METALS & MINING
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

INDUSTRY LEAD

Himani Phadke

CONTRIBUTORS

Andrew Collins
Henrik Cotran
Stephanie Glazer
Anton Gorodniuk
Jerome Lavigne-Delville
Nashat Moin
Arturo Rodriguez
Jean Rogers
Gabriella Vozza

SASB, Sustainability Accounting Standards Board, the SASB logo, SICS, Sustainable Industry Classification System, Accounting for a Sustainable Future, and Materiality Map are trademarks and service marks of the Sustainability Accounting Standards Board. © 2014 SASB™
INTRODUCTION

The Metals & Mining industry supplies the essential materials that make up modern society, with all the diverse applications of metals from jewelry and technology to construction and machinery. Much of the economic growth in emerging markets today is accompanied by an expansion in construction and manufacturing activity requiring greater metal inputs. Innovations in the industry are creating lighter, more durable products, enabling efficiency downstream. Metal recycling rates are increasing and new technologies are reducing the need for extracting virgin materials.

While the industry has made significant strides in improving resource efficiency, metal mining and production remains resource-intensive. With the worldwide growth in demand for metals, companies in the industry will need to continue working to reduce their environmental externalities. In many parts of the world, regulatory action and public expectations for environmental performance and worker health and safety are intensifying in the face of global challenges like climate change and economic development. Therefore, management (or mis-management) of material sustainability issues has the potential to affect company valuation through impacts on profits, assets, liabilities, and cost of capital.
If Metals & Mining companies reported metrics in their regulatory filings on the material sustainability risks and opportunities that could affect value in the near- and long-term, 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 Metals & Mining industry:

- Reducing direct greenhouse gas (GHG) emissions;
- Reducing other air pollutants;
- Sustainable management of energy to reduce cost of inputs and indirect GHG emissions;
- Managing water use and impacts on local water systems;
- Managing, treating, and safely disposing of waste and hazardous materials;
- Minimizing the biodiversity impacts of operations;
- Ensuring strong relations with local communities at all project stages;
- Protecting human rights, with special consideration for operations in conflict areas and on indigenous peoples’ lands;
- Ensuring worker health and safety to reduce injuries and fatalities in a high risk environment;
- Managing labor relations; and
- Maintaining strong business ethics and transparency in payments to governments.

INDUSTRY SUMMARY

The Metals & Mining industry is involved in extracting all metals and minerals, producing and refining ores, quarrying stones, smelting and manufacturing metals, and providing mining support activities. It also produces iron ores, rare earth metals, and precious metals and stones. Larger companies in this industry are vertically integrated – from mining ores in several countries to wholesaling metals to customers.¹

This mature industry has total global revenues of $1.2 trillion.¹ The industry has established technology and processes and a stable number of companies; mergers and acquisitions are common. According to Bloomberg Industry Classification data, around 52 percent of industry revenue came from base metals (aluminum, cobalt, copper, tin, uranium, etc.), 23.5 percent from iron and steel raw materials supplies, and 13.3 percent from precious metal mining. Metal and ore wholesalers, mining services,

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.
and sales of other mined minerals represent a much smaller portion of the industry. Most mines in the U.S. are located in western states like Wyoming, Colorado, New Mexico, Utah, Arizona, and California, with a handful in the eastern and southern states, such as New York, South Carolina, and Texas. However, the largest metal mining companies have truly global operations spanning six continents.

Net income margins of the top industry players (companies in Appendix I, such as Alcoa and Rio Tinto) varied widely according to data for fiscal year (FY) 2013, ranging from -9.9 percent to 16.5 percent. Profit margins for base metals suppliers were generally lower than for steel raw materials suppliers.

Demand for ores and metals has grown, as emerging economies need more iron ore for electricity generation and steel production, and more gold for jewelry. Projections show that demand for iron ore will double by 2030, mainly driven by China’s rising consumption of steel raw materials, which has increased nearly eight-fold since 2000. Gold sales reached record levels in 2012, indicating the profitability of mining this metal, despite shrinking reserves and high mining costs.

The base metals market is highly fragmented, due to the large capital expenditure requirements for new mines, and their depletion rates once they are brought online. In the global copper market, the top five producers control about 37 percent of global copper mine output; the next five account for around 16 percent. U.S. domestic demand for copper is linked to the growth of auto manufacturing and homebuilding industries. Similarly, in primary aluminum production, the top five producers account for around 33 percent of the global market. Mergers and acquisitions are common in the industry as larger miners acquire smaller ones to increase production and secure mines in the developmental stage.

The 2010 earthquake and tsunami in Japan exposed citizens to radiation and brought concerns regarding safe storage and disposal of uranium and spent fuel to the forefront. U.S.-listed uranium mining companies have operations in the U.S., Australia, and Africa. The price of uranium, which is determined by demand for nuclear energy, drives production levels. Even though concerns about safety have halted construction of new nuclear reactors in the U.S., Switzerland, and Spain—and caused Germany and Japan to shut down many reactors—increasing and sustained demand from China and France will likely drive growth in this market. China’s National Development and Reform Commission aims to increase nuclear power production to 6 times its current output by 2020. Even though revenues generated from uranium mining constitutes only 0.9 percent of total revenue from all base metals, it is a high-risk business due to the potential for radiation exposure.

Rare earth elements (REE) are a group of 17 chemical elements in the periodic table that are abundant in the earth’s crust, but unlike most metals that are found in concentrated deposits, REE are dispersed. Among their many uses are applications in almost all electronic devices. Mining of REE by U.S.-listed companies is limited to southern Africa, the western U.S., and Canada. China, with 36 percent of reserves and control over 95 percent of global
output, has restricted exports to protect domestic manufacturing industries that use REE. To date, Mountain Pass in California is the only rare earth mine in the U.S. However, Bokan Mountains in Alaska, Diamond Creek in Idaho, and the Bear Lodge Mountains in Wyoming are being explored as potential mine sites. The environmental impacts of REE mining are great; however, since China has limited REE exports, the U.S. and other countries may need to boost domestic production.\textsuperscript{15}

The main costs of the industry include fuel, explosives, energy, and chemicals for metal extraction, followed by wages. Depending on the metal, prices are determined through contracts (iron) or by world price (gold). In the face of increased price competition from foreign companies, the industry must manage costs in order to maintain profit margins. In response to competition from China, the three largest shippers of iron ore, Vale, Rio Tinto, and BHP Billiton, recently broke a four decade-old custom of selling on annual contracts and moved to sales at spot market rates through auctions and private negotiations. Steel mills in China, the single largest consumer of iron ore, prefer contracts on a shorter-term basis, using price indices.\textsuperscript{16}

The mining industry has become increasingly automated over the years, with technology to map different grades of ores. With ore quality diminishing, technology that can sort grades before processing of ores can cut processing costs by discarding non-profitable grades.\textsuperscript{17} Other industry automations are expected to come to market in the near future, including driverless trains to carry metals from production sites to ports, and in the near future, fully automated mines with remote control.

Though the outputs of this industry are long-lived, reusable, and can be recycled, the industry generates significant environmental and social impacts from its operations. With the general decline of ore quality, more ore needs to be extracted to produce the same amount of productive output. Hence the industry’s processes are becoming more resource-intensive and impactful.

**LEGISLATIVE AND REGULATORY TRENDS IN THE METALS & MINING INDUSTRY**

The environmental and social regulations governing this industry are substantial and revolve around environmental protection, protection of local communities, and promoting business ethics. The following section provides a brief summary of key regulations and legislative efforts related to this industry.\textsuperscript{18}

In the U.S., many federal laws on environmental protection apply to mining activities, for example, the Endangered Species Act, Coastal Zone Management Act, River and Harbors Act of 1899, Wild and Scenic Rivers Act, Fish and Wildlife Coordination and Conservation Acts, and Migratory Bird Protection Treaty Act. The Environmental Protection Agency’s (EPA) Toxic Release Inventory process requires companies to report the use, manufacture, or processing of listed toxic materials that exceed defined

\textsuperscript{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.

© 2014 SASB™

RESEARCH BRIEF | METALS & MINING
thresholds, including chemicals used in equipment maintenance, reclamation, and water treatment.

The 1976 Resource Conservation and Recovery Act (RCRA) affects U.S. mining operations by establishing “cradle to grave” requirements for the treatment, storage, and disposal of hazardous wastes. However, this excludes many wastes like specific types of slag from copper, lead, phosphorus, and zinc processing, muds from bauxite refining, and process wastewater from production of certain metals and minerals.\textsuperscript{18}

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or “Superfund” enables the government to clean up any site contaminated with untreated hazardous substances including mining, milling, and smelter wastes that are currently excluded under RCRA. Regulators use special funds and hold all historical owners or contributors responsible for the cleanup costs. The Toxic Substances Control Act, passed in 1977, regulates the development and application of new and existing chemicals in ore processing, like the use of sodium cyanide solutions in gold ore processing.

The Pollution Prevention Act (PPA) of 1990 mandates data collection on toxic chemicals that are treated, recycled, and combusted for energy recovery. The PPA, along with the Emergency Planning and Community Right to Know Act (EPCRA) of 1986, requires mining companies to “report annually on disposal or other releases and other waste management activities related to these chemicals.”\textsuperscript{19} Starting in 2007, the European Union’s regulatory framework, Registration, Evaluation and Authorization of Chemicals (REACH), requires manufacturers and importers to gather and register information on the properties of their substances that meet certain volume or toxicological criteria.\textsuperscript{20}

The Surface Mining Control and Reclamation Act of 1977 (SMCRA), administered by the Office of Surface Mining Reclamation and Enforcement (OSM), establishes mining, environmental protection, and reclamation standards for surface and underground mining. Mining companies are required to gain permits from the OSM before proceeding with new projects.

The federal Clean Water Act (CWA) and related state laws mandate treatment of wastewater prior to discharging into water bodies. Additionally, the CWA Section 401 gives states the authority to deny federal permits by withholding certification and to place limits on federal permits by limiting certification for operations that might result in a discharge to water bodies located in that state.

The Securities and Exchange Commission’s (SEC) final rule on Section 1503 of the Dodd-Frank Act mandates mine safety disclosures in Form 10-K, 20-F, 40-F, and 10-Q. The disclosures include health and safety violations, orders and citations, related assessments, and legal actions and mining-related fatalities.
The Mine Improvement and New Emergency Response Act of 2006 (MINER) includes a number of provisions to improve safety and health in U.S. mines. Even though miner safety regulations exist in other countries, they are rarely enforced. Nonetheless, many mining companies have created policies around zero harm or the goal of zero fatalities. The International Council on Mining and Metals (ICMM) is an industry association that aims to embed the ‘Zero Harm’ vision.21

There are various guidelines to protect human rights in business activities, including mining operations. In 2011, the International Finance Corporation (IFC) released its revised Sustainability Framework, including a new requirement to obtain free, prior, and informed consent of indigenous populations. In the same year, the UN Human Rights Council endorsed the Guiding Principles on Business and Human Rights, designed to provide an unprecedented “global standard for preventing and addressing the risk of adverse impacts on human rights linked to business activity.”22

Furthermore, both domestic and international laws have been established to promote strong business ethics and increase transparency of payments to fight bribery and corruption. The Foreign Corrupt Practice Act of 1977 (FCPA) prohibits using any means of commerce corruptly to influence foreign officials to violate their lawful duty, or to secure improper advantages to assist in obtaining or retaining business. In August 2012, the SEC issued the final rule on Section 1504 “Disclosure of Payments by Resource Extraction Issuers” of the Dodd-Frank Act. Section 1504 requires any company that files an annual report with the SEC to separately file a certified report of all payments totaling $100,000 or more made to the U.S. or a foreign government to develop any projects.23 However, this rule was vacated by the U.S. District Court for DC in July 2013. The SEC could appeal the judgment or re-issue an edited version of the rule.

A growing number of companies are joining the Extractive Industries Transparency Initiative (EITI), which is a voluntary global initiative that promotes transparency in payments to government and revenues for extractive industries. In order to be EITI compliant, not only do countries have to disclose all payments received by the government, but all companies operating in said country must also disclose all payments made.24 Furthermore, an increasing number of countries are adopting their own anti-corruption laws, including several developing nations. The UK Bribery Act, passed in April 2010, creates an even more effective legal framework for combating bribery by introducing additional provisions like a new corporate offense for failing to prevent bribery. Growing globalization, media attention, and cooperation between global enforcement agencies is putting pressure on companies to increase their accountability, establish anti-corruption control programs, and conduct periodic monitoring.
SUSTAINABILITY-RELATED RISKS AND OPPORTUNITIES

Industry drivers and recent regulations suggest that while traditional value drivers will continue to impact financial performance, intangible assets such as environmental, human, and social capital, 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 Metals & Mining industry:

- **Resource intensity**: Mining is an energy and water-intensive process that is easily impacted by rising fuel costs and water scarcity. The industry faces several challenges, from decreasing grades of deposits to increasing depth and scale of mines, all of which lead to greater resource needs and costs.

- **Negative externalities**: The nature of large-scale mining often displaces communities and/or affects health and environment in the locality.

- **Worker safety**: The fundamental mining processes, though now largely automated, still expose workers to health and safety risks and companies to worker-related production disruptions.

- **Shifting markets**: The mining industry faces a growing international market, and competition from foreign producers is intensifying. Focusing on innovation and productivity could be key to maintaining profitability.

As described above, the regulatory and legislative environment surrounding the Metals & Mining 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 Metals & Mining 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 IIA and IIB. Appendix IIA 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. Finally,
Appendix IV provides an analysis of the quality of current reporting on the material sustainability disclosure topics in SEC filings, by the top companies in the industry.

---

**ENVIRONMENT**

The environmental dimension of sustainability includes corporate impacts on the environment. These could result from 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.

Natural resources such as metal ore, fossil fuels, and water constitute some of the mining industry's key inputs. At the same time, the industry's operations have significant impacts on the environment, due to the use of natural resources and the creation of environmental externalities such as GHG emissions and water pollution. According to the EPA's Toxic Release Inventory (TRI), the metal mining industry is the largest toxic polluter in the U.S. Trucost estimated that the total direct cost of environmental damage of iron ore mining could be as high as 14 percent of revenue in 2009. Environmental impacts will be exacerbated as it becomes more difficult to extract metals, minerals and stones, and rising fuel costs, water constraints, and environmental regulation will put downwards pressure on profit margins in this industry.

---

**Greenhouse Gas Emissions**

Mining operations are energy-intensive and generate significant direct greenhouse gas (GHG) emissions, including carbon dioxide. Mining metals such as iron and copper is energy-intensive, requiring six times more energy to produce each ton of metal when compared to mining industrial materials such as phosphate, stone, sand, and gravel. The sources of GHG emissions for mining are carbon dioxide from use of gasoline, diesel, natural gas, steam, coal, and propane, during mining, ore processing, and smelting activities.

Larger players in the industry also operate their own rail networks, ports, roads, and other logistics networks to transport construction materials and workers, and to deliver metal ores to smelters and refineries or consumers. Depending on the size of these operations, transport-related emissions may also be significant.

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 impact of increased fuel costs and regulations that limit – or put a price on – carbon emissions, in an environment of increasing regulatory and public concerns about climate change, in the U.S. and globally.

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 mining industry, a significant contributor of GHG emissions, is at regulatory risk from current and future requirements pertaining to GHG reporting, limits on emissions, and carbon taxes. In 2000, five percent of Canada’s industrial GHG emissions originated from metal mining and nonferrous metal smelting and refining, which accounted for nearly one percent of total GHG inventory.  

In 2009, the EPA made greenhouse gas reporting mandatory for large emitters in the U.S. Those include metal production facilities that smelt, refine, and/or cast ferrous and nonferrous metals, including primary aluminum, ferroalloy, iron and steel from ore, pig, or scrap using electrometallurgical and other methods. In 2011, total emissions from this industry were 115 million metric tons of carbon dioxide equivalent (CO₂-e), or 10.7 percent of all reported emissions excluding power plants.  

Aluminum smelting in particular releases vast quantities of GHGs – for every ton of aluminum produced, smelters release 2 tons of carbon dioxide and 1.4 kilograms of perfluorocarbons (PFCs), which have global warming potential of 6,500-9,200. A study on the impact of climate change on institutional investment portfolios identifies the primary metals and metal mining industries 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.” As a result of higher regulatory cost, profit margins may decline.

Companies in the industry are cognizant of the materiality of this issue. In its Form 10-K for 2012, Kaiser Aluminum states that climate change regulation could “increase costs for our use of natural gas, potentially restrict access to the use of natural gas, require us to purchase allowances to offset our own emissions or result in an overall increase in our costs of raw materials, any one of which could significantly increase our costs, reduce our competitiveness in a global economy or otherwise negatively affect our business, operations or financial results.”

There is direct evidence of financial impact for mining companies that are covered by Australia’s carbon pricing regulation. As a result of Australia’s mining and carbon taxes, UBS, a global financial services company, downgraded BHP Billiton and Rio Tinto’s earnings estimates by 4 percent in June 2012. It is estimated that the carbon tax cost the two companies a combined $502 million in the year ending June 30, 2013.
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. Mandated emissions reductions through regulations can significantly increase operational costs and capital expenditures. At the same time, reducing emissions can create operational efficiency, and protect companies from further regulations that limit or put a price on emissions. Reducing emissions through energy efficiency can also protect companies from higher fuel costs. Furthermore, as a relatively large emitter of GHG emissions, the Metals & Mining industry might face difficult borrowing conditions and increased cost of capital.

As newer or more stringent GHG regulations are implemented, the probability and magnitude of these impacts are likely to increase in the near to medium term.

Air Quality

Apart from GHGs, which have global impacts, other air emissions from mining and metal production include Hazardous Air Pollutants, Criteria Air Pollutants, and Volatile Organic Compounds. These emissions have more localized (but significant) human health and environmental impacts, and the EPA, state, and local agencies regulate them under the Clean Air Act (CAA), creating significant regulatory risks for this industry.

Mining, which concentrates ore, is followed by beneficiation to concentrate the valuable minerals. A process called metallurgy further concentrates the metals by separating them from the other minerals in the ore. The most common technique for doing this involves heating the minerals to a melting point and mixing them with other materials. This process is also the most significant in terms of its environmental impacts. In modern smelters, gases are collected at the end of smoke stacks and treated to remove certain pollutants. This cleansing process removes most—but not all—of the impurities; so uncaptured sulfur dioxide, lead, mercury, cadmium, and arsenic are among the chief pollutants.

Financial impacts on companies will vary depending on the specific location of operations and the prevailing air emissions regulations. Nonetheless, active management of the issue—through technological and process improvements—could allow companies to limit the impacts of increasingly stringent air quality regulations globally. Leading companies are making significant investments to reduce air emissions.

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

The scale of air emissions from the industry is significant. Global releases of lead from smelting and refining non-ferrous metals are more than 28,000 metric tons annually. Mercury
emissions from these processes total 710 metric tons per year, the second largest source after power plants.\textsuperscript{38} Even though small-scale and artisanal gold mining is commonly associated with mercury emissions, large-scale gold mining also has significant mercury releases from cyanide leaching, and even from mine tailings where no mercury has been added.\textsuperscript{39} While the release of sulfur dioxide is regulated in the U.S. through the Acid Rain Program, worldwide emissions of the gas make up 13 percent of global emissions, 142 million tons every year.\textsuperscript{40}

In 2008, industrial processes related to metal mining in the U.S. released over 241,000 pounds of PM10 (particulate matter smaller than 10 micrometers in diameter) and 37,000 pounds of PM2.5 (particulate matter smaller than 2.5 micrometers in diameter). This is equivalent to 57 and 24 percent of all PM10 and PM2.5 emissions from industrial processes from 2008. Chronic (long-term) inhalation exposure of particulate matter can cause premature death in infants, decreased lung function, aggravated asthma, and other respiratory illnesses. Excessive levels of particulate matter can lead to the creation of smog. Local communities near Anglo American’s copper mines and smelters in Zambia suffered from asthma, lung diseases, and other health problems as a result of the pollution.\textsuperscript{41}

Investments in reducing air emissions can be expensive; however, the reductions achieved can be significant, lowering regulatory costs and reputational risks. In Canada, Vale invested $1 billion to “capture sulphur bearing gases from the smelter’s converter aisle and significantly reduce dust and metal emissions.”\textsuperscript{42} The project, which will be completed in 2016, is expected to reduce smelter emissions from 150,000 metric tons annually to 45,000 metric tons, well below the 66,000 metric ton government limit.\textsuperscript{43}

In 2008, Asarco, a subsidiary of Grupo Mexico based in the U.S., deposited $186 million into an EPA special account for cleanup of lead-contaminated soil from its smelter air emissions in Omaha. In some areas around the lead smelter and refinery, up to 40 percent of children had elevated blood lead levels.\textsuperscript{44} That same year, the EPA reached a $3 million settlement with the company for contamination from smelter emissions and tailings at its Hayden smelter and concentrator sites.\textsuperscript{45}

\section*{Value Impact}

Managing air emissions can provide operational efficiency and affect the cost structure of companies in the industry, with a direct, ongoing 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 costs if new regulations are introduced. Companies could face one-off impacts
on cash flows and liabilities as a result of fines. There may be legal challenges from the local population or businesses that are directly affected by air pollutants, which could result in liabilities. Companies could face delays in obtaining permits if they do not meet state or local emissions limits, which could impact production, and therefore, revenues.

Active management of the issue could allow companies to limit the impact of regulations and benefit from operational efficiencies that could lead to a lower cost structure over time. Companies could also benefit from improved reputation over the long-term.

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

Mining and metals production is an energy-intensive process, with a significant proportion of energy consumption in the industry accounted for by purchased electricity. While fuel combustion on-site contributes to the industry’s direct (Scope 1) GHG emissions, electricity purchases from the grid create indirect impacts on the climate through Scope 2 emissions. The energy-intensity of operations is likely to increase with decreasing grades of deposits and increasing depth and scale of mining operations. The choice between on-site versus grid-sourced electricity and use of alternative energy can play an important role in influencing both the costs and reliability of energy supply.

The long-term prospects of rising energy prices, increased demand from the developing world, as well as energy security and climate change concerns, all point towards increasing upward pressure on price and availability of conventional sources of energy. Therefore, mining companies may not always be able to rely on affordable or easily accessible energy, which is essential to compete in a commodity market driven by global competition. As a result, sustainable energy management - the way in which a company manages its overall energy efficiency and intensity, its reliance on different types of energy and associated sustainability risks, and its ability to access alternative source of energy – is likely to be material for the industry.

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 energy consumed, percentage grid electricity, and percentage renewable.

Evidence

About half of energy consumption and GHG emissions in the mining industry are the result of purchased electricity. For example, in both 1990 and 2000, about 48 and 52 percent of the energy consumed by the Canadian metal mining industry was from electricity. In 2000, about 5.2 percent of the industrial energy used in Canada was consumed by metal mining (2.5 percent) and nonferrous metal smelting and refining (2.7 percent).66
Aluminum production and processing is particularly energy-intensive. According to U.S. Census data, purchased energy constituted 25.5 percent of value added for aluminum production and processing, with purchased electricity contributing to 66 percent of energy costs.47

Likewise, other metals production also requires large quantities of energy, with companies facing high and increasing energy costs. The mining sector consumes a third of the electricity in Chile, the world’s top copper producer. Between 2000 and 2013, electricity costs have risen 11 percent, making it expensive to secure electricity for mining projects. According to industry executives, the high cost of energy is threatening the competitiveness of Chile’s copper industry.48

Alcoa, the third largest producer of aluminum, has such high electricity demand that its wholly-owned subsidiary, Alcoa Power Generating Inc. is responsible for generating, purchasing, and managing electricity for Alcoa’s own smelting and other industrial processes. Alcoa reports that electric power accounts for 26 percent of the company’s aluminum production costs, 20 percent of which is generated by the company, while the rest is purchased through long-term contracts.49

According to Newport Consulting’s 2013 Mining Business Outlook Report, cost control and management are high on the agenda for mining leaders.50 Given the significance of energy costs, many mining companies are implementing energy efficiency measures. For example, Anglo Platinum Limited has demonstrated the use of large-scale stationary fuel cell systems for power generation using coalbed methane as fuel.51 Fuel cell systems are especially useful in remote locations where it is difficult to access the grid for electricity. In South Africa, Lonmin set a target to achieve 10 percent energy efficiency based on 2007 levels in order to manage energy shortages.52

Value Impact

Proper energy management is key to increasing productivity and maintaining resilience in the face of regulatory and other changes affecting the industry. Energy management primarily impacts current costs of operation, while energy source rigidity can lead to increases in future costs as certain energy sources become less competitive. Therefore, there is a direct opportunity for mining and metals companies to generate significant cost savings through technology improvements. Active energy management can also reduce a company’s risk profile and its cost of capital.

Water Management

Mining and metals production impacts both the quantity and the quality of local water resources. Metals and mining companies face operational, regulatory, and reputational risks due to water scarcity, costs of water acquisition, regulations on effluents or amount of water used, and competition with local communities and other industries for limited water resources. Impacts of water-intensive production and potential contamination of water
resources include higher costs, liabilities, and lost revenues due to curtailment or suspension of operations. The severity of these risks can vary depending on the region's water resources and regulatory environment.

Companies in the industry are addressing risks by increasingly using new technologies, including desalination, water recirculation, and innovative waste-disposal solutions. Hence, new mining projects may require higher capital expenditures, while more stringent environmental rules and permitting requirements could add to project timelines and capital expenditure. Reducing water use and contamination could also create operational efficiency for companies and lower their operating costs.

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 recirculated, percentage in water-stressed regions; and

- Number of incidents of non-compliance with water quality permits.

**Evidence**

Metal mining is water-intensive, requiring between 100 and 8,000 liters of water per ton of ore extracted. MSCI Ranking of sub-industries within the General Industry Classification System by water intensity finds the mining industry among the most water-intense, just after Utilities and Food and Beverage. These findings are also consistent with Trucost results indicating that Basic Resources industries, which include Metals & Mining, rank high in water intensity.

According to the 2009 U.S. Geological survey, the mining industry uses 18.2 billion gallons in comparison to 29.4 billion for all domestic households. The global scale of water withdrawal by this industry is significant, with many reserves in areas where there are water constraints. For example, around half of the world's copper comes from mountainous and dry areas.

A Carbon Disclosure Project and Eurizon Capital report finds that water risks threaten the industry's growth prospects. Of the 36 companies - representing $773 billion in market capitalization - that disclosed water data, 92 percent identified the potential for water risks to reduce profits. U.S. company Newmont Mining, for example, had to spend $200 million on larger water reservoirs to re-secure its license to do business in Peru. In Chile's Atacama Desert, BHP Billiton and its partners are planning to build a $3.43 billion desalinization plant for a copper mine.

Freeport-McMoRan Copper & Gold reports in its Form 10-K that its operations “require significant quantities of water for mining, ore processing and related support facilities” and acknowledges that “the loss of water rights [...] or shortages of water to which we have rights, could require us to curtail or shut down mining operations.” It also reports that environmental capital expenditures and other environmental costs amounted to $612 million in 2012, and was expected to be in the same range for 2013.
In April 2013, a Chilean court suspended Barrick Gold’s Pascua Lama mine project because of allegations that it threatened local water and polluted glaciers. Although Barrick Gold believes that Pascua Lama can become one of the world’s biggest mines with the lowest operating cost, the court order has created delays and increased costs from $3 billion to more than $8 billion due to the need to source and develop the necessary infrastructure to ensure the availability of water. Barrick Gold has promised $30 million in remediation and is constructing water management infrastructure in order to fulfill the conditions required to restart the mine.

Unaddressed community concerns and protests over the impact of mining on local water resources can damage a company’s social license to operate. In 2004, thousands of residents in Peru protested the expansion of Newmont’s mine into a mountain that supplies water to local farmers. Newmont’s stock prices declined by seven percent in two weeks, and the company suspended that expansion plan. Newmont reclassified the 3.9 million ounces of gold with a valuation of $1.6 billion in 2004 prices from “proven and probable reserves” to “mineralized material not in reserves.”

According to Moody’s Investors Service, scarcity of inputs such as water could adversely affect the ratings of mining companies that fail to proactively manage the accompanying risks to their businesses.

### Value Impact

According to a JP Morgan report, risks associated with water management create three types of impacts on financial performance—higher costs, delayed growth, and higher cost of capital. Disruptions in operations can lead to financial losses in the form of foregone revenue and higher costs. Securing clean water, ensuring quality of discharges, and compliance with regulation can also lead to significant one-time costs and capital expenditures. To the extent that mining companies affect the quality of local water resources, they can face significant one-time costs or contingent liabilities associated with regulatory fines and litigation. Water-intensity, particularly in regions with water scarcity, can impact reputation and brand value through social and political unrest. Mismanagement of water resources can also affect 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 & Hazardous Materials Management

The Metals & Mining industry generates large volumes of mineral processing and smelting wastes, including slags and tailings, some of which may be hazardous or chemically reactive. Due to the large volumes of waste generated by the industry and the harmful chemicals used in the production process, the management of waste and hazardous material is of significance to the industry.

Wastes generated from metal mining can be divided into two broad categories – mineral and non-mineral waste. Mineral wastes such as mine tailing and overburden are the main solid wastes produced by mining operations. Overburden, or waste rock, are the rocks and minerals that surround an ore and so need to be removed to recover it. Usually, for every ton of metal ore produced, two or three tons of waste rock is generated. Mine tailings is the material that is left after extracting the valuable parts of the ore. Mineral wastes are typically stored on-site in impoundments or used as in-pit backfill.

Non-mineral waste includes waste from equipment use, office wastes and hazardous wastes. Such waste is much smaller in quantity than mineral waste, and is generally managed by recycling, off-site treatment and disposal, or placement in on-site engineered landfills.

The impoundments associated with some of the largest mills can cover thousands of acres and be several hundred feet thick. This can present a significant threat if the impoundments burst, collapse, or leak, leading to destruction of lives, property, and ecosystems. In addition, toxic chemicals used in extraction remain in the tailings at the end of the process and may leach into ground water. Therefore, mine tailings can contain harmful toxins that are released into the environment if handled inadequately, with significant environmental and health impacts. Furthermore, companies face associated risks from the transport, storage, and use of such chemicals.

Mineral wastes are also often stored in-pit, using abandoned open-pit surface mines. Such storage can create the potential for groundwater contamination and could affect the stability of active mines in the area.

Companies that reduce and recycle waste streams, effectively manage tailings ponds, and ensure the integrity of their impoundments could lower regulatory and litigation risks, remediation liabilities, and costs. Additionally, companies’ ability to manage the sourcing, transport, use, and disposal of mining and metal processing chemicals and by-products can lower operational risks.

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 weight of tailings waste, percentage recycled;
- Total weight of mineral processing waste, percentage recycled; and
- Number of tailings impoundments, categorized by their hazard potential.
Evidence

Disposal of both mineral and non-mineral waste requires extensive planning and management to limit the negative externalities. In 2011, Rio Tinto generated 1,535 million metric tons of mineral waste and about a half million metric tons of non-mineral waste. A quarter of the hazardous non-mineral waste was placed in storage pending disposal or reuse.69

Waste management and remediation of contamination can be an expensive process. In 2012, Doe Run, a leading mining company, spent more than $60 million to clean up mine tailings near Bonne Terre and Park Hills in Missouri, at the request of the EPA. In addition, the company has been well known for its record of corporate citizenship and its work to repurpose historic mining sites to invigorate the communities. However, with more residents asking for compensation for the damage from mine debris, Doe Run faced potential punitive damages of up to $500,000 per case for inadequate site cleanup. Local legislation shielded the company from further punitive damages.70

In September 2011, the U.S. Justice Department and the U.S. EPA reached an agreement with Newmont Mining and Dawn Mining companies regarding the payment for the cleanup of the Midnite mine. This former open-pit uranium mine was closed in 1981, but still posed a potential threat to public health and the environment because of the hazardous metals and elevated radioactivity. The cleanup was estimated at $193 million, but the two companies could be required to pay more, if necessary, to complete the cleanup.71

Freeport-McMoRan agreed to pay $6.8 million in 2012 to settle state and federal claims about tailing leak in Morenci mine in Arizona.72 In its 2012 form 10-K, Freeport-McMoRan Copper discussed the proposed changes in EPA classification of hazardous wastes by citing the changes that could subject the industry to significant new and costly waste management requirements.73 Suncoke Energy, a large independent producer of metallurgical coke, cites similar concerns in its 2012 form 10-K.74

Regulations around the management and use of harmful chemicals can affect the industry through impacts on its suppliers. In its 2012 form 10-K, DuPont, a chemical company that supplies chemical products for the mining industry, cites European REACH regulations, which contain a mechanism for the progressive substitution of the most dangerous chemicals and could require the company to use safer alternatives. As a result, the company may be required to make changes in production processes and bear additional costs.75

While accidents are difficult to predict, the use of hazardous chemicals certainly increases the risks from such incidents. In 1998, a truck carrying 2 tons of sodium cyanide to the Kumtor mine crashed through a bridge and fell into Barskoon River in Kyrgyz Republic. Kumtor mine, funded by International Finance Corporation, is operated by Canadian Centerra Gold. The estimated damages from the spill were in the range of $20 to $42 million, and the mine settled for $4.5 million.76 In 2000, a truck spilled 330 pounds of mercury, a byproduct of mining, over 25 miles of roads 53 miles from Newmont’s Yanacocha gold mine in Peru. The Peruvian government fined the mine $500,000 and Newmont reported paying $18 million more.77
Value Impact

Companies that fail to reduce waste from their operations, or to deal with it appropriately when it is generated, are likely to face higher regulatory compliance costs and operational costs compared to peers that perform well on this issue. Permitting of mining sites may be affected, lowering companies’ revenue-earning potential, or requiring additional capital expenditures or other costs prior to approval. In addition, mismanagement of waste and hazardous materials may result in fines and penalties. In extreme cases, poor management can result in litigation or contingent liabilities due to its significant environmental impacts.

Biodiversity Impacts

Both the development and closure of mines can have detrimental impacts on the environment. Mining alters the landscape by removing vegetation, wildlife habitats, and displacing local communities. Thus the mining industry’s activities can have significant impacts on biodiversity, including habitat loss and alteration of land use for mining and disposal of tailings and other wastes. For this reason, regulation requires extensive reclamation to return land to a productive state.

During the initial stages of mine development, greenhouse gas emissions arise from land use change for surface mining, which requires clearing large areas of land. After mine closures, acid mine drainage can be a major source of pollution for local water sources. Acid mine drainage is a metal-rich water that is the result of overburden metals dissolving in acidic rain water, which is created when iron sulfide in overburden is oxidized and washed away with rain water. The metal-rich acidic drainage can poison water downstream, at times reaching concentrations where waters can no longer support life.

Mining operations’ impacts can affect the valuation of reserves, and create operational risks, potentially affecting mining companies’ cost of capital. Extraction costs can vary depending on the environmental characteristics of the land. Increasing awareness and protection of ecosystems and endangered species could make it uneconomical to extract from such sites. Companies could also face regulatory or reputational barriers to accessing reserves in ecologically sensitive areas due to: more stringent legislation and permitting requirements to protect ecosystems and endangered species; delays or denial of permits; and new protection status afforded to areas where reserves are located. In fact, the number and size of protected conservation areas has increased exponentially around the world over the past several years.78

The IFC lists another channel of impact, especially for companies operating in remote areas. These concerns involve “less manageable indirect or induced impacts, such as those caused by improved access to an area along roads or other infrastructure corridors.” While improved access can facilitate income-generating activities for communities like farming, artisanal mining, hunting, or logging operations, these activities can also severely impact biodiversity and are very hard to control.79
In the U.S., mine operators must obtain SMCRA permits and permit renewals for mining operations from the OSM. In addition, states require mined property to be restored to a specific standard according to a previously approved reclamation plan. Restoration is a material cost to mining companies, and includes processes like removing or covering refuse piles, water treatment obligations, and dismantling facilities and roadway infrastructure.80

Mining companies need to proactively work with various stakeholders to ensure that they restore mine land for future use after operations are finished. Breaching remediation and other environmental laws can result in costly litigation and adversely affect reputation.

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):

- Environmental management policies and practices for active sites;
- Percentage of mine sites where acid rock drainage is predicted to occur, actively mitigated, and under remediation; and
- Proved and probable reserves in or near sites with protected conservation status or endangered species habitat.

Evidence

A metals and mining company’s performance in mitigating biodiversity impacts of operations can affect its value through impacts on reserves and production.

First, companies’ decisions about acquiring reserves in ecologically sensitive areas, together with their performance on managing biodiversity impacts, could have material implications for the value of their reserves, and therefore shareholder value. As concerns over ecological impacts have grown in the past decade, additional areas have been designated as protected under new or existing laws, increasing risks to reserves. From 1990 to 2010, global protected area coverage increased from 8.8 percent to 12.7 percent on land, and from 0.9 percent to 4 percent in marine areas under national jurisdiction.81

A 2004 assessment of company exposure to biodiversity risk identified mining operations as a high-risk industry. The research was undertaken by Earthwatch Institute and investment manager F&C Asset Management.82 Industry players acknowledge the high levels of environmental risks associated with mining activities in their 10-K filings. For example, in its 2012 10-K filings, TMS International acknowledges the risk of contract termination and excessive costs resulting from violation of current or future environmental laws.83

The Pebble Project to develop copper, gold, and molybdenum deposits in southwest Alaska has been a source of concern from regulators and other stakeholders due to the environmental risks. From 2011 to 2013, Trillium Asset Management and Calvert Investments lead a group of 27 investors representing over $35 billion in assets to repeatedly ask the EPA to review the proposed Pebble Mine jointly owned by Northern Dynasty Minerals and Anglo American. The EPA’s Draft Impact Assessment on the Pebble Mine found that
its operations could result in ninety miles of eliminated or blocked streams, 4,800 acres of destroyed wetlands, as well as adverse impacts on commercial, subsistence, and sport fishing for salmon in Bristol Bay, and the $500 million in direct revenue from fish sales.\textsuperscript{64} In September 2013, Anglo American announced its withdrawal from the project, and took a $300 million write-down.\textsuperscript{65} Northern Dynasty stock fell 33 percent when Anglo American announced its withdrawal.\textsuperscript{66} In May 2014, Northern Dynasty, the sole owner of the Pebble Limited Partnership, filed suit in U.S. District Court for Alaska to halt an unprecedented veto process, a regulatory process initiated by the U.S. EPA under the CWA.\textsuperscript{67}

In Indonesian New Guinea, Freeport-McMoRan has converted Mount Ertsberg into a 600-meter hole the result of decades of mining for gold, silver, and copper. By the company’s own estimates, the operation will generate 6 billion tons of waste over the course of its lifetime, twice the amount of earth excavated for the Panama Canal. The New York Times reported that a 2002 study commissioned by Freeport-McMoRan found that rivers and wetlands in the vicinity were inundated with waste and unsuitable for aquatic life. A separate report stated that waste in river was responsible for massive “die-off of vegetation.”\textsuperscript{68}

**Value Impact**

Biodiversity impacts can have both a chronic and acute impact on company value. The location of a company’s reserves and its performance on biodiversity impact mitigation and management can affect its long-term value through impacts on the value of reserves. Unanticipated changes in environmental laws could also result in acute impacts on reserves. Minimizing risks and impacts to biodiversity and ecosystems can help companies manage operational risk, which can influence one-time costs and contingent liabilities.

In countries with strong enforcement of laws protecting endangered species and habitats and governing remediation and decommissioning, companies could face significant regulatory penalties and compliance costs. Generally, companies’ impact on biodiversity may lead to community protests and lawsuits, which can lead to lost revenue and higher costs from delayed production, create legal liabilities, and ultimately increase their risk profile and cost of capital.

Conversely, companies that proactively manage ecological impact can improve their reputation and brand value, limit their contingent liabilities associated with legal action, and gain easier access to new projects and sources of revenue. Strong biodiversity risk and impact management could improve companies’ access to finance, as an increasing number of lenders and equity investors are incorporating environmental criteria in their lending or investment decisions.

**SOCIAL CAPITAL**

Social capital relates to the perceived role of business in society, or the expectation that business will contribute to society in return for its license to operate. It addresses the management of relationships with key outside stake-
holders, such as customers, local communities, the public, and the government.

A mining company’s activities can have significant impacts on local communities, and it is important for companies to manage the concerns of these stakeholders to maintain their ‘social license to operate’. Poor management of social capital can lead to difficulty in obtaining regulatory permits, lost market share, impacts on brand value, and frequent disruptions to operations.

Community Relations

Mining operations take place over a number of years, and companies may be involved in multiple projects in a region that can have a wide range of community impacts. Communities may be affected through environmental and social impacts of mining, such as competition for access to local energy or water resources, air and water emissions, waste from operations, and strain on local health services. Land acquisition and resettlement of communities can be particularly disruptive to both communities and mining operations in countries that do not have well-established land or property rights. Generally, impacts from metal mining risk impinging on the basic economic, social, environmental, or cultural rights and interests of community members.

In addition to community concerns around direct environmental and social impacts of projects, the presence of mining activities may give rise to associated socio-economic concerns such as education, health, livelihoods, and food security for the community. Mining companies that are perceived as rent-seeking and exploiting a country or community’s resources without providing any socio-economic benefits in return may be exposed to the risk of resource nationalism actions by host governments and communities, such as imposition of ad hoc taxes, export restrictions, local content requirements, or other additional costs. Such resource nationalism risks may be higher in countries that are heavily dependent on mineral resources for their economic growth, or where there are fewer checks and balances on executive action that might lead the government to renege on prior policy commitments.

Ultimately, whether in countries such as the U.S. with well-defined individual and community rights, or in countries where communities or individuals may not have legal recourse or rights, mining companies need support from local communities to be able to obtain permits and leases and conduct their activities without disruptions. The expected value of reserves could be affected if the community interferes, or lobbies its government to interfere with the rights of a mining company in relation to those reserves.89
Companies in the extractives industries can adopt various community engagement strategies in their global operations to manage risks and opportunities associated with community rights and interests. Strategies are often underpinned by the integration of community engagement into each phase of the project cycle. Companies are beginning to adopt a “shared value” approach to provide a key socio-economic benefit to the community while also creating value for the company.

Company management of community-related risks and opportunities can affect company and project value through community-related disruptions to operations. Company performance in this area can therefore 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 process to manage risks and opportunities associated with community rights and interests; and
- Number and duration of non-technical delays.

Evidence

The Minerals Council of Australia summarized the types of impact of community relations in its report, Enduring Value: The Australian Minerals Industry Framework for Sustainable Development. “Unless a company earns that license and maintains it on the basis of good performance on the ground, and community trust, there will undoubtedly be negative implications. Communities may seek to block project developments; employees may choose to work for a company that is a better corporate citizen; and projects may be subject to ongoing legal challenge, even after regulatory permits have been obtained, potentially halting project development.”

Community relations could affect the financial market valuation of mining companies if a discount is placed on the value of reserves to account for the effect that conflict with the community can have on the probability of timely exploitation of reserves. A 2011 study investigated the discount placed by investors on the value of gold reserves and financial market valuation of publicly traded companies, due to expectations of significant planning and operational delays. The paper looked at two factors affecting the timely extraction of reserves – the level of stakeholder cooperation or conflict and country-level political risk. The authors concluded that “theoretical arguments and empirical results point to the existence of a direct positive and economically substantive relationship between financial market valuation and stakeholder relations.”

The empirical analysis looked at how the expected resource valuation of a mining company determined the market value of the company, compared to its announced resource valuation. The expected valuation was calculated by adjusting the valuation of the mines of a company at a point in time using a traditional valuation method, using the probability at that
time that the company will advance the exploitation of the resources at that mine according to the announced schedule.

The authors found that the market value of the firm placed a discount on the announced resource valuation (based on net present value of the gold controlled by the mining firms) of up to 72 percent. When the authors tested the market value using the expected resource valuation, this discount was reduced to between 33 and 12 percent. This indicates that the market value of the gold firms incorporated the probability that the resources could not be extracted as planned – i.e. market value is affected by the level of stakeholder cooperation or conflict and country-level political risk.

Poor community relations can have a material financial impact on companies through planning or operational delays and associated costs for projects - or even cancelled projects. In 2002, Meridian Gold purchased a mine near Esquel, Argentina. When the company set up a laboratory to sample ores and test the use of cyanide, a key input in extracting gold from its ore, community concern rose about the dangers of cyanide use in mining. Due to a lack of clear communication from and engagement by the company about this and other issues, 81 percent of the public voted against the project in a public referendum. In 2006, Meridian was required to write down the value of the Esquel property by $542.8 million to its fair commercial value without the reserves. This had a significant impact on the company’s assets and reserves; in 2004, Esquel represented approximately 53 percent of the proven and probable reserves, and 48 percent of the total reserves in the company’s portfolio. Often community engagement is considered a mechanism for achieving consent, however, WRI highlighted the Esquel case as an example of when community engagement “may have greater utility as a tool for assessing the political and social risks of proceeding with a project at all.” In the related example, community opposition to an expansion plan for the Yanacocha gold mine in Peru led to project delays worth $1.69 billion in lost earnings.

In order to maintain their social license to operate, companies make annual commitments to sustainable community development through investments in social programs, including in-kind support and administration. Between 2010 and 2012, Freeport-McMoRan invested approximately $180 million per year. The global bauxite mining industry invests more than $400,000 annually per mine in support of community programs. BHP Billiton’s anti-malaria program in Mozambique was successful in reducing malaria both in the community and among its workers, reducing absenteeism. Direct returns from the resulting increase in productivity of assets more than covered the cost of the program.

Realizing the value of community engagement for companies, Anglo American has implemented a program called Social Way, which is a framework for community engagement at every stage of a mining project. The International Council on Mining and Metals (ICMM), a major industry association, requires its members to integrate “a set of 10 principles...
and seven supporting position statements into corporate policy, as well as setting up transparent and accountable reporting practices.”

In addition to direct disruption from community action, mining companies also face the risk of government resource nationalism actions impacting their operations. In its FY 2012 Form 10-K, Rio Tinto discloses that “(t)hroughout 2012 the mining industry also continued to face increased stakeholder pressures, highlighting the importance of proactive stakeholder engagement and good track records in sustainable development. Nevertheless, rising threats of resource nationalism, greater rent extraction by governments, or simply increased uncertainty, have implications for the economics and feasibility of projects across the industry.”

There are several instances of resource nationalism within recent years. In past years, more than 20 countries announced or implemented an increase in governments’ percentage of profits from mining projects. For instance, Australia’s 2012 Minerals Resource Rent Tax dictates a 30 percent tax on iron ore and coal profits in excess of a specified limit. In Angola, the 2011 mining code requires the country to have a minimum of 10 percent ownership in the operator or the minerals being extracted. According to the South African Mineral and Petroleum Resources Development Act 2002 and Broad-Based Socio-Economic Charter, 26 percent of mining companies’ equity must be owned by historically disadvantaged South Africans by 2014.

**Value Impact**

Community relations issues can be a source of both value and risk for Metals & Mining companies. Without due diligence and effective action to address community impacts throughout a project’s lifecycle, companies may expose themselves to short-term and acute operational risks or longer-term reputational impact from ongoing community cooperation or conflict.

Companies with strong community relations will be able to gain easier access to new projects, improving their revenue growth profile. As local communities have significant influence over the outcome of mining operations, effective community engagement can help in the identification of risks and the continual resolution of concerns. Delays to projects with large capital requirements can affect overall profitability, through additional costs and delayed revenues. Poor management of this issue can also result in extraordinary expenses and contingent liability associated with legal actions. Negative community impacts can hurt a company’s future social license to operate, thus increasing its risk profile and cost of capital.

**Security, Human Rights, and Rights of Indigenous Peoples**

Metals & Mining companies face heightened community-related risks when operating in conflict zones; in areas with weak or absent...
governance institutions, rule of law, and legislation to protect human rights; or in areas with vulnerable communities such as indigenous peoples. Without corresponding enhanced diligence measures to protect human rights and the rights of indigenous peoples in such areas, companies could encounter difficulties in accessing reserves or significant operational disruptions with impacts on costs and liabilities.

In their global operations, mining companies may find themselves operating in zones of conflict (which often are resource-rich areas subject to what is known as the “resource curse”101), in areas under socially repressive regimes, or where conflict or political instability subsequently emerges. Company activities in such areas, including using private or government security forces to protect their workers and assets, may knowingly or unknowingly contribute to extreme cases of human rights violations, including use of excessive force. The Voluntary Principles on Security and Human Rights (VPSHR), developed in 2000, seek to address the balancing of safety needs with respecting human rights and fundamental freedoms.102

Furthermore, indigenous peoples are often the most vulnerable sections of the population, with limited capacity to defend their unique rights and interests. Indigenous peoples have lived on their land for generations, and rely on it for their livelihoods and self-identity. The displacement of such communities, or the degradation of their land due to mining activities, may lead to loss of identity, culture, and natural resource-based livelihoods, and expose them to impoverishment and diseases.103

The UN Declaration on the Rights of Indigenous Peoples calls for the free, prior and informed consent (FPIC) of the indigenous peoples for decisions affecting them.104 The IFC’s Performance Standards include one that recognizes the unique vulnerabilities of indigenous peoples, and requires project sponsors to obtain the FPIC of affected communities.105 With greater awareness, several countries are also beginning to implement specific laws protecting indigenous peoples’ rights, creating increasing regulatory risk for companies.

Companies perceived as contributing to human rights violations or failing to account for indigenous peoples’ rights may be affected due to protests, riots, or suspension of permits. They could face substantial costs related to compensation or settlement payments and write-downs in the value of their reserves in such areas.

Company performance in this area and the potential for value impact can therefore 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):

- Proved and probable reserves in or near areas of conflict;
- Proved and probable reserves in or near indigenous land; and
- Discussion of engagement and due diligence practices with respect to human rights, indigenous rights, and operations in conflict areas.
Evidence

Without adequate due diligence and policies that take into account special considerations, operating reserves in or near areas of conflict or indigenous lands can expose companies to operational risks. A 2013 paper analyzing the location of operations of 52 oil, gas, and mining companies found that 92 percent of the 370 oil, gas, and mining sites that were located on or near indigenous land posed a medium to high risk to shareholders. The risk score for each site was based on its location, indigenous peoples policy, reputation, country, community, and legal features. Only one of the 52 companies analyzed had an explicit policy of abiding by the FPIC mandate of the UN Declaration mentioned earlier, and only four others had a company-wide policy related to indigenous peoples. As indigenous peoples’ rights become more formally recognized around the world, and such communities begin to exercise these rights, the lack of a clear policy to engage with such communities could affect company value.106

In August 2011, the Peruvian Congress passed a law requiring the state to consult with indigenous peoples before approving projects that affect their rights and territories. This was following the Peruvian government’s rejection of Southern Copper’s Tia Maria project in April of the same year. There were 17 days of violent protests by local residents about the impact of the mine on fresh water sources.107

In July 2013, Brazilian indigenous people demanding better public service blocked a railway carrying iron ore from the world's largest iron ore mine in Carajas. Vale, the Brazilian mining company that owns the mine reported that its staff had been the subject of violent attacks.108

When operating in politically unstable areas or countries subject to the “resource curse,” mining companies face reputational, legal, and operational risks from close associations with governments that are viewed as corrupt or repressive, and from their use of security forces, particularly where the security forces have been allegedly involved in human rights violations. Often, indigenous peoples are affected by these violations.

For example, African Barrick Gold, Tanzania's largest gold producer, is facing lawsuits for allegedly being complicit in the killings of six locals by the police. The lawsuit alleges that the company failed to curb excessive use of force in at its North Mara mine in recent years. Company stock fell by 4.6 percent a couple of days after the lawsuit was filed.109 The company has previously faced allegations of other violent abuses by security forces at their mines in Papua New Guinea.110

Other mining companies operating in the region have also faced allegations of human rights abuses. In New Guinea, it is estimated that 160 people were killed by the military between 1975 and 1997 in area surrounding the gold, copper, and silver mine owned by Freeport-McMoRan, a U.S. mining company. In March 1996, anger directed at the company ended in riots that shut the mine and its mill for three days. Damages to equipment and offices by rioters amounted to about $3 million.111
Value Impact

Performance on this issue can have acute impacts on company value.

Physical occupation of roads and infrastructure, protests, and even violent actions can prevent a company from exploiting its reserves, or damage its existing assets. This could affect operational results and lower the value of reserves. In addition, reputational impacts could hurt a company’s social license to operate, and its ability to access new projects, impacting revenue growth potential. Protests and occupation of mines could also disrupt operations temporarily, lowering production volumes and, therefore, revenues. Furthermore, additional environmental or social protections under national law or international instruments could increase operating expenditures in areas belonging to indigenous peoples, or could lead to a suspension of permits. Companies could also face extraordinary expenses and contingent liabilities from litigation.

Operational risks from operating in or near indigenous peoples’ lands could also increase the risk premium for financing, and therefore the cost of capital.

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. In addition, it includes 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, as well as the ability to create a culture of safety for companies that operate in dangerous working environments.

The nature of mining operations generates health and safety risks for workers. Maintaining a healthy and productive workforce directly impacts labor productivity through avoidance of lost working hours and payout of medical benefits. A company’s ability to protect employee health and safety, and to create a culture of safety at all levels of the organization, can directly influence the results of its operations.

Workforce Health, Safety, and Well-being

Safety is critical to mining operations due to hazardous working conditions, and accidents often have the greatest impact on workers. The Metals & Mining industry has relatively high fatality rates compared to other industries, and miner fatality or injuries can result from incidents that include powered-haulage and machinery accidents and mine cave-ins. Poor
health and safety records can result in fines and penalties, and an increase in regulatory compliance costs from more stringent oversight.

Considering the dangerous working hazards workers face, mining companies must ensure that operations are safe and that the number of injuries is minimized. This points to the importance of creating a safety culture, which includes putting in place proactive safety management plans, developing training requirements for employees and contractors, and conducting regular audits.

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

Evidence

Safety is critical to mining operations since mine work can be hazardous. In 2011, 16 miners lost their lives in the U.S., and companies operating domestically received 63,601 citations related to health and safety, for which $40.8 million in penalties and fines were issued. In 2012, the metal mining industry had a fatal work injury rate of 8.56 per 100,000 full time employees, which is 2.4 times the U.S. industry average.

Many miners die or are injured from mining accidents each year around the world. In the U.S., the leading causes of death were powered haulage and machinery accidents. Of the 17 fatalities in U.S. non-coal mines in 2012, the MSHA reported that eight of the miners had less than one year of experience at the mine or at the task they were performing. This underscores the need for effective task training whenever miners are assigned to new tasks.

Mining companies have long been subject to criticism about the health and safety of their employees, and recent incidents show that this is a chronic issue is for the industry. For instance, despite a commitment to improving employee health and safety, BHP Billiton reported 26 deaths between 2009 and 2011, and has failed to decrease the number of fatalities at its operations over the past five years. In 2013, BHP Billiton Iron Ore and its subcontractor were fined over AUD 230,000 for a 2008 fatal accident in which both companies were found guilty of failing to provide a safe working environment.

Mining accidents can result in loss of lives and loss of earnings from suspended production. In 2013, a roof collapsed in an underground mine, killing 28 Freeport-McMoRan workers in one of the worst mining accidents in Indonesia. Operations were suspended at the mine, which incurred costs of about $15 million per day in lost production. Companies acknowledge their concern about employee safety with public disclosure that they need to improve their record by integrating safety considerations into their culture. According to
Freeport-McMoRan’s 2011 Sustainability Report, workforce safety remains the company’s number one priority.\(^{119}\)

**Value Impact**

Poor health and safety records can result in fines and penalties and increase regulatory compliance costs from more stringent oversight. In addition, a company’s health and safety record can affect its insurance premiums and therefore, operating costs.

Health and safety incidents can also result in downtime or operations at reduced capacity, and ultimately a loss of revenue-generating opportunities. Ultimately, it can lead to chronic impacts on company value due to lower employee morale and productivity, and can impact a company’s reputation and brand value.

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.

**Labor Relations**

Labor relations play an important role in mining companies’ operations. As metals are commodities with competition mainly based on price, mining companies face in inherent conflict between the need to lower the cost of labor and managing human resources to ensure long-term performance. In addition, jobs in mining are usually physically demanding and hazardous, potentially affecting workers’ health, safety and well-being. In this context, unions play a key role in representing workers’ interests and managing collective bargaining for better wages and working conditions.

Since the location of mining operations is determined by presence of high quality, accessible ores, mining operations span the globe. As mentioned in the section on community relations, often companies operate in areas where worker rights are not adequately protected. The nuances of both domestic and international worker concerns make management of labor relations critical for mining companies, as conflict with workers can lead to extended periods of strikes, which can slow or shut down operations and create reputational risk. Continued labor stresses can impact the long-term profitability of the business.

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):

- Percentage of active workforce covered by collective bargaining agreements, for U.S. and foreign employees; and
- Number and duration of strikes and lockouts.

**Evidence**

The industry players disclose the high rates of unionization among their employees in their Form 10-Ks. Forty-five percent of Newmont’s global employee workforce is unionized.\(^{120}\)
Freeport-McMoran has similar levels of unionization among its employees.121 Out of Alcoa’s 60,000 employees, 40,000 are represented by labor unions.122

Strikes tend to occur frequently in the mining industry, as many workers are unionized. In October 2012, union workers demanding higher pay and better working conditions went on strike at Peru’s only iron mine.123 In the same month in South Africa, nearly 75,000 miners - or 15 percent of the mine workers - went on strike.124 In June 2013, miners went on strike at a Lonmin platinum mine in South Africa after a fellow union member was shot dead by unknown assailants.125 The company’s shares dipped 5 percent amid fears of violent unrest similar to what occurred the previous year resulting in a high death toll and impacting the local mining industry.126

In July 2013, DeBeers, the world’s largest diamond producer, agreed to raise wages by 9 percent in order to avoid a strike. Of its 2,550 employees, about half are members of the Association of Mineworkers and Construction Union, a fast growing labor coalition that recently called for increased wages for gold miners.127 In 2012, Lonmin, a platinum producer, agreed to a 22 percent pay increase after workers at Marikana mine went on strike.128 The strike prompted mine workers at platinum and gold mines owned by Amplats, AngloGold Ashanti, and Gold Friends to make similar demands. AngloGold Ashanta estimates that the strikes cost approximately 235,000 ounces in lost production from its South African operations.129

Value Impact

Disruptions to production due to labor unrest can affect profits due to cost increases and production shortfalls leading to lost revenue. In addition, companies that have historically relied on below-market wages could face higher costs as workers demand higher compensation. Continued labor stresses can significantly impact profitability, and increase the company’s risk profile and its cost of capital.

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 are in potential conflict with the interest of broader stakeholder groups (government, community, customers, and employees). They therefore create a potential liability, or worse, a limitation or removal of license to operate. This includes regulatory compliance, lobbying, and political contributions. It also includes risk management, safety management, supply chain and resource management, conflict of interest, anti-competitive behavior, and corruption and bribery.

Governance issues in the mining industry are driven by lack of transparency in payments to governments and other national entities.
Business Ethics & Payments Transparency

Mining companies operate in an environment of increasing anti-fraud and anti-corruption enforcement risk, as governments all over the world have been implementing regulatory changes. There have been instances of illegal payments or gifts to influence decisions, indirect influence to gain permits, and inflation of contracts to reduce government share of returns. New regulatory developments in the U.S. and abroad (see regulatory trends section) have also increased pressure on mining companies that would like to avoid negative impact on their reputation, social license to operate, and their shareholder value.  

Mining companies depend on concessions, licenses, and permits from governments or government agencies to conduct their business and gain access to deposits in the U.S. and abroad. Companies make related payments to governments, such as taxes and royalties, which, in many resource-rich nations, along with profits from production, are at risk of being used by the government for purposes other than economic and social development. Influx of these high royalties and taxes can lead to corrupt practices in these countries.

When mining companies engage in corrupt practices to access rights, they contribute to the distortion of the fair awarding of contracts as well as the poor quality of public services, and they limit opportunities to develop a competitive private sector in the host country. Bribery or corruption also distorts international competitiveness and affects other companies in the industry.

Business ethics and transparency in payments to governments or individuals are likely to be material for companies in this industry due to the importance of government relations in order to conduct business, and the emergence of several anti-corruption, anti-bribery, and payments-transparency laws. Some of these laws, including the FCPA in the U.S. and the Bribery Act 2010 in the U.K., are mentioned in the Legislative and Regulatory Trends section.

A number of global initiatives have also been developed to address the role of companies in fighting corruption and bribery, including the United Nations Global Compact (10th Principle); the World Economic Forum’s (WEF) Partnering Against Corruption Initiative (PACI); the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multi-national Enterprises; and EITI.

Pursuant to Section 1504 of the Dodd-Frank Act, the SEC issued rules in September 2012 requiring companies that file an annual report with the SEC to file separately a certified report of all payments totaling $100,000 or more made to the U.S. or a foreign government. Although this rule was vacated by the U.S. District Court for DC in July 2013 due to concerns about the public disclosure requirements and the lack of exemptions for them, the SEC could appeal the decision or conduct new rulemaking taking these concerns into account.

Despite the recent ruling, many extractive industry companies already support global efforts such as the EITI to promote transparency on payments, and include disclosures on the issue of business ethics and transparency in its voluntary sustainability reporting guidelines for the industry. As of 2013, there are
27 EITI compliant countries, and 35 countries have produced EITI reports for 202 fiscal years, accounting for $1,309 billion in government revenues.\(^{134}\)

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):

- Description of the management system for preventing corruption and bribery throughout the value chain, including contractors and business partners; and
- Production in countries that have the 20 lowest rankings in Transparency International’s Corruption Perception Index.

**Evidence**

Transparency International’s Bribe Payers Index for 2011 shows that business executives view mining companies as being among those most engaged in bribery.\(^{135}\) Newmont Mining disclosed in its 2012 10-K filing that it conducts “mining and exploration activities pursuant to concessions granted by, or under contract with, the host government,” including authorities in Australia, Canada, Ghana, Indonesia, Mexico, New Zealand, Peru and Suriname, and “[t]he concessions and contracts are subject to the political risks associated with foreign operations”.\(^{136}\)

Since mining companies often operate in frontier economies and remote locations, they rely on armed forces for security. According to company documents, Freeport-McMoRan gave the military and police in Indonesian New Guinea at least $20 million between 1998 and 2004. The New York Times also reported that Freeport spent $35 million on military infrastructure - barracks, headquarters, mess halls, roads - and gave the commanders 70 Land Rovers and Land Cruisers, which were replaced every few years. Individual commanders received tens of thousands of dollars - in one case up to $150,000. In later filings with the Securities and Exchange Commission, Freeport admitted to paying the military $4.7 million in 2001 and $5.6 million in 2002, but did not disclose whether the payments were made to personal accounts, or what the money was used for. Direct payments to officers are illegal under Indonesian law.\(^{137}\)

U.S. and Australian government investigations of the possibly corrupt practices by BHP Billiton in regards to its generous sponsorship of the 2008 Beijing Olympics and other violations can serve as a good example of implementation of the recent rules. The company may face criminal charges, civil sanctions, and millions of dollar in fines.\(^{138}\)

Industry giants consider corruption and bribery an important issue. Transparency International ranked Rio Tinto and BHP Billiton among the most transparent in corporate reporting on anticorruption measures among the 105 largest publicly-traded companies.\(^{139}\) Ernst & Young’s 11th Global Fraud Survey of chief financial officers and heads of legal, compliance, and internal audit highlights the important of this issue. The report states that 76 percent of respondents were concerned about personal liability for actions carried out by the company.\(^{140}\)
Value Impact

Corrupt practices can result in acute impact on value through extraordinary costs and contingent liabilities from regulatory actions. Regulatory actions can also result in higher ongoing compliance costs. Furthermore, this issue can affect a company’s reputation and therefore, intangible assets. Combined with potential legal liability, this can raise a company’s risk profile and cost of capital.

SASB INDUSTRY WATCH LIST

The following section provides a brief description of sustainability issues that did not meet SASB's materiality threshold at present, but could have a material impact on the Metals & Mining industry in the future.

Employee Recruitment, Development, and Inclusion: The Metals & Mining industry, which has global operations, is facing an impending shortage of experienced and skilled workers. A significant proportion of the workforce is close to retirement and there is a need for more workers due to rapid growth in the industry.

At the same time, the industry has low representation of women and minorities in the workforce. Not only are there few women in the workforce and on the Boards of Metals & Mining companies, but there is also a pay gap between men and women at similar levels of responsibility. Remote locations of mining operations, among other factors, make mining activities less attractive for not only women but also younger workers looking for more flexibility in working conditions.

In the context of upcoming human capital needs of the industry and the lack of diversity in the workforce, companies that have a comprehensive recruitment and development strategy, which may include recruiting from a diverse talent base; ensuring equal career advancement opportunities; partnering with educational institutions; and employing and training local hires in international operations, could improve efficiencies and lower disruptions to operations in the future, as the skills gap becomes more acute.

While there is an emerging awareness and understanding of the business risks from the expected skills shortage, SASB’s analysis of companies’ 10-K and 20-F filings, shareholder resolutions, and other public documents shows that the evidence of interest in the topic is as yet weak. The business impacts of the skills shortage and implications for diversity in the workforce and training and development of workers in developing countries will likely become more apparent in the future.
APPENDIX I: Five Representative Companies | Metals & Mining

<table>
<thead>
<tr>
<th>COMPANY NAME (TICKER SYMBOL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rio Tinto (RIO)</td>
</tr>
<tr>
<td>Vale (VALE)</td>
</tr>
<tr>
<td>BHP Billiton (BBL)</td>
</tr>
<tr>
<td>Aluminum Corporation of China-ADR (ACH)</td>
</tr>
<tr>
<td>Alcoa (AA)</td>
</tr>
</tbody>
</table>

This list includes five companies representative of the Metals & Mining industry and its activities. This list includes only companies for which the Metals & Mining industry is the primary industry; companies that are U.S.-listed but are not primarily traded Over-the-Counter; and companies 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 18, 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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HM (1-100)</td>
<td>IWGs</td>
<td>EI Revenue &amp; Costs</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
<td>80*</td>
<td>86</td>
<td>4 High</td>
</tr>
<tr>
<td>Air Quality</td>
<td>80*</td>
<td>75</td>
<td>9 Medium</td>
</tr>
<tr>
<td>Energy Management</td>
<td>55*</td>
<td>92</td>
<td>3 High</td>
</tr>
<tr>
<td>Water Management</td>
<td>40</td>
<td>92</td>
<td>2 High</td>
</tr>
<tr>
<td>Waste &amp; Hazardous Materials Management</td>
<td>80*</td>
<td>92</td>
<td>8 High</td>
</tr>
<tr>
<td>Biodiversity Impacts</td>
<td>65*</td>
<td>78</td>
<td>6 Medium</td>
</tr>
<tr>
<td>Community Relations</td>
<td>40</td>
<td>94</td>
<td>1t High</td>
</tr>
<tr>
<td>Security, Human Rights, and Rights of Indigenous Peoples</td>
<td>N/A</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Workforce Health, Safety, and Well-being</td>
<td>80*</td>
<td>94</td>
<td>1t High</td>
</tr>
<tr>
<td>Labor Relations</td>
<td>55*</td>
<td>92</td>
<td>5 High</td>
</tr>
<tr>
<td>Business Ethics &amp; Payments Transparency</td>
<td>60*</td>
<td>92</td>
<td>7 High</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 &amp; Hazardous Materials Management</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Biodiversity Impacts</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Community Relations</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Security, Human Rights, and Rights of Indigenous Peoples</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>Labor Relations</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Business Ethics &amp; Payments Transparency</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
APPENDIX III: Sustainability Accounting Metrics | Metals & Mining

<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 CO₂-e, Percentage (%)</td>
<td>NR0302-01</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>NR0302-02</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Air emissions for the following pollutants: CO, NO (excluding N₂O), SO₄, particulate matter (PM), mercury (Hg), lead (Pb), and volatile organic compounds (VOCs)</td>
<td>Quantitative</td>
<td>Metric tons (t)</td>
<td>NR0302-03</td>
</tr>
<tr>
<td>Energy Management</td>
<td>Total energy consumed, percentage grid electricity, percentage renewable</td>
<td>Quantitative</td>
<td>Gigajoules (GJ), Percentage (%)</td>
<td>NR0302-04</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 (m³), Percentage (%)</td>
<td>NR0302-05</td>
</tr>
<tr>
<td></td>
<td>Number of incidents of non-compliance with water-quality permits, standards, and regulations</td>
<td>Quantitative</td>
<td>Number</td>
<td>NR0302-06</td>
</tr>
<tr>
<td>Waste &amp; Hazardous Materials Management</td>
<td>Total weight of tailings waste, percentage recycled</td>
<td>Quantitative</td>
<td>Metric tons (t), Percentage (%)</td>
<td>NR0302-07</td>
</tr>
<tr>
<td></td>
<td>Total weight of mineral processing waste, percentage recycled</td>
<td>Quantitative</td>
<td>Metric tons (t), Percentage (%)</td>
<td>NR0302-08</td>
</tr>
<tr>
<td></td>
<td>Number of tailings impoundments, broken down by MSHA hazard potential</td>
<td>Quantitative</td>
<td>Number</td>
<td>NR0302-09</td>
</tr>
<tr>
<td>Biodiversity Impacts</td>
<td>Description of environmental management policies and practices for active sites</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0302-10</td>
</tr>
<tr>
<td></td>
<td>Percentage of mine sites where acid rock drainage is: (1) predicted to occur, (2) actively mitigated, and (3) under treatment or remediation</td>
<td>Quantitative</td>
<td>Percentage (%)</td>
<td>NR0302-11</td>
</tr>
<tr>
<td></td>
<td>(1) Proven and (2) probable reserves in or near sites with protected conservation status or endangered species habitat</td>
<td>Quantitative</td>
<td>Metric tons (t), Grade (%)</td>
<td>NR0302-12</td>
</tr>
</tbody>
</table>
### APPENDIX III: Sustainability Accounting Metrics | Metals & Mining (cont.)

<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>Community Relations</td>
<td>Discussion of process to manage risks and opportunities associated with community rights and interests</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0302-13</td>
</tr>
<tr>
<td></td>
<td>Number and duration of non-technical delays</td>
<td>Quantitative</td>
<td>Number, Days</td>
<td>NR0302-14</td>
</tr>
<tr>
<td>Security, Human Rights, and Rights of Indigenous Peoples</td>
<td>(1) Proven and (2) probable reserves in or near areas of conflict</td>
<td>Quantitative</td>
<td>Metric tons (t), Grade (%)</td>
<td>NR0302-15</td>
</tr>
<tr>
<td></td>
<td>(1) Proven and (2) probable reserves in or near indigenous land</td>
<td>Quantitative</td>
<td>Metric tons (t), Grade (%)</td>
<td>NR0302-16</td>
</tr>
<tr>
<td></td>
<td>Discussion of engagement processes and due diligence practices with respect to human rights, indigenous rights, and operation in areas of conflict</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0302-17</td>
</tr>
<tr>
<td>Workforce Health, Safety, and Well-Being</td>
<td>(1) MSHA All-Incidence Rate, (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>NR0302-18</td>
</tr>
<tr>
<td>Labor Relations</td>
<td>Percentage of active workforce covered under collective-bargaining agreements, broken down by U.S. and foreign employees</td>
<td>Quantitative</td>
<td>Percentage (%)</td>
<td>NR0302-19</td>
</tr>
<tr>
<td></td>
<td>Number and duration of strikes and lockouts[^1]</td>
<td>Quantitative</td>
<td>Number, Days</td>
<td>NR0302-20</td>
</tr>
<tr>
<td>Business Ethics &amp; Payments Transparency</td>
<td>Description of the management system for prevention of corruption and bribery throughout the value chain</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0302-21</td>
</tr>
<tr>
<td></td>
<td>Production in countries that have the 20 lowest rankings in Transparency International’s Corruption Perception Index</td>
<td>Quantitative</td>
<td>Metric tons saleable (t)</td>
<td>NR0302-22</td>
</tr>
</tbody>
</table>

[^1] Note to NR0302-20 – Disclosure shall include a description of the root cause for each work stoppage.
APPENDIX IV: Analysis of 10-K Disclosures | Metals & Mining

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

![Graph showing the percentage of disclosures for various sustainability topics in Metals & Mining companies. The graph is divided into categories such as Greenhouse Gas Emissions, Air Quality, Energy Management, Water Management, Waste & Hazardous Materials Management, Biodiversity Impacts, Community Relations, Security, Human Rights of Indigenous Peoples, Workforce Health, Safety, and Well-being, Labor Relations, and Business Ethics & Payments Transparency. Each category is further divided into No Disclosure, Boilerplate, Industry-Specific, and Metrics subcategories. The percentage of IWG participants that agreed each topic was likely to constitute material information for companies in the industry is also shown.]

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

1 Author’s calculations based on Bloomberg data: BICS value of industry revenue data using globally listed companies accessed on June 19, 2013.

2 Author’s calculations based on Bloomberg data: BICS value of industry revenue data using globally listed companies accessed on June 19, 2013.


14 Author’s calculations based on Bloomberg data: BICS value of industry revenue data using globally listed companies accessed on August 2, 2013.


30 Author’s calculations based on EPA’s 2011 Greenhouse Gas Reporting Program data from http://www.epa.gov/ghgreporting/ghgdata/reported/index.html

References (cont.)


References (cont.)

60 Freeport-McMoRan Copper & Gold. Form 10-K. 2012.  
61 Freeport-McMoRan Copper & Gold. Form 10-K. 2012.  
71 “Cleanup Agreement Reached at Former Uranium Mine on Spokane Indian Reservation in Northeastern Washington.” Environmental Protection Agency. [http://www.epa.gov/environmentalprotection/cases/ercila/midnitemine/index.html]  
73 Freeport-McMoRan Copper. Form 10-K, Item 1, 2012.  
References (cont.)


92 Freeport-McMoRan Copper & Gold. Form 10-K. 2012.


97 Rio Tinto. FY 2012 Form 10-K.


100 http://opinionator.blogs.nytimes.com/2013/02/13/avoiding-the-curse-of-the-oil-rich-nations


104 World Resources Institute, “BREAKING GROUND Engaging Communities in Extractive and Infrastructure Projects.” 2009.


© 2014 SASB™
References (cont.)


113 Author’s calculations based on 2012 data from Bureau of Labor Statistics.


120 Newmont Mining Corp. FY2013 Form 10-K

121 Freepost-McMoran. FY2013 Form 10-K.

122 Alcoa Inc. FY2013 Form 10-K


129 Anglogold Ashanti. FY2013 Form 10-K.


