2008 data for the U.S. shows that industrial processes for ferrous metals were responsible for around 42 percent of carbon monoxide emissions from all industrial process sources, around 41 percent of lead emissions, and 29 percent of mercury releases.46 There is wide variation among companies in the extent of emissions, suggesting potential for improvement. For example, 2009 reported data for iron and steel producers shows the emissions intensity of sulfur oxides ranging from 3.3 metric tons per million dollars in sales for ArcelorMittal to 0.43 metric tons per million dollars for Nucor.47

In the U.S., air emissions are regulated by the
EPA under the Clean Air Act. In the E.U., the European Commission has developed an extensive body of legislation that regulates air pollutants and establishes air quality standards for industrial processes. Regulators in the U.S. and Europe are actively augmenting and updating air pollution regulations. For example, under the EPA’s new Maximum Achievable Control Technology (MACT) standards, several aspects of steel production are covered, including coke making, iron ore processing, iron making, and steelmaking. Specific MACT standards for boilers were reissued in December 2012 and will impose new limitations on coke oven gas and emissions from boilers and process heaters. The standards were finalized in 2013, and compliance is required within three years of the final published rule. Furthermore, in 1997, the EPA established 24-hour and annual standards for fine particulate emissions less than 2.5 micrometers in size (PM$_{2.5}$). In 2006, the EPA tightened the 24-hour standard, and recently, in December 2012, the annual standard was made more stringent, tightening from 15 micrograms per cubic meter of air to 12 micrograms per cubic meter.

New and increasingly stringent regulations can affect operating and capital expenditures for companies in the industry. Air pollution control technologies have previously accounted for around 10 to 20 percent of total plant investments. United States Steel discussed potential costs related to increased European regulation in its FY 2012 Form 10-K. According to the company, the E.U.’s Industry Emissions Directive will require an overhaul of best available techniques in order to comply with emissions standards and environmental regulations. Iron and steel facilities must be in compliance with new standards for air emissions, water and solid waste disposal, and energy use by March 8, 2016. United States Steel estimated that it will need to spend approximately $400 million in capital expenditures over the following three years in order to bring its facilities up to code. This amount did not include higher maintenance costs of the new equipment.

Furthermore, public anger and concern in China about high levels of air pollution from heavy industries, including iron and steel, have driven authorities to introduce both emergency and long-term measures to curb emissions. Efforts have focused on steel plants in the country. In 2013, a National Action Plan introduced targets of $275 billion in spending on anti-pollution measures over the five years ending in 2017, including efforts to bring PM$_{2.5}$ levels down by 25 percent in the region around Beijing. New limits on air pollutants from iron and steel production, such as sulfur dioxides, nitrogen oxides and particulate matter, were introduced in 2012, replacing standards from the 1990s.

In March 2014, emergency measures were imposed on several regional steelmakers in Tangshan, with the government ordering them to suspend at least 30 percent of production. Given the overcapacity in China’s steel production, the measures were unlikely to impact companies significantly in terms of lost production. However, new emissions regulations are expected to increase the cost of implementing...
control technologies and processes, pressur- ing already thin margins further. Most steel plants in the country were expected to require additional operating costs of more than RMB 50 to RMB 60 per ton ($8.3 to $10 per ton) to achieve emissions levels comparable to plants in Japan or South Korea.55

Value Impact
Managing air emissions can provide opera- tional efficiency and affect the cost structure of companies in the industry with a direct, ongo- ing impact on value.

Air pollution may result in regulatory penalties, higher regulatory compliance costs, or new capital expenditures to upgrade equipment. While the timeline for regulatory compliance is partly designed to allow companies to reallocate resources to cover the costs, companies are nonetheless likely to face higher ongoing operating and compliance costs, with one-off impacts on cash flows and liability as a result of fines and litigation. Active management of the issue—through technological and process improvements—could allow companies to limit the impact of regulations and benefit from operational efficiencies that could lead to a lower cost structure over time.

Public concern and regulatory action to improve air quality is increasing globally; as a result, the probability and magnitude of the impact of air emissions management on financial results is likely to increase in the near term.

Energy Management
Despite gains in energy efficiency in recent years, the production of steel requires signifi- cant quantities of energy, sourced primarily from the direct combustion of fossil fuels and the electrical grid. This energy-intense production has implications for climate change, due to Scope 1 GHG emissions from direct fossil fuel use. The regulatory implications of this were discussed earlier under the topic of “GHG Emissions.” However, in addition to the industry’s direct GHG emissions, electricity purchases from the grid create environmental concerns such as indirect impacts on the climate through Scope 2 emissions. Purchased electricity consumption, although unlikely to create direct regulatory risks for companies from Scope 2 GHG emissions, could have a material impact on company value through its impact on cost of production.

The choice between different production processes – EAF and integrated BOF – can influence whether a company uses more fossil fuels directly or purchases relatively more elec- tricity. Based on 1998 MECS data, integrated steel-making accounted for about 75 and 36 percent of the industry’s fuel and electricity consumption respectively, while these ratios were approximately 25 and 64 percent respectively for EAF steel-making.56,57

The choice between the two production pro- cesses, and between coal versus natural gas or on-site versus grid-sourced electricity, can play an important role in influencing both the costs
and reliability of energy supply. There is also a potential trade-off between lowering Scope 1 GHG emissions by increasing grid-purchased electricity versus producing electricity on-site to save on purchased electricity costs and ensure reliability of supply. Affordable, easily accessible, and reliable energy is essential for competitive advantage in this industry.

Long-term prospects of increased energy demand from emerging markets, and energy security, geopolitical, and climate change concerns, indicate upward pressure on the price and limited availability of conventional sources of energy. Regulatory actions are placing greater emphasis on resource conservation, and innovations in energy efficiency and alternative energy are providing new avenues for energy management. The way in which an iron and steel company manages its overall energy efficiency, its reliance on different types of energy and associated sustainability risks, and its ability to access alternative sources of energy, could therefore be material.

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Total purchased electricity consumption, percentage from renewable sources; and
- Total fuel consumption, percentage from fossil fuels and renewable sources.

**Evidence**

Energy costs can account for a substantial 20 percent of the total steel manufacturing cost. Therefore energy efficiency is critical for cost savings and improved profitability. By some estimates, modern technological improvements to the steel-making process could improve energy efficiency by 20 percent. Through energy recycling, electronic monitoring and automation, pressure recovery, and heat conversion, the industry can significantly reduce its environmental impacts and related costs. According to the Lawrence Berkeley National Laboratory, improved efficiency can provide benefits beyond cost savings, including higher product quality, decreased exposure to energy price variability, and reduced regulation-related costs and exposure.

Energy sources for the industry are primarily fossil fuel based. Coke and breeze represent 36 percent of primary fuel inputs (separate from the use of coke as a raw material in the production process). Natural gas satisfies an additional 27 percent of the energy needs for the industry, with other sources of energy, such as byproduct fuels (coke oven gas and blast furnace gas) accounting for a substantial 21 percent of total energy supply. In the past, higher natural gas prices have motivated the industry to seek to lower energy intensity.

Net electricity contributes 13 percent to the industry's fuel supply. A 2010 Manufacturing Energy Consumption survey for the U.S. estimates the total electricity consumed by iron and steel mills at 50.7 billion kilowatt hours (KWh). Purchased electricity can account for a significant proportion of the industry's cost structure. According to the 2011 Annual Survey of Manufacturers released in December...
2013, for the iron and steel mills and ferroalloy manufacturing industry in the U.S., the total cost of purchased electricity was over $3.2 billion, or almost 4 percent of the total cost of materials for the industry. On the other hand, the total cost of purchased fuels was approximately $3 billion and accounted for about 3.6 percent of the total cost of materials.\(^1\)

At a company-level, energy efficiency and alternative energy projects can garner impressive financial returns. The examples below outline different ways in which companies are managing their energy consumption and the impact on their operations. At ArcelorMittal’s East Chicago, Indiana steel mill, a company called Primary Energy was hired in 1996 to build on-site energy capture systems to harness waste energy from the plant. The mill has since cut its coal-fired electricity purchases in half, saving over $100 million.\(^4\)

In 2013, ArcelorMittal achieved $264 million in savings from energy gains.\(^5\) In partnership with the U.S. DoE, the company is developing a number of initiatives aimed to reduce the energy intensity of 17 U.S. plants by 10 percent, through an energy efficiency-training program. At its European sites, through the Energise initiative, the company expects to reduce the energy use per ton of steel by nine percent by 2016, which would lower the cost of energy by 10 percent over the same period. By the end of 2013, the company had already saved more than €100 million since 2011 by reducing energy use per ton of steel by 3.4 percent. Overall in 2013, ArcelorMittal’s capital expenditures on energy-related projects totaled $23 million, $8 million of which were spent on energy upgrades at its Dofasco site in Hamilton, Canada. This project is expected to save the company five percent in energy costs per year.\(^6\)

During an earnings call for the third quarter 2013 financial results of Mechel, a Russia-based steel and ferroalloy producer, management stated that the company was able to achieve a 14 percent reduction in the cash cost of ferrosilicon production. They did it largely through the reduction of stock with higher production cost as well as the reduction of electricity and heating expenses.\(^7\) Evraz Highveld Steel and Vanadium Ltd., a South African iron and steel producer, initiated several energy-savings initiatives in 2013. For example, a project aimed at replacing fixed-speed equipment with variable speed drives to balance energy use with output requirements, is expected to save R1.4 million, an equivalent of 1.98 megawatt energy use reduction.\(^8\)

**Value Impact**

Energy management could have ongoing impacts on company value and operating costs through continuing reductions in energy use, or growth in energy consumption due to overall increases in steel production. There could be one-time effects on cash flows through capital expenditures for energy-related projects.

In the face of rising costs of electricity, iron and steel companies that develop more energy-efficient methods of production can benefit from significant cost reductions and gain a competitive advantage. Through energy efficiency and alternative energy, companies could reduce operational risks arising from fluctuations in fossil fuel prices. Another factor affecting operational risks is the reliability of energy supply, which can be influenced by decisions about on-site versus purchased electricity and diversification of energy sources. This could ultimately impact
the company’s risk profile and cost of capital. As a result of rising energy costs and steel production, the probability and magnitude of the impact of energy management on financial results is likely to increase in the near term.

**Water management**

Water usage at steel plants is closely correlated with steel production. Despite reductions in water intake by the industry over the past several years, the substantial water requirements of steel production could present a material risk to the industry, especially in regions of water scarcity, due to potential water availability constraints and price volatility.

While water has typically been a freely available and abundant commodity in many parts of the world, it is becoming a scarce resource, due to increasing consumption from population growth and rapid urbanization, and potentially reduced supplies due to climate change. Furthermore, pollution can render water supplies expensive to treat or unusable. Based on recent trends, it is estimated that by 2025, important river basins in the U.S., Mexico, Western Europe, China, India, and Africa will face severe water problems as demand overtakes renewable supplies. Many important river basins can already be considered “stressed.” Water scarcity can result in higher supply costs and social tensions, for many companies across different sectors.

In iron and steel manufacturing, 81 percent of the total water intake is used for once-through cooling; water is also used in descaling and dust scrubbing. The industry uses saltwater and brackish water, as well as fresh water from municipal sources and adjacent water bodies. Water loss occurs due to evaporation, although the amounts of water intake and discharge are not far apart. The World Steel Association reports that with advanced technologies, up to 98 percent of water can be recycled and reused.

However, the great volumes required make water access a key issue. Companies that are unable to secure a stable water supply could face production disruptions, while rising water prices could directly increase production costs. Consequently, the adoption of technologies and processes that continue to reduce water consumption could lower operating risks and costs for companies and create a competitive advantage. This could minimize the impact of regulations, water supply shortages, and community-related disruptions on company operations.

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Freshwater withdrawals, percentage recycled, percentage in water-stressed regions.

**Evidence**

Steel manufacturing continues to be water-intensive relative to other industries, despite
significant reductions in water use. Steel manufacturing is ranked 16th out of 130 GICS sub-industries by water intensity. Due to evaporation losses, 13,000 to 23,000 gallons of additional water per ton of product are required through all production stages. EAF is a less water-intensive steel-making process than BOF; as the share of EAF in total production has grown substantially over the years, water withdrawals by the industry in the U.S. have declined, reducing by more than 50 percent by the year 2008 from their peak in 1973.

Depending on geographical access to water and local regulations, the use of water by steel mills may vary significantly. According to a global survey of steel mills, water intake ranges from 1 to 148 cubic meters (m³) per metric ton of crude steel, and water discharge ranges from under 1 to 145 m³ per metric ton. Therefore, due to water availability and cost considerations, seawater is the preferred source of water intake where feasible.

In areas with limited access to fresh- and seawater, rising costs of fresh water and conflicts with the local population may lead to water shortages for industrial use. In India, about $80 billion in investments by companies including POSCO and ArcelorMittal have been hindered due to disputes with local farmers over irrigated land. Tata Steel Ltd. has set annual goals at its Indian operations to reduce water consumption, as the country faces critical water shortages. The actions are entirely voluntary and show the degree to which the company is concerned about managing its water consumption in the face of limited supply.

In its Corporate Responsibility report, ArcelorMittal states that eight of its sites operate in basins of water scarcity and 12 in basins under water stress. Water costs and availability are pressing issues for the company. In 2013, the company’s research and development (R&D) teams initiated 17 projects aimed at improving the efficiency of raw materials use, which included 2 related to water use. Through changes in production processes and the modernization of the effluents treatment area at its steel plant in Villa Constitucion in Argentina, the company was able to reduce water consumption at the plant by 98 percent. In 2013, the net water used (the difference between the amounts withdrawn and discharged, usually lost to evaporation during the steel-making process) by the company was 4.2 m³ per metric ton, which is 22 percent lower than in 2010.

POSCO states in its 2013 water report for CDP that treated sewage is cheaper than obtaining dam water. In 2011, POSCO started reusing about 50,000 tons of wastewater sewage from its disposal plant for industrial use, which is estimated to create cost savings of 3.6 billion won annually for the company.

Signifying the value of water management, some companies recognize water rights on their balance sheets. In its FY 2013 Form 10-K, United States Steel discusses its acquired water rights as intangible assets with indefinite lives, and states that it regularly reviews such assets for impairment. (The company indicates that for 2013 there was no indication of impairment based on a qualitative assessment).

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Value Impact

Managing water consumption and discharge can influence operational risks faced by companies, with potentially acute impacts on value from disruptions to production. Water management can also affect ongoing operating costs and impact cash flows through one-off capital expenditures.

Water access is a long-term material concern to companies in the steel industry, given its key role in the manufacturing process. Water shortages are a problem in many regions of the world and are expected to become a critical issue in developing nations such as India. Higher water prices or lack of availability directly affect operating costs of iron and steel companies. Limits on industrial water consumption could force producers to curb or cease production, with impact on market share and revenue growth.

Water intensity, particularly in regions with water scarcity, can lead to social and political unrest, with impact on reputation and a company’s license to operate, increasing its risk profile and ultimately its cost of capital.

Water costs are gradually expected to rise across the globe as human consumption rises with higher standards of living, existing sources become unfit for use due to pollution, and climate change causes variations in precipitation patterns. Therefore, the probability and magnitude of the impact of water management on financial results in this industry is likely to increase in the near term.

Waste Management

While waste reclamation rates in steel production are high, the industry generates significant quantities of hazardous wastes, and around half of the industry’s hazardous waste stream is managed through disposal. Process wastes such as EAF dust, which is regulated as a hazardous material in the U.S. due to its heavy metal content, can have significant environmental and human health impacts, present a regulatory risk, and raise operating costs for companies. Steel companies that reduce waste streams, hazardous waste streams in particular, and recycle or sell non-hazardous by-products, could lower regulatory risks and costs while increasing revenues.

Solid and hazardous wastes generated from iron and steel production are regulated under the RCRA, and are of three main types – slag, dusts, and sludges. Slag accounts for 90 percent of the by-products generated, and can be sold to other industries, for example, for use in construction materials. It can also be recycled during the steel-making process. Some companies have co-product utilization and recycling rates as high as 99 percent. However, according to the World Steel Association, there remains significant potential to increase the recovery and use of slag in many countries, given the economic and environmental benefits. Dusts and sludges consisting of iron content are collected from pollution control equipment and can also be recycled internally or sold to other industries.
In addition to these types of wastes, primary feedstock for shredders operated by scrap metal recycling facilities may include unrecyclable material known as shredder fluff. Some companies remove hazardous contaminants from the feed material prior to shredding to avoid the waste being classified under hazardous waste laws.\(^8^2\)

The slag by-product provides an avenue for revenue-generation or operational efficiency for the industry, while the handling of hazardous wastes, primarily EAF dust, poses regulatory risks. Reduction in such hazardous wastes, which require special handling, recycling, or disposal,\(^8^3\) can contribute to operational efficiencies and cost decreases.

Furthermore, in the U.S., the EPA's RCRA Corrective Action is a mandatory remediation program related to past waste disposal sites. Many states have similar programs.\(^8^4\) As environmental regulations were implemented in the U.S. and evolved over time, some waste disposal activities that were allowed under the law previously began to be understood as creating a contamination threat. Such threats are periodically discovered, including contaminated off-site disposal properties, and iron and steel producers may be held responsible for remediation of such legacy sites.\(^8^5\)

As environmental concerns grow in emerging markets, similar legacy issues may materialize in these countries with more stringent regulations and enforcement actions. Iron and steel companies therefore need to adopt industry best practices in waste management in both developed country and emerging market operations.

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Amount of waste from operations, percentage hazardous, and percentage recycled.

**Evidence**

While hazardous waste is not a primary by-product from the industry, it can pose regulatory risks due to the relative volumes of such waste compared to other industries. Based on 2011 data on hazardous solid wastes regulated under the RCRA, the EPA found that iron and steel mills and ferroalloy manufacturing activities ranked fifth for the 50 largest quantities of hazardous waste generated in the U.S. (around 1.4 million tons).\(^8^6\) According to the EPA, EAF dust accounted for 55 percent of the industry's RCRA-reported hazardous waste generation in 2005. Of the EAF dust generated annually in the U.S., large quantities are shipped long distances or exported for recycling.\(^8^7\) In fact, several steel-making facilities were among the 50 largest RCRA hazardous waste shippers in the U.S. in 2011.\(^8^8\)

Furthermore, the primary metals\(^V\) industry ranked first among all U.S. industries in 2012 for total quantities of toxic chemicals in waste transferred off-site for disposal or release.\(^V\)

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\(^8^2\) North American Industry Classification System (NAICS) code 331.

\(^V\) Transferred to Class I underground injection wells, RCRA Subtitle C landfills, and other landfills.
Several steel facilities were among the top 25 facilities within the primary metals industry for such disposal or releases. These figures indicate that hazardous waste management is a relatively high-priority issue for this industry.

This is also reflected in the industry’s pollution abatement expenditures. According to the Pollution Abatement Costs and Expenditures Survey published by the EPA in 2005, the total operating costs of pollution abatement for iron and steel mills and ferroalloy manufacturing were $1.2 billion, or around six percent of the total for all manufacturing industries. 55 percent of the operating costs went to treatment, 13 percent to prevention, 10 percent to recycling, and 22 percent to disposal. Operating expenses related to solid waste pollution abatement were $336 million, or 28 percent of the total pollution abatement operating costs for the industry.

Furthermore, legacy waste management can be a substantial burden for the industry. Some companies acknowledge related benefits from recycling waste. Nucor states in its Form 10-K for FY 2013 that by recycling EAF dust, “Nucor is not only acting in a sustainable, responsible manner but is also substantially limiting its potential for future liability under both CERCLA and RCRA.”

In June 2012, ArcelorMittal reached an agreement with the Indiana Department of Environmental Affairs to clean up a solid waste site near its Burns Harbor, Indiana mill. Some 870,000 tons of blast furnace waste and 1.8 million tons of sludge had been dumped in a mound on the shore of Lake Michigan. Concern over contamination of the lake by arsenic, lead, benzene, and chromium was the primary motivation for pressing ArcelorMittal to address the site.

Most of the leading iron and steel companies discuss the RCRA and its implications for financial results in their Form 10-K filings for FY 2013. United States Steel discloses that it agreed to close three hazardous waste disposal sites at a plant in Indiana; the company had an accrued liability of approximately $16 million for the estimated costs to close these sites.

Allegheny Technologies reports in its Form 10-K for FY 2013 that in 2013, the EPA filed a civil action and a consent decree against the company, including a civil penalty of $825,000, in relation to notices of violation sent to subsidiaries of the company in 2008 and 2010. These notices alleged violations of rules governing the management of hazardous wastes.

Iron and steel companies are also being affected by changing regulations in other countries. For example, United States Steel discloses in its Form 10-K for 2013 that legislation being considered in Slovakia is expected to increase existing fees for the company to use its landfill.

**Value Impact**

Waste management can create operational efficiencies for companies, with a potential to lower costs on an ongoing basis. Companies also have the opportunity to improve profitabili-
ity by cost-effectively separating and recycling, or selling by-products. Significant quantities of hazardous waste disposal could affect companies through one-time regulatory fines or ongoing operating expenditures related to waste handling.

Furthermore, legacy remediation from past waste disposal activities is, and will continue to be, a costly issue for iron and steel producers, creating litigation costs and contingent liabilities. Environmental regulations in developing countries are likely to become more stringent, further pressuring the industry and increasing regulatory compliance costs and operational costs. For U.S. and European-based producers, however, this may level the playing field somewhat in regard to regulatory compliance costs.

HUMAN CAPITAL

Human capital addresses the management of a company’s human resources (employees and individual contractors) as a key asset to delivering long-term value. It includes factors that affect the productivity of employees, such as employee engagement, diversity, incentives and compensation, as well as the attraction and retention of employees in highly competitive or constrained markets for specific talent, skills, or education. It also addresses the management of labor relations in industries that rely on economies of scale and compete on the price of products and services. Lastly, it includes the management of the health and safety of employees and the ability to create a safety culture for companies that operate in dangerous working environments.

Worker health and safety is an important consideration for steel producers due to inherent dangers in manufacturing and the pressure on lowering production costs.

Workforce Health, Safety, and Well-being

The Iron & Steel Producers industry is typically seen as a large source of employment in a region or economy, and globally employs millions of employees and contractors. Industrial processes used in iron and steel production can present significant risks to employees and contractors working at steel plants. Given the high temperatures and heavy machinery involved, worker injuries and fatalities are a matter of great concern to iron and steel producers.

The most severe injuries in steel operations are likely to occur during normal operations and as a result of accidents involving the use of industrial trucks and cranes. While accident rates in the steel industry are on a long-term decline, worker injury can lead to negative publicity, low worker morale, and increased healthcare and injury compensation costs. The OSHA usually levies fines against U.S. operators for non-compliance of worker health and safety standards and preventable accidents.
Companies in the industry recognize the importance to long-term value of maintaining high standards of health and safety despite pressures to reduce costs in order to protect profitability. Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Injury, fatality, and near-miss frequency rates for full-time and contract employees.

**Evidence**

Many steel producers track worker accident rates in order to minimize downtime and maximize worker safety. For example, the World Steel Association receives reports on the instances of lost time due to injury from 90 companies representing approximately 42 percent of global production. This data shows that the lost time injuries frequency rate (LTIFR) has decreased significantly from an average of 5 in 2006 to 1.4 in 2012.

Nevertheless, iron and steel production remains a dangerous occupation, and incidents can lead to fatalities. For 2011, U.S. Bureau of Labor Statistics data shows that the average fatal work injury rate per 100,000 iron and steel workers (for iron and steel mills and ferroalloy manufacturing only) was 11.33, while the rate for non-fatal occupational injuries and illnesses was 3.2 per 100 full time equivalent workers. The value for fatal work injuries is much higher than the U.S. average of 3.5 for all industries, and signifies the risky work environment in the industry, requiring a strong safety culture and health and safety policies.

Accidents at iron and steel facilities can create significant expenses for companies related to worker compensation. A July 2010 explosion at United States Steel's Clairton coke facility injured six United States Steel employees and five employees of a steam-fitting company that were repairing a furnace on-site. United States Steel paid $3 million in OSHA fines and personal injury compensation to its own employees and faces significantly more in claims from the contractor's employees.

Non-compliance with OSHA standards can create regulatory penalties for companies, as well as additional operating costs for achieving compliance. In 2014, OSHA proposed penalties of around $5.5 million for Republic Steel in relation to a safety inspection. The company was ordered to pay $2.4 million out of this amount and could be subject to additional charges if there is substantial failure to perform its obligations under the settlement reached with OSHA. Other regulatory penalties from OSHA for companies in the industry may be smaller, with an insignificant impact on value in the near-term. However, over the long-term, frequent smaller violations could have chronic impact on company value, by affecting both worker productivity and a company’s reputation.

In its Form 10-K for FY 2013, United States Steel highlights safety performance as being consistent with the company's strategic objectives to improve quality, cost-competitiveness, and customer service. The disclosure highlights improvements in its safety practices over a nine-year period, including reductions in recordable injuries, and improvements in the days away from work rate and severity.
rate of 45 percent, 66 percent, and 94 percent respectively.\textsuperscript{102} Similarly, in its filing for FY 2013, Allegheny Technologies discusses its focus on safety and provides information on its industry-leading recordable incident and lost time rates.\textsuperscript{103} Other leading companies in the industry also highlight the importance of employee health and safety, and the possibility of liabilities, in their 10-K filings.

**Value Impact**

In an industry with higher than average fatality rates, poor health and safety records can increase regulatory compliance costs from more stringent oversight. Poor health and safety records may also lead to chronic impacts on company value due to lower employee morale and productivity, and can impact a company’s reputation and brand value.

A company’s health and safety record can also affect its insurance premiums, and, therefore, operating costs.

Serious incidents with low probability of occurrence, but high potential magnitude of impacts can lead to acute, one-time costs and contingent liabilities from legal action or regulatory penalties.

**LEADERSHIP AND GOVERNANCE**

As applied to sustainability, governance involves the management of issues that are inherent to the business model or common practice in the industry, and that are in potential conflict with the interest of broader stakeholder groups (government, community, customers, and employees) and therefore create a potential liability, or worse, a limitation or removal of license to operate. This includes risk management, safety management, supply chain and resource management, conflict of interest, anti-competitive behavior, and corruption and bribery. It includes regulatory compliance, lobbying, and political contributions.

For the Iron and Steel Industry, managing the supply chain and sourcing of raw material inputs by considering related environmental and social impacts is important in order to reduce sourcing risks and disruptions to production.

**Supply Chain Management**

Iron ore and coal are critical raw material inputs to the steel production process. While some companies in the industry may own mining operations, iron and steel producers typically source their raw material inputs from mining companies and other suppliers.

Iron ore mining and coal production are resource-intensive processes. Extraction of these materials often has substantial environmental and social externalities affecting local communities, workers, and ecosystems. Furthermore, some countries depend on the mining of their natural resources for tax revenues and economic growth. As a result, mining companies are often subject to heavy regulation related to their environmental and social impacts, and sometimes face community opposition to the development or continued operation of mines.

Disruptions to mining operations due to community protests, legal or regulatory action,
or increased costs of extraction as a result of regulatory compliance costs or penalties, have the potential to affect iron and steel companies directly, if the disruption takes place at operations that are their main source of raw materials. Iron and steel companies could face disruptions to their own production as a result, or in some cases, may also be subject to regulatory penalties associated with the environmental or social impact of the mining company supplier. Such events could also raise raw material costs for iron and steel companies through their impacts on global commodity prices, if the disruption is prolonged or affects a large mining area or company.

In order to minimize such risks, iron and steel producers could ensure that their direct suppliers of critical raw materials are not engaged in illegal or otherwise environmentally or socially damaging practices, through appropriate supplier screening, monitoring, and engagement.

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

• Discussion of the process for managing materials sourcing risks due to environmental and social considerations.

Evidence

With the beginning of the Chinese economic boom in the early 2000s, the global demand for iron ore has increased dramatically. India is the world’s fourth largest supplier of iron ore. In 2010, it accounted for 230 million metric tons of global iron ore production; however, the number dropped to 144 million metric tons in 2012. Increased demand has given a rise to illegal mining in the iron ore-rich regions of India, leading not only to environmental damage, but also to substantial losses from tax revenues and environmental permits. For example, the Indian state of Goa has estimated its loss due to illegal mining at $6 billion.

Concerns about illegal mining and environmental impacts have resulted in public interest litigation and increased regulatory scrutiny of iron ore mining in India, with a direct impact on steel production. For example, in 2010, Odisha state, a major iron-ore producing region in India, shut down over 100 mines following a probe into illegal mining in the state. The mines had been operating without environmental clearances and without their leases being renewed. In May 2014, India’s Supreme Court imposed restrictions on the operations of 26 additional mines in the state. This latest action is expected to increase input costs for steel companies by 20 percent.
In early April 2014, Odisha state’s Directorate of Mines ordered the closure of Sarda Mines Pvt. Ltd-owned Thakurani mines, due to the expiration of its environmental clearance. The mines were also being investigated for other irregularities. The action led to a supply stoppage to Jindal Steel and Power Ltd., an Indian steel and energy company, which sources all the iron ore produced from the Thakurani mines. While the impact on Jindal in the short-term was not likely to be significant due to its iron ore inventory, the ongoing investigation and closure of the mines could affect production and have an impact on financial results, as the mines were a major source of iron ore for the company’s steel plant. A ban on iron ore mining in Karnataka in 2011 resulted in Indian iron and steel company JSW Steel operating at less than 30 percent capacity at one point.

Iron and steel producers may themselves face regulatory action and other repercussions due to the environmental practices of their suppliers. For example, in November 2011, the mining giant Vale ceased supplying iron ore to, and transporting the pig iron of, Brazilian iron and steel producer Sidem. Brazil’s environmental protection agency, Ibama, had found that some of the charcoal suppliers to Sidem were in violation of environmental regulations due to insufficient reforestation efforts. Ibama fined Sidem $70 million due to the destruction of 105 square miles of the Amazon rain forest over four years by the company’s charcoal supply chain.

Value Impact

Effective supply chain management can reduce operational risks for companies, such as production disruptions and volatility of raw materials costs. Frequent or one-off but significant supply disruptions of iron ore or coal could both affect market share and revenue, and lead to a higher risk premium and therefore, cost of capital.

As concerns around the environmental and social impacts of mining grow in both developed countries and emerging markets, supply chain management will become increasingly important in order for iron and steel producers to secure materials in a cost-effective and timely manner, with significant impact on profitability.
APPENDIX I: Five Representative Companies | Iron & Steel Companies

<table>
<thead>
<tr>
<th>COMPANY NAME (TICKER SYMBOL)</th>
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<tbody>
<tr>
<td>ArcelorMittal (MT)</td>
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<tr>
<td>POSCO-ADR (PKX)</td>
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<td>US Steel Corp (X)</td>
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<td>Gerdau SA-ADR (GGB)</td>
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<td>Nucor Corp (NUE)</td>
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VIII This list includes five companies representative of the Iron & Steel Producers industry and its activities. This includes only companies for which the Iron & Steel Producers industry is the primary industry, that are U.S.-listed but are not primarily traded Over-the-Counter, and where at least 20 percent of revenue is generated by activities in this industry, according to the latest information available on Bloomberg Professional Services. Retrieved on June 10, 2014.
## APPENDIX IIA:
Evidence for Sustainability Disclosure Topic

<table>
<thead>
<tr>
<th>Sustainability Disclosure Topics</th>
<th>EVIDENCE OF INTEREST</th>
<th>EVIDENCE OF FINANCIAL IMPACT</th>
<th>FORWARD-LOOKING IMPACT</th>
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<tr>
<td></td>
<td>HM (1-100)</td>
<td>IWGs % Priority</td>
<td>EI Revenue &amp; Costs</td>
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<td>Cost of Capital</td>
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<td>EFI Probability &amp; Magnitude</td>
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<tr>
<td>Supply Chain Management</td>
<td>23</td>
<td>80</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Medium</td>
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<tr>
<td></td>
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<td></td>
<td>No</td>
</tr>
</tbody>
</table>

**HM**: Heat Map, a score out of 100 indicating the relative importance of the topic among SASB’s initial list of 43 generic sustainability issues; asterisks indicate “top issues.” The score is based on the frequency of relevant keywords in documents (i.e., 10-Ks, shareholder resolutions, legal news, news articles, and corporate sustainability reports) that are available on the Bloomberg terminal for the industry’s publicly-listed companies; issues for which keyword frequency is in the top quartile are “top issues.”

**IWGs**: SASB Industry Working Groups

**%**: The percentage of IWG participants that found the disclosure topic to likely constitute material information for companies in the industry. (-) denotes that the issue was added after the IWG was convened.

**Priority**: Average ranking of the issue in terms of importance. One denotes the most important issue. (-) denotes that the issue was added after the IWG was convened.

**EI**: Evidence of Interest, a subjective assessment based on quantitative and qualitative findings.

**EFI**: Evidence of Financial Impact, a subjective assessment based on quantitative and qualitative findings.

**FLI**: Forward Looking Impact, a subjective assessment on the presence of a material forward-looking impact.
### APPENDIX IIB:
Evidence of Financial Impact for Sustainability Disclosure Topics

<table>
<thead>
<tr>
<th>Evidence of Financial Impact</th>
<th>REVENUE &amp; EXPENSES</th>
<th>ASSETS &amp; LIABILITIES</th>
<th>COST OF CAPITAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Revenue</td>
<td>Operating Expenses</td>
<td>Non-operating Expenses</td>
</tr>
<tr>
<td></td>
<td>Market Size</td>
<td>Pricing Power</td>
<td>COGS</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Air Quality</td>
<td>•</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Energy Management</td>
<td>•</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Water Management</td>
<td>•</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Waste Management</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Workforce Health, Safety, and Well-being</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Supply Chain Management</td>
<td></td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

- •: MEDIUM IMPACT
- #: HIGH IMPACT
## APPENDIX III: Sustainability Accounting Metrics | Iron & Steel Producers

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>ACCOUNTING METRIC</th>
<th>CATEGORY</th>
<th>UNIT OF MEASURE</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse Gas Emissions</td>
<td>Gross global Scope 1 emissions, percentage covered under a regulatory program</td>
<td>Quantitative</td>
<td>Metric tons, CO$_2$-e, Percentage (%)</td>
<td>NR0301-01</td>
</tr>
<tr>
<td></td>
<td>Description of long-term and short-term strategy or plan to manage Scope 1 emissions, emissions reduction targets, and an analysis of performance against those targets</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0301-02</td>
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<tr>
<td>Air Quality</td>
<td>Air emissions for the following pollutants: CO, NO, (excluding N$_2$O), SO$_x$, particulate matter (PM), manganese (Mn), lead (Pb), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs)</td>
<td>Quantitative</td>
<td>Metric tons</td>
<td>NR0301-03</td>
</tr>
<tr>
<td>Energy Management</td>
<td>Total purchased electricity consumed, percentage renewable</td>
<td>Quantitative</td>
<td>Gigajoules (GJ), Percentage (%)</td>
<td>NR0301-04</td>
</tr>
<tr>
<td></td>
<td>Total fuel consumed, percentage from: (1) coal, (2) natural gas, (3) renewable sources</td>
<td>Quantitative</td>
<td>Gigajoules (GJ), Percentage (%)</td>
<td>NR0301-05</td>
</tr>
<tr>
<td>Water Management</td>
<td>Total fresh water withdrawn, percentage recycled, percentage in regions with High or Extremely High Baseline Water Stress</td>
<td>Quantitative</td>
<td>Cubic meters (m$^3$), Percentage (%)</td>
<td>NR0301-06</td>
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<tr>
<td>Waste Management</td>
<td>Amount of waste from operations, percentage hazardous, percentage recycled</td>
<td>Quantitative</td>
<td>Metric tons, Percentage (%)</td>
<td>NR0301-07</td>
</tr>
<tr>
<td>Workforce Health, Safety, and Well-being</td>
<td>(1) Total Recordable Injury Rate (TRIR), (2) Fatality Rate, and (3) Near Miss Frequency Rate for (a) full-time employees and (b) contract employees</td>
<td>Quantitative</td>
<td>Rate</td>
<td>NR0301-08</td>
</tr>
<tr>
<td>Supply Chain Management</td>
<td>Discussion of the process for managing iron ore and/or coking coal sourcing risks arising from environmental and social issues</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0301-09</td>
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</table>
APPENDIX IV: Analysis of 10-K Disclosures | Iron & Steel Producers

The following graph demonstrates an aggregate assessment of how the top ten U.S.-domiciled Iron & Steel Producers, by revenue, are currently reporting on sustainability topics in the Form 10-K.

<table>
<thead>
<tr>
<th>TYPE OF DISCLOSURE ON SUSTAINABILITY TOPICS</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
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<tbody>
<tr>
<td>Iron &amp; Steel Producers</td>
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<tr>
<td>Greenhouse Gas Emissions</td>
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<td>Air Quality</td>
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<td>90%</td>
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<td>Energy Management</td>
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<td>100%</td>
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<tr>
<td>Water Management</td>
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<td>90%</td>
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<td>Waste Management</td>
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<td></td>
<td>70%</td>
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<tr>
<td>Workforce Health, Safety, and Well-being</td>
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<td></td>
<td>100%</td>
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<tr>
<td>Supply Chain Management</td>
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<td></td>
<td></td>
<td></td>
<td>80%</td>
<td></td>
</tr>
</tbody>
</table>

IWG Feedback*:

*Percentage of IWG participants who agreed topic was likely to constitute material information for companies in the industry.
References

5 Data from Bloomberg Professional service accessed on June 12, 2014, using the ICS <GO> command. The data represents global revenues of companies listed on global exchanges and traded over-the-counter (OTC) from the Iron & Steel Producers industry, using Level 3 of the Bloomberg Industry Classification System.
18 United States Steel Corp. 2012 Form 10-K. p. 25
References (Cont.)


33 Ibid.


49 Forms 10-K for FY 2012 and FY 2013. United States Steel.


52 United States Steel Corp. 2012 Form 10k, P. 24


References (Cont.)


71 MSCI. “ESG Issue Report: Water: Upstream and Downstream Impacts from a Well Running Dry –Executive Summary.” September 2013. Figure 2.


86 EPA. “The National Biennial RCRA Hazardous Waste Report (Based on 2011 Data).”


References (Cont.)


93 Form 10-K for fiscal year 2013. United States Steel. Page 3-49.


96 https://www.osha.gov/SLTC/basicsteel/standards.html


