COAL OPERATIONS
Research Brief

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

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

Related Documents

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

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For example, China is the largest consumer and one of the largest producers of coal in the world. However, as cleaner sources of energy such as natural gas and solar are gaining traction, the industry has to innovate to reduce the environmental impacts of not only its operations but also downstream.

Coal mining operations are resource-intensive and working conditions for miners can be dangerous. Regulatory action and public expectations for environmental performance and worker health and safety are intensifying in the face of global challenges such as climate change and economic development in many parts of the world. Therefore, management (or mismanagement) of material sustainability issues has the potential to affect company valuation through impacts on profits, assets, liabilities, and cost of capital.

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

Specifically, performance on the following sustainability issues will drive competitiveness within the Coal Operations industry:

- Reducing fugitive methane and direct greenhouse gas (GHG) emissions;

### SUSTAINABILITY DISCLOSURE TOPICS

**Environment**
- Greenhouse Gas Emissions
- Water Management
- Waste Management
- Biodiversity Impacts

**Social Capital**
- Community Relations & Rights of Indigenous Peoples

**Human Capital**
- Workforce Health, Safety, and Well-being
- Labor Relations

**Leadership and Governance**
- Reserves Valuation & Capital Expenditures

### INTRODUCTION

The Coal Operations industry, which is responsible for mining and processing coal, plays a critical role in modern life. Coal is currently used to produce 40 percent of global electricity¹ and 70 percent of global steel.² As such it fuels economic growth, particularly for emerging economies.
• Managing water use and impacts on local water systems;
• Managing, treating, and safely disposing of waste;
• Mitigating biodiversity impacts from operations;
• Maintaining social license to operate through developing strong relations with local communities, including indigenous people, at all project stages;
• Ensuring worker health and safety to reduce injuries and fatalities in a high risk environment;
• Managing labor relations; and
• Incorporating environmental considerations into the valuation of coal reserves and long-term business strategy.

INDUSTRY SUMMARY

The Coal Operations industry includes companies that mine coal and those that manufacture coal products. Mining represents a major fraction of the industry’s global revenue, 92.6 percent, compared to the rest, 7.4 percent, from the manufacture of coal products and mining support services. The mature industry has global revenues of nearly $500 billion. Net income margins of the top industry players (companies in Appendix I, such as Peabody Energy and Alpha Natural Resources) varied widely according to data for fiscal year (FY) 2013, ranging from -22.5 percent to 17.9 percent. For U.S. companies, the purchase of explosives, consumable parts of machinery, and fuels is a major cost (31.3 percent of revenue) followed by wages, which constitute 13.9 percent of revenue.

In 2012, the two largest coal-producing countries, U.S. and China, together produced over half of the world’s coal. In terms of world regions, the Asia-Pacific produced 67.8 percent of coal, followed by North America at 14.5 percent and Eurasia at 12.2 percent. Lastly, Africa and South and Central America combined produced less than 6 percent of world coal in 2012. Typically, U.S. coal mining companies have domestic operations, however, both of the largest U.S.-listed companies, Yanzhou Coal and Peabody Energy, have operations in Asia-Pacific, namely China, Mongolia, Indonesia, and Australia.

Most of the coal mined in the U.S. is consumed domestically and faces competition from natural gas as a substitute in electricity generation.

1 Industry composition is based on the mapping of the Sustainable Industry Classification System (SICS™) to the Bloomberg Industry Classification System (BICS).
As thermal coal faces increasing competition from cheap natural gas and is at regulatory risk due to its emissions potential, companies are shifting production towards higher-priced metallurgical coal. Coal mining costs are rising since more accessible reserves have already been mined and due to rising input costs such as transportation, explosives, and labor. With falling margins, the industry is consolidating as a means of streamlining operations, increasing economies of scale, and enhancing profits.

Growing demand from emerging economies and stronger domestic regulation and public concerns about coal have led domestic producers to increase exports. Environmental regulations like California’s AB32 and the Northeast’s Regional Greenhouse Gas Initiative, which limits emissions from utilities and industrial facilities, have put downward pressure on coal consumption. Emerging economies continue to consume coal. However, shipping costs make it profitable to export coal only when world prices are high.

Coal operations are fraught with risks to the environment, local communities, and miners. Companies will have to balance increased cost of mining and tough competition from natural gas, along with regulations and significant environmental and social issues affecting the industry or its customers, discussed below, in order to protect shareholder value over the long term. Companies that manage these trends successfully will be able to capture opportunities for growth and attain a stronger competitive position.

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**LEGISLATIVE AND REGULATORY TRENDS IN THE COAL OPERATIONS INDUSTRY**

Due to the potential for environmental impact and employee safety concerns in this industry, coal mining is one of the most extensively regulated industries in the U.S. The following section provides a brief summary of key regulations and legislative efforts related to this industry.¹

Coal mining as a commercial venture has been around for more than 250 years in the U.S. The Bureau of Mines was established in 1910 following the highest death toll in coal mining with 3,200 deaths in 1907. However, it was not until the Federal Coal Mine Safety Act of 1952 and the Federal Coal Mine Health and Safety Act of 1969 that regulation required multiple annual inspections of mines, established monetary penalties for non-compliance, and established a provision for compensation for miners with black lung disease. Under the Black Lung Benefits Revenue Act of 1977 and the Black Lung Benefits Reform Act of 1977, coal companies must secure payment of black lung benefits to claimants who are current and former employees and to a trust fund for the payment of benefits and medical expenses to claimants who last worked in the coal industry prior to 1973.

More recently, the Mine Improvement and New Emergency Response Act of 2006 (MINER)

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¹ This section does not purport to contain a comprehensive review of all regulations related to this industry, but is intended to highlight some ways in which regulatory trends are impacting the industry.
introduced a number of provisions to improve safety and health in America’s mines. Signed into law in 2010, the Patient Protection and Affordable Care Act and Health Care and Education Reconciliation Act also amended previous legislation related to black lung disease to provide an automatic extension of awarded lifetime benefits to surviving spouses and change the legal criteria used to assess and award claims.

The Clean Air Act (CAA) created a demand for low-sulfur coal, mined primarily in surface mines in the western U.S. The rise in surface mining (of low-sulfur coal) in the western states in the late 1970s resulted in the enactment of the Surface Mining Control and Reclamation Act for strict regulation of surface mining. Deregulation in the electricity sector led to an increase in natural gas power plant construction and a decline in new coal plant construction in the 1990s. In addition to mining and land reclamation laws, operators must comply with other local, state, and federal laws and programs to maintain a permit to mine coal. It can take several years to complete the permitting processes before any coal can be mined.

Many other federal laws also 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.

In addition to these regulations, initiatives by industry bodies (including collaboration with government agencies) may create competitive drivers for the industry to act on environmental and social issues. The Coalbed Methane Outreach Program is a voluntary program that has assisted the coal mining industry in increasing its methane recovery by 50 percent between 1994 and 2009. Methane release from coalbeds is a major source of direct greenhouse gas emissions from coal mining that also impacts employee safety through the increased likelihood of explosions.

The coal mining industry faces regulatory uncertainty with respect to emissions. The U.S. Environmental Protection Agency announced in May 2013 that it will not restrict emissions of coalbed methane, nitrogen dioxide, volatile organic compounds, and particulate matter from coal mining operations. In contrast, the following month President Obama specifically mentioned mitigating methane emissions in his climate action plan. As coalbed methane contributes to over ten percent of total U.S. methane emissions, it is a likely focus of the President’s plan.

The Office of Surface Mining (OSM) is the primary Federal agency responsible for abandoned coal mine reclamation. It is a national program, established by law since 1977, which includes an inventory of high priority sites, a reclamation fee paid by the coal mining industry, and a funding mechanism comprised largely of grants to states and Indian tribes. The program prioritizes sites posing health
and safety hazards. In contrast, the Federal government follows a ‘polluter pays’ principle for abandoned hardrock metal mines, seeking out the responsible parties to clean up sites or cover costs of cleaning. The program has reclaimed nearly 240,000 acres that were plagued with hazardous coal-related problems, eliminated safety and environmental hazards on almost 315,000 acres containing coal or non-coal problems, and addressed nearly 8,000 emergencies.

Mine safety and environmental regulations are more lax in emerging economies like China and Indonesia. However, current and impending regulations on coal power plants in the U.S. and China will impact the industry by dampening demand. In September 2011, China’s Ministry of Environmental Protection announced new standards for NOx, mercury, SO2, and particulate matter emissions from power plants. President Obama’s Climate Action Plan of 2013 specifically targets coal power plants as a significant source of greenhouse gas (GHG) reduction. In June 2014, the U.S. Environmental Protection Agency (EPA) proposed a regulation to reduce carbon dioxide emissions from existing coal plants by up to 30 percent by 2030 compared with 2005 levels. This is likely to have a drastic impact on demand for coal.

Furthermore, regulations like Australia’s carbon price mechanism, which applies to companies that directly emit at least 25,000 metric ton of carbon dioxide each year from non-liquid fuels, will impact mining companies both by imposing a new carbon tax and by dampening demand for their output. In addition, environmental groups are increasingly putting pressure on reducing dependence on coal. The Sierra Club’s major campaign, Beyond Coal, is a sustained and well-funded effort to replace coal with clean energy. One of the main goals of the campaign is to retire a third of the nation’s coal power plants within the decade.

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**SUSTAINABILITY-RELATED RISKS & OPPORTUNITIES**

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

Broad industry trends and characteristics are driving the importance of sustainability performance in the Coal Operations industry:

- **Resource intensity**: An energy and water-intensive process that is easily impacted by rising fuel costs and water scarcity;

- **Negative externalities**: The nature of large-scale mining that often displaces communities and/or affects the health and environment of the locality;
• **Worker safety:** The fundamental processes, though now largely automated, that still require miners to work underground and expose them to health and safety risks;

• **Shifting markets:** A growing international market and lagging domestic market that increases pressure to export coal while managing the increasing costs of mining and shipping.

As described above, the regulatory and legislative environment surrounding the Coal Operations 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 Coal Operations 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.

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**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 coal ore, fossil fuels, and water are key inputs for the coal operations industry. In addition, the industry’s operations have significant impacts on the environment, due to resources management and externalities. As it becomes more difficult to extract coal, rising fuel costs, water constraints, and environmental regulation put downward pressure on profit margins.

Investors must understand how individual companies within this industry manage these risks and innovate to reduce the environmental impacts of their operations.

**Greenhouse Gas Emissions**

Coal mining is energy-intensive – at 370,628 Btu/ton of coal mined, it requires seven times the energy needed to mine industrial metals like phosphate, stone, sand, and gravel. The sources of GHG emissions for coal operations are carbon dioxide from gasoline, diesel, natural gas, steam, coal, and propane and methane.
released from coal beds during mining and post-mining activities. Additional sources of emissions arise from land use change, particularly for surface mining and mountain top removal which requires clearing large areas of land.

Significant contributors of GHG emissions, such as companies in the coal operations industry, are at regulatory risk from current and future regulation pertaining to GHG reporting, limits on emissions, and carbon taxes.

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 production of coal is a carbon-intensive process. While exact numbers for carbon intensity varies, Teck Resources, a Canadian natural resources company, reports emitting between 0.05 and 0.12 metric tons of carbon dioxide equivalent per metric ton of coal produced at their mines, including direct carbon dioxide emissions, methane releases, and emissions from purchased electricity.²²

The EPA estimates that coal mining contributed 63.2 million metric tons of carbon dioxide equivalent emissions from methane release in 2011, greater than ten percent of total domestic methane emissions for the year.²³ Carbon regulations directly impact the industry through increased costs of fuel use due to limits on emissions and/or carbon prices. An indirect channel of impact is decreased demand for coal and electricity generated from coal because of its GHG-intensity. The indirect impact is further explored under the Reserves Valuation and Capital Expenditures disclosure topic. A study on the impact of climate change on institutional investment portfolios identifies the coal industry among sectors that are highly sensitive to a climate change regulations due to its energy-intensity and the declining demand from power utilities and iron and steel manufacturers.²⁴

Companies with mining operations overseas are facing increasing regulatory pressure. Carbon markets already exist in several regions, like western Canada, Australia, and Europe. The level of the impact on companies is directly related to the carbon pricing framework. For example, Peabody Energy Corporation in its Form 10-K recognized expenses of approximately $40 million and $15 million in 2013 and 2012 respectively based on the Australian government’s carbon pricing framework with an initial carbon price of $23 Australian dollars per metric ton of carbon dioxide equivalent emissions. The carbon price was expected to increase by 2.5 percent annually until transitioned to an emission trading scheme after June 30, 2015.²⁵ Furthermore, the Australian Land and Environment Court delivered a decision in 2011 requiring the owner of Ulan coal mine to offset part of the GHG emissions from the mine as a condition for approval of mine expansion in New South Wales.²⁶
under management of Xstrata, a large natural resources entity listed on the London and Hong Kong stock exchanges.

In 2009, the U.S. Environmental Protection Agency (EPA) made GHG reporting mandatory for large emitters in the U.S., including underground coal mines. Underground mines that emit a minimum of 36.5 million cubic feet of methane are required to report their emissions. Methane emissions from surface and abandoned mines are considered fugitive emissions and reporting is not required. President Obama’s Climate Action Plan of 2013 includes new rules to curb GHG emissions, which increases the likelihood of regulation of coalbed methane. Major coal companies including, Consol Energy and Alpha Natural Resources, reports the risk of coalbed methane regulations in their FY2013 Form 10-K, “Our gas operations capture coalbed methane from our underground coal mines, although some coalbed methane is vented into the atmosphere when the coal is mined. If regulation of GHG emissions does not exempt the release of coalbed methane, we may have to further reduce our methane emissions, pay higher taxes, incur costs to purchase credits that permit us to continue operations as they now exist at our underground coal mines or perhaps curtail coal production.”

**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. Furthermore, as a relatively large emitter of GHG emissions, the Coal Operations 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.

**Water Management**

Coal mining is water-intensive and the process has impacts on both quality and quantity of local water resources. Water is becoming a scarce resource around the world due to increased consumption from population growth and rapid urbanization, and reduced supplies due to climate change. Furthermore, water pollution from industrial and commercial processes makes available water supplies unusable or expensive to treat.

One of the several ways that coal mining impacts local water sources is through the disposal of overburden. Mountain-top removal entails removing layers of rock and dirt above coal beds to reach the lucrative parts of the mountain. The waste rock and dirt, known as overburden, is usually discarded in nearby val-
leys, a practice that can bury streams, contami-
nate local water sources and increase risks of
flooding.

Water is used for coal cutting and dust sup-
pression, washing, and transportation. Coal is
often washed with water and chemicals to re-
move sulphur to meet the requirements of the
CAA. As discussed under waste management,
the waste water is not classified as hazardous
waste by the EPA. This is a water-intensive pro-
cess that can create strains on local resources
in water-scarce regions. After extraction, coal
is sometimes transported in a slurry pipeline by
mixing water with finely grounded coal. This
process is extremely water-intensive adding
to the burden coal mining can place on local
water supplies. The federal Clean Water Act
(CWA) and corresponding state laws mandate
treatment of wastewater prior to discharging
into water bodies.

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 re-
cycled, percentage in water-stressed regions;
and
- Number of incidents of non-compliance with
water quality permits.

Evidence

The industry has had and continues to have
a negative impact on the environment across
the globe. According to the Chinese Ministry
of Water Resources and the National Bureau of
Statistic, roughly 28,000 rivers have vanished
since 1990.30 The EPA estimates that mountain-
top removal for coal mining has buried almost
2,000 miles of Appalachian headwater streams
affecting water quality and biodiversity in
the area.31

The U.S. Department of Energy reports that
total water used for coal mining in the United
States ranges from 70 million to 260 mil-
ion gallons a day.32 Coal industries, including
mining and power generation, use an esti-
mated 17 percent of China’s water. At least 80
percent of mines are located in areas that the
UN considers “stressed” for water or have an
“absolute scarcity”.33

Coal operations not only contribute to this
problem but are also impacted by the lack of
water resources. Caps on water usage were
introduced in the four biggest coal-producing
regions in China to limit growth in water use to
only 2.9 percent annually while coal output is
set to increase by almost 5 percent.34 In its CDP
report South Africa-based coal operator Exxaro
Resources Limited discloses that 100 percent
of the operations are located in water-stressed
regions. The risks that company identifies are
related to inadequate water infrastructure and
flooding.35
Major industry players including Arch Coal, Alpha Natural, Walter Energy, and Consol recognize the potential impact of violating the limits on the concentration of selenium, sulfate, and dissolved solids in drainage from operations. In its FY2012 Form 10-K, Arch Coal cites that these violations “could lead to significant penalties, compliance costs and delays in coal production.”

Patriot Coal, another coal company, has been involved in several legal proceedings related to compliance with the effluent selenium limits of their mining permits. In the past, this has resulted in fines and penalties with respect to violations of these limits. In its 2012 Form 10-K, the company states that “[t]he asset retirement obligation expense included adjustments to increase the selenium water treatment liability by $258.3 million, $35.0 million and $69.5 million for the years ended December 31, 2012, 2011 and 2010, respectively, due to modifications to [their] selenium water treatment plan.”

In March 2014 Alpha Natural Resources was fined $27.5 million for toxic discharges from its mines in five states. The company also agreed to spend about $200 million on implementing an environmental management system, expanding its auditing/reporting protocol, and installing selenium and osmotic pressure treatment facilities. Allegedly, between 2006 and 2013 the company exceeded water pollution limits of state permits 6,289 times which includes such pollutants as iron, aluminum, selenium, and manganese. The fine is the largest ever imposed for water pollution violations ever which indicates a serious intentions of the EPA and the DOJ not to tolerate such kind of violations in the future.

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 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 substantial 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 protest.

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 multiple regions as human consumption rises with higher standards of living, existing sources become unfit for use due to pollution, and climate change causes variations in precipitation patterns. Therefore, the probability and magnitude of the impact of water management on financial results in this industry is likely to increase in the near term.
Waste Management

Coal mines generate three main types of waste:

- Solid rock and clay waste - overburden and interburden found above and below the coal seam, respectively;
- Refuse or coarse-grained waste material produced during processing coal; and
- Liquid coal waste containing toxins like mercury, arsenic, and cadmium, which is generated from the process of crushing and washing coal.

The focus of this topic is the storage of liquid coal-mining waste in slurry ponds or impoundments. Coal slurry or tailings ponds can present a significant threat if the impoundments burst, collapse, or leak, leading to destruction of lives, property, and ecosystems. This ultimately leads to costs for companies in the form of regulatory penalties, compensation payments, and remediation or compliance obligations.

EPA’s Toxic Release Inventory process requires companies to report the use, manufacture, or processing of listed toxic materials that exceed defined thresholds, including chemicals used in equipment maintenance, reclamation and water treatment. The 1976 Resource Conservation and Recovery Act (RCRA) affects U.S. coal mining operations by establishing “cradle to grave” requirements for the treatment, storage, and disposal of hazardous wastes. However, this is limited to wastes generated at a mine site from products used in vehicles and for machinery maintenance. Of note is the fact that certain wastes, such as coal cleaning wastes and solid waste from the extraction and processing of coal, are currently not categorized as hazardous waste under RCRA. Improper handling of these wastes can leave companies vulnerable to future legal action by those affected in the surrounding communities.

Ultimately, companies’ ability to lower the number and size of tailings ponds and ensure the structural integrity of impoundments can help minimize impacts on company value. 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):

- Number of tailings impoundments, categorized by U.S. Mine Safety and Health Administration hazard potential.

Evidence

In the U.S., the average recovery rate for coal was 77 percent in 2011, far greater than the average recovery rate for metals. However, given the amount of coal mined, over 1 billion tons in the U.S. alone, the amount of solid waste generated is significant. Every year, an average of 70 to 90 million tons of coal preparation slurry are produced in the U.S. In the past, slurry would be discharged into streams and rivers, however, greater environmental
awareness and public concerns led to slurry being stored in constructed ponds. Since coarse coal waste was available in high volumes, they were used to construct the impoundments. However, mine wastes are ill-suited for this purpose.

In early 1970s, a mine-waste constructed dam in West Virginia collapsed, causing flooding that claimed 125 lives and destroying millions of dollars of property. Similarly, in 2000, a dam in Kentucky burst leaking 250 million gallons of coal waste into the Big Sandy River and its tributaries. More than 75 miles of the river were choked with thick sludge that destroyed all fish and river life. The spill affected 1,500 residences and the cleanup cost was estimated to be in the millions.

**Value Impact**

Companies that fail to reduce or properly manage waste from their operations are likely to face higher regulatory compliance costs and waste-handling costs compared to their peers that perform well on this issue. Permitting of mining operations may be affected, lowering a company’s revenue-earning potential, or require additional capital expenditures or other costs prior to approval. In addition, companies with poor management of the issue may face reputational damage and/or hurt their brand value, thereby impacting their intangible assets.

Particularly with respect to wastes that are not categorized as hazardous waste under RCRA, community concerns and possible legal action due to unintended negative impacts on the environment and public can lead to contingent liabilities and increase companies’ risk profile, resulting in an increase in the cost of capital.

**Biodiversity Impacts**

Surface mining and mountain top removal have a range of social and environmental consequences, including altering the landscape, removing vegetation and wildlife habitats, and disrupting local communities. Significant volumes of solid rock and clay waste – overburden and interburden found above and below the coal seam – is generated during mining. In addition, extensive reclamation is required to return land to a productive state. Acid mine drainage is particularly significant: It is highly acidic water, rich in heavy metals, that is formed when surface and shallow subsurface water comes into contact with coal mining overburden, and can have harmful effects on humans, animals, and plants.

The amount of coal that can be recovered from reserves varies by location. Both rock and clay waste and refuse are generally used during reclamation as fill. Ore processing operations often change the chemical composition and physical structure of the refuse. Therefore, solid mine waste can contain harmful toxins that are released into the environment if handled inadequately. The resulting soil and water contamination has significant negative impact on the environment and human health.

As previously mentioned, the SMCRA, administered by the Office of Surface Mining Reclamation and Enforcement (OSM), establishes mining, environmental protection and reclamation standards for surface and underground mining. 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 specific stan-
dards according to prior approved reclamation plan. This is a material cost to coal operations companies and include processes like “removing or covering refuse piles and settling ponds, water treatment obligations, and dismantling preparation plants, other facilities, and roadway infrastructure.”

As mentioned in the regulatory trends section, the OSM is the primary Federal agency responsible for abandoned coal mine reclamation with funds collected from the industry. In contrast, the Federal government follows a ‘polluter pays’ principle for abandoned hardrock metal mines. The difference in policy between cleanup of coal and metal mines poses regulatory uncertainty.

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):

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

Evidence

Water contamination risks remain after mines have been closed. Acid mine drainage is an environmental risk posed by both coal and metal mining. Acid mine drainage is a metal-rich water that results from overburden metals dissolving in acidic rain water. It is created when iron sulfide in overburden is oxidized and washed away with rain water. The metal-rich acidic drainage can poison waterways, at times reaching concentrations where the water can no longer support life. In the eastern U.S., more than 5,150 stream miles have lost aquatic life due to contamination, affecting recreational use, public drinking water, and industrial water supplies.

The OSM has identified more than 500 abandoned mining sites in Pennsylvania, Virginia, and West Virginia alone. The OSM estimated that at least $3.8 billion would be required to remedy the known acid mine drainage sites in this region.

In 2011, Alpha Natural Resources had a total of 279 environmental violations resulting in $180,700 in fines. Alliance Resource Partners, a coal producer and marketer, estimates the company’s total reclamation and mine-closing liabilities at $155.6 million by end of 2012. Alpha Natural Resources estimates the same at $856.7 million.

Mine closure plans must be established well in advance of closure so that all stages of the
mining operation occur with a future sight on how the area will be rehabilitated. Mine infrastructure, like tailing dams, emplacement areas, and creek diversion must be planned with restoration as an important end goal. Xstrata Coal spent AUD 8 million over two and a half years starting in 2002 to restore a single coal mine in Newcastle, Australia to grasslands for a range of sustainable land uses. Restoration included the re-establishment of a 500 meter section of Maryland Creek.

**Value Impact**

Poor management of biodiversity impacts can result in higher regulatory compliance costs and legal liabilities. Reducing both the probability and magnitude of occurrence of ecological impacts can enhance company brand value, increasing its intangible assets. Companies that place particular importance on remediation and rehabilitation of closed mines will likely generate less contingent liabilities for legal actions and face less resistance in developing new mines.

**SOCIAL CAPITAL**

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

Coal operations have significant impacts on local communities and it is important for companies to manage the concerns of these stakeholders. Companies performing poorly on such issues are generally impacted by their ‘social license to operate’ eroding or being completely taken away. This could be in the form of being denied regulatory permits, losing market share, or facing frequent disruptions to operations.

**Community Relations & Rights of Indigenous Peoples**

Collaborating with local communities is an important element of doing business in the coal mining industry. Without community consent, companies may not be able to attain necessary land permits or gain access to energy and water resources for their operations. Community engagement can “directly assist the company [to] achieve its corporate goals by defining areas where relations with the community might be unduly sensitive,” while making a valued contribution to local communities’ own development aspirations.

Coal mining can benefit community stakeholders through employment opportunities, revenue-sharing, and increased commerce. For these reasons, local officials may be particularly willing to invite mining companies to the community. However, on an individual level, communities may be apprehensive about the entry of a coal company. There can be
displacement of people, and negative impacts on health and loss of livelihood as a result of mining operations.

Local community engagement is made more complex by the global nature of operations. Companies may have mining sites abroad and addressing community needs and concerns will vary by location.

When a mine closes, it can have significant impact on the community through a reduction in employment opportunities and reduced social services. A report on case studies in Romania, Russia, and Ukraine found that mine closure had the most significant impact on employment and labor migration, municipal and social services, community cohesiveness, and the environment.59

Coal companies that are perceived as engaging in rent-seeking and exploiting a community’s resources without providing any socioeconomic benefits in return may be exposed to the risk of resource nationalism actions by host governments and communities that restrict their activities or impose additional costs. Furthermore, indigenous peoples are often the most vulnerable sections of the population, with limited capacity to defend their unique rights and interests.

Accounting for indigenous peoples’ rights could protect companies from protests, impacts of laws and international instruments governing such rights, and write-down of reserves located on indigenous peoples’ lands. 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, such as integrating community engagement into each phase of the project cycle. Companies are beginning to adopt a “shared value” approach to provide a key socioeconomic benefit to the community that also creates value for the company itself.

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

- Discussion of process to manage risks and opportunities associated with community rights and interests;
- Number and duration of non-technical delays; and
- Proven and probable reserves in or near indigenous land.

Evidence

Realizing the value to companies of community engagement, Rio Tinto is funding a study, expected to cost AUD 150,000, to gain a greater understanding of community through the analysis of cross-cultural negotiations between indigenous peoples and companies.60

BHP Billiton Mitsubishi Alliance’s (BMA) Community Partnership Program addresses local community needs by developing partnerships with various training and welfare organizations and the communities themselves. As the largest private employer of nearly 9,000 people in
Central Queensland, Australia, BMA operations provide many benefits to the nearby communities, including more than 40 percent of expenditure on equipment, materials, and services spent with local businesses.61

In South Africa, Xstrata Coal’s Commercial Farmer Settlement Project illustrates the potential of coal companies to invest in the community. The four farms within the project could generate a combined turnover of up to R 12.8 million each year and create 20-30 permanent jobs and 80-100 seasonal employment opportunities.62

Protests about the potential impact of clearing 4,000 acres of “culturally significant forest, artifacts and cultural values” for a Whitehaven Coal mine in New South Wales resulted in workers walking off site on July 8, 2013. The protesters are Gomeroi people who are traditional owners of the land in question.63

Value Impact
Effective community relations can help avoid costs through identifying risks and establishing community communication and preemptive and continual resolution of concerns. In addition, it can improve negotiation strategies, thereby expediting access to land permits and better revenue-sharing contracts. Poor management of this issue can result in delays to projects with large capital requirements, affecting overall profitability through additional cost and delayed revenue. It can also result in extraordinary expenses and contingent liability associated with legal actions. Legacy community impacts can affect a company’s social license to operate, thus increasing its risk premium and 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, and incentives and compensation, as well as the attraction and retention of employees in highly competitive or constrained markets for specific talent, skills, or education. It also addresses the management of labor relations in industries that rely on economies of scale and compete on the price of products and services. Lastly, it includes the management of the health and safety of employees and the ability to create a safety culture for companies that operate in dangerous working environments.

Coal mining is an inherently risky industry, often involving workers operating heavy machinery in dangerous conditions several hundred feet below surface. 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

Coal mining involves relatively high fatality and injury rates among miners. Even though coal mining processes have become increasingly automated over time, they are heavily reliant on miners to operate critical machinery. Most coal mine accidents occur as the result of cave-ins, methane explosions, or the flooding of mine shafts. More serious injuries and illnesses require days away from work to recuperate.

As mentioned in the regulatory trends section, the Federal Coal Mine Safety Act of 1952 and the Federal Coal Mine Health and Safety Act of 1969 that mandated annual inspections of mines, established monetary penalties, and made provisions for black lung disease compensation. In addition, the aforementioned 2010 health care legislations provided an automatic extension of awarded lifetime benefits to surviving spouses and amended the legal criteria used to assess and award claims. Although compliance with these regulations is costly, non-compliance has even greater costs through potential penalties and mine closures.

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; and
- Discussion of management of accidents and safety risks and long-term health and safety risks.

Evidence

The industry is characterized by high fatality rates. The rate of fatal injuries in the coal mining industry in 2011 was 17.4 per 100,000 fulltime equivalent workers, nearly five times the average rate of 3.5 fatal injuries for all U.S. industries. Also correlated with fatalities are number of days away from work for non-fatal illnesses and injuries. In 2008, coal miners averaged 31 days away from work compared to 8 days for all private industry.

In 2011, the U.S. Department of Labor’s Mine Safety and Health Administration recorded 21 fatalities and issued 93,451 citations amounting $119.7 million in the coal mining industry. While mine safety has improved in the U.S. and other developed economies, it has not elsewhere. In China, the largest producer of coal, there were 3,341 accidents in coal mines causing 5,986 death in 2005, according to the China Labour Bulletin. Poor safety records impact companies’ social license to operate.

In the wake of the April 2010 explosion that resulted in 29 miner fatalities in West Virginia, the state’s governor asked 290 underground mines in the state to halt production for a day to review safety issues. The mines employed about 15,000 workers and collectively produced nearly 400,000 tons of coal per day. The average daily cost of shutting an underground mine is $11,000, which translates to nearly $3.2 million in costs for the day. This is indicative of the prohibitive cost of mine closures for safety breaches.

The explosion occurred at Massey’s Upper Big Branch (UBB) mine in West Virginia in April 2010 and the company was acquired by Alpha
Natural Resources in 2011. Under a non-prosecution agreement, Alpha Natural Resources entered into a “comprehensive settlement with MSHA in which [the company] resolved various outstanding MSHA civil citations, violations and orders related to the UBB explosion and other matters for approximately $34.8 million.” The company also states in its FY2013 Form 10-K that “it is possible that other actions may be brought in the future.” According to a press release from the U.S. Attorney’s Office, Alpha Natural Resources agreed to make payments totaling $209 million in connection with the criminal investigations of events surrounding the explosion. This includes $46.5 million to the families of those minors lost and injured, over $80 million in safety enhancements at all of their underground mines, and the $34.8 million in penalties to MSHA.

Mining companies also incur costs associated with occupational illnesses. In 2012, Arch Coal recorded $72.9 million of expense related to the excise tax that secures payments for the trust fund of ex-employees effected by black lung disease. The excise tax charges up to $1.10 per ton of coal mined underground and up to $0.55 per ton of coal mined on the surface. The tax is capped at 4.4 percent of gross sales and only applies to coal sold domestically. Arch Coal spent an additional $16.5 million on MINER Act compliance and other safety improvement matters. Alliance Holding estimates that the impact of the 2010 health care acts mentioned above resulted in an estimated $8.3 million increase to its black lung obligation at December 31, 2010.

Companies are cognizant of the importance of establishing a strong safety culture to minimize risks to employees and contractors and already provide disclosures in Form 10-Ks around safety under Item 4 Mine Safety Disclosure. The type of information presented, however, varies. While all companies present number of fatalities per mine site, some go further in providing information on injury rates. Cloud Peak Energy, for example, states in its FY 2013 Form 10-K that its All Injury Frequency Rate (AIFR) for its three owned and operated mines was 0.59 and that there were no mining-related fatalities. Aside from the mandated disclosure under Item 4, other companies provide qualitative information on the issue. Arch Coal, for example, informs its shareholders about certain details of their safety programs and policies: “We have in place a comprehensive safety program that includes extensive health & safety training for all employees, site inspections, emergency response preparedness, crisis communications training, incident investigation, regulatory compliance training and process auditing, as well as an open dialogue between all levels of employees. The goals of our processes are to eliminate exposure to hazards in the workplace, ensure that we comply with all mine safety regulations, and support regulatory and industry efforts to improve the health and safety of our employees along with the industry as a whole.”

Value Impact

In an industry with higher than average accident and fatality occurrences, poor performance on this issue can increase regula-
tory compliance costs from more stringent oversight. Health and safety incidents can also result in downtime or operations at reduced capacity, and ultimately a loss of revenue-generating opportunities. 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.

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.

Labor Relations

Labor relations play an important role in coal companies’ operations. As coal is a commodity with competition mainly based on price, mining companies face inherent conflict between the need to lower the cost of labor and manage human resources to ensure long-term performance. In addition, jobs in mining are usually physically demanding and hazardous, and therefore unions play a key role in representing workers’ interests and managing collective bargaining for better wages and working conditions. This makes the management of labor relations critical, as conflict with workers can lead to extended periods of strikes, which slow or shut down companies’ operations causing losses and reputational risk.

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 under collective-bargaining agreements, for both U.S. and foreign employees; and
- Number and duration of strikes and lockouts.

Evidence

The unionization rates in the industry are varied. For example, in its FY 2013 10-K form Peabody Energy discloses that 35 percent of its 5,900 hourly employees were represented by organized labor unions. Moreover, the workers in Australia employed by the company through contract mining relationships are also members of trade unions. Walter Energy’s 10-K states that approximately 2,000 of their 3,600 salaried and hourly employees are covered by collective bargaining agreements. On the other hand, only 12 percent of the Alpha Natural Resources employees were affiliated with union representation with the United Mine Workers of America (“UMWA”) according to the company’s 2014 Form 10-K. In 2013, approximately 89 percent of the company’s coal production came from mines operated by union-free employees.

In their SEC filings, Peabody Energy and Alpha Natural Resources further recognize the risks associated with a potential increase in the unionization rates of their workforce. The quote from the Peabody 2014 10-K states: “If some or all of our current non-union operations were to become unionized, we could incur an increased risk of work stoppages, reduced productivity and higher labor costs. Also, if we fail to maintain good relations with our union workforce, we could experience labor disputes, work stoppages or other disruptions in production that could negatively impact our profitability.”
In February 2013, a workers union representing 3,000 workers went on strike at a Colombian mine owned by BHP Billiton, Xstrata and Anglo American, which exports over 30 million metric tons of coal per year. Among their demands were human, social, and environmental capital issues such as wage increases, occupational disease, and prohibition of diversion of 27 km of River Rancheria.83

Patriot Coal Corp. declared bankruptcy in July 2012 mainly due to weak coal markets and heavy pension and healthcare burden, asking for concessions from unions to stay in business. Patriot is seeking to impose $150 million a year in labor cuts and has proposed ceasing pension contributions and transferring healthcare to a Voluntary Employees’ Beneficiary Association (VEBA), giving the union a 35 percent equity stake in the reorganized company, which could be sold to help fund the VEBA. Without the cuts, Patriot Coal believes it would be forced to liquidate. The union has called the proposal unfair and staged heated rallies in St. Louis and New York.84

In the recent years, economic downturn and the government’s policies aimed at air pollution reduction led to a rapid fall in coal prices in China.85 Falling profits forced many of the small Chinese companies out of business while some major players had to reduce employee wages by up to 50 percent to cut losses.86

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 drastically impact the long-term profitability of the business and increase the risk profile and 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.

In the coal operations industry, the primary governance issue comes from the constraints that carbon regulations place on the valuation of reserves.
Reserves Valuation & Capital Expenditures

The Carbon Tracker Initiative\(^{87}\) and HSBC’s Global Research on Climate Change\(^{88}\) have estimated the scale of unburnable carbon listed on the world’s capital markets based on “current understanding of an allowable carbon budget to keep below two degrees of global warming.”\(^{89}\) In one scenario, the calculations are based on the maximum allowed level of GHG emissions that will result in no more than a two degree increase in the average global temperature. According to these estimates, a significant fraction of coal reserves, along with other fossil fuels, will not be burned and hence including them in fossil-fuel company valuation gives an artificially high value for companies with these unburnable assets.

As carbon markets form around the world — Australia, European Union, India, parts of the U.S. and Canada, among others — and stricter limits on GHG emissions loom in the horizon, companies in the business of extracting fossil fuels face the risk of asset write-off or a negative impact on asset valuation.

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):

- Sensitivity of coal reserve levels to future price projection scenarios accounting for a price on carbon emissions;
- Estimated carbon dioxide content emissions embedded in proven coal reserves; and
- Discussion of how climate regulation influences the capital expenditure strategy for exploration, acquisition, and development of assets.

Evidence

Following President Obama’s speech in June 2013 on how and when carbon emissions from power plants will be reduced, shares of Peabody Energy fell 3.2 percent and Walter Energy dropped 11.6 percent. Under the President’s climate action plan, mandatory GHG limits will be placed on all power plants and many subsidies to existing energy companies are at risk.\(^{90}\)

In developing countries, the World Bank has put severe limitations on financing coal-fired power plants and has increased focus on mitigating the effects of climate change.\(^{91}\) Luke Popovich, a spokesman at the National Mining Association, said the U.S. will lose coal mining jobs as a result of a smaller export market. The association’s members include Peabody Energy Corp., the largest U.S. coal producer.\(^{92}\)

According to an HSBC stranded asset risk assessment, a weakening coal market could impact valuations of coal assets as much as 44 percent.\(^{93}\) Impact could be as much as -15 percent on valuation of coal-heavy miners such as Xstrata.\(^{94}\)

Most of the top companies in the industry already recognize the risks stemming from GHG emissions regulations in their annual SEC filings, and the impact on demand for coal.
Alpha Natural Resources, for example, informs its shareholders in its FY 2013 Form 10-K that “coal-fired generators could switch to other fuels that generate less of these emissions, possibly reducing the construction of coal-fired power plants or causing some users of [their] coal to switch to a lower CO₂ generating fuel.” The company acknowledges that this may result in an indeterminate decrease in demand for coal nationally; further recognizing these regulations may also impact the price of coal and the cost of coal. Furthermore, the company mentions that “the majority of our coal supply agreements contain provisions that allow a purchaser to terminate its contract if legislation is passed that either restricts the use or type of coal permissible at the purchaser’s plant or results in specified increases in the cost of coal or its use to comply with applicable ambient air quality standards.”

Several other companies, including Consol Energy, Walter Energy, and Arch Coal, among others, provide similar disclosures.

In addition to identifying these risks, some companies provide disclosure on price sensitivity analysis in their FY 2013 Form 10-Ks. For example, Walter Energy mentions that global metallurgical coal pricing is volatile and that “in light of this volatility, the Company performed a sensitivity analysis and noted that a sustained price decrease of 5 percent over and above the prices used in the analysis through the life of all its mines would result in a potential impairment of coal reserves.” The company does not mention climate change regulations as a factor considered in this analysis, however, when such regulations are implemented, coal prices are likely to be affected.

Value Impact

Regulatory limits on GHG emissions and the development of alternative energy, as well as new policies limiting financing of coal-fired power plants could lower the global demand for coal. This could reduce the price of coal and decrease the net present value of coal reserves. As a result, there could be a significant correction in the market value of companies’ assets, as well as a material impact on future growth prospects and cost of capital. Companies at risk may face higher cost of capital and restricted access to refinancing.

The magnitude and probability of impacts of climate change regulation on reserves valuation and capital expenditures are likely to increase in the medium term, particularly towards 2020, when the global emissions trajectory begins to deviate significantly from the required path to keep temperature increases to below two degrees Celsius.
APPENDIX I: Five Representative Companies | Coal Operations

<table>
<thead>
<tr>
<th>COMPANY NAME (TICKER SYMBOL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yanzhou Coal – ADR (YZC)</td>
</tr>
<tr>
<td>Peabody Energy (BTU)</td>
</tr>
<tr>
<td>Alpha Natural Resources (ANR)</td>
</tr>
<tr>
<td>Alliance Resource Partners (ARLP)</td>
</tr>
<tr>
<td>Walter Energy (WLT)</td>
</tr>
</tbody>
</table>

This list includes five companies representative of the Coal Operations industry and its activities. This list includes only companies for which the Coal Operations 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>Revenue &amp; Costs</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
<td>80*</td>
<td>82</td>
<td>High</td>
</tr>
<tr>
<td>Water Management</td>
<td>30</td>
<td>91</td>
<td>2 Medium</td>
</tr>
<tr>
<td>Waste Management</td>
<td>75*</td>
<td>91</td>
<td>3 High</td>
</tr>
<tr>
<td>Biodiversity Impacts</td>
<td>50*</td>
<td>100</td>
<td>1t High</td>
</tr>
<tr>
<td>Community Relations &amp; Rights of Indigenous Peoples</td>
<td>23</td>
<td>91</td>
<td>5t</td>
</tr>
<tr>
<td>Workforce Health, Safety, and Well-being</td>
<td>80*</td>
<td>91</td>
<td>1t</td>
</tr>
<tr>
<td>Labor Relations</td>
<td>45</td>
<td>91</td>
<td>5t Medium</td>
</tr>
<tr>
<td>Reserves Valuation &amp; Capital Expenditures</td>
<td>N/A</td>
<td>82</td>
<td>4</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>COGS</td>
<td>R&amp;D</td>
</tr>
<tr>
<td>Greenhouse Gas Emissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Management</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Waste Management</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodiversity Impacts</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Relations &amp; 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>Reserves Valuation &amp; Capital Expenditures</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

- MEDIUM IMPACT
- HIGH IMPACT
## APPENDIX III: Sustainability Accounting Metrics | Coal Operations

<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><strong>Greenhouse Gas Emissions</strong></td>
<td>Gross global Scope 1 emissions, percentage covered under a regulatory program</td>
<td>Quantitative</td>
<td>Metric tons CO$_2$-e, Percentage (%)</td>
<td>NR0201-01</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>NR0201-02</td>
</tr>
<tr>
<td><strong>Water Management</strong></td>
<td>Total fresh water withdrawn, percentage recycled, percentage in regions with High or Extremely High Baseline Water Stress</td>
<td>Quantitative</td>
<td>Cubic meters (m$^3$), Percentage (%)</td>
<td>NR0201-03</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>NR0201-04</td>
</tr>
<tr>
<td><strong>Waste Management</strong></td>
<td>Number of tailings impoundments by MSHA hazard potential</td>
<td>Quantitative</td>
<td>Number</td>
<td>NR0201-05</td>
</tr>
<tr>
<td><strong>Biodiversity Impacts</strong></td>
<td>Description of environmental management policies and practices for active sites</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0201-06</td>
</tr>
<tr>
<td></td>
<td>Percentage of mine sites where acid rock drainage is: (1) predicted to occur, (2) actively mitigated, (3) under treatment or remediation</td>
<td>Quantitative</td>
<td>Percentage (%)</td>
<td>NR0201-07</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>Million metric tons (t)</td>
<td>NR0201-08</td>
</tr>
<tr>
<td><strong>Community Relations &amp; Rights of Indigenous Peoples</strong></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>NR0201-09</td>
</tr>
<tr>
<td></td>
<td>Number and duration of non-technical delays</td>
<td>Quantitative</td>
<td>Number, Days</td>
<td>NR0201-10</td>
</tr>
<tr>
<td></td>
<td>(1) Proven and (2) probable reserves in or near indigenous land</td>
<td>Quantitative</td>
<td>Million metric tons (t)</td>
<td>NR0201-11</td>
</tr>
<tr>
<td><strong>Workforce Health, Safety, and Well-Being</strong></td>
<td>(1) MSHA All-Incidence Rate, (2) Fatality Rate, and (3) Near-Miss Frequency Rate</td>
<td>Quantitative</td>
<td>Rate</td>
<td>NR0201-12</td>
</tr>
<tr>
<td></td>
<td>Discussion of management of accident and safety risks and long-term health and safety risks</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0201-13</td>
</tr>
</tbody>
</table>
### APPENDIX III: Sustainability Accounting Metrics | Coal Operations (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>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>NR0201-14</td>
</tr>
<tr>
<td></td>
<td>Number and duration of strikes and lockouts(^{vi})</td>
<td>Quantitative</td>
<td>Number, Days</td>
<td>NR0201-15</td>
</tr>
<tr>
<td>Reserves Valuation &amp; Capital Expenditures</td>
<td>Sensitivity of coal reserve levels to future price projection scenarios that account for a price on carbon emissions</td>
<td>Quantitative</td>
<td>Million metric tons (t)</td>
<td>NR0201-16</td>
</tr>
<tr>
<td></td>
<td>Estimated carbon dioxide content emissions embedded in proven coal reserves</td>
<td>Quantitative</td>
<td>Metric tons CO(_2)-e</td>
<td>NR0201-17</td>
</tr>
<tr>
<td></td>
<td>Discussion of how price and demand for coal and/or emissions regulations influence the capital expenditure strategy for exploration, acquisition, and development of assets</td>
<td>Discussion and Analysis</td>
<td>n/a</td>
<td>NR0201-18</td>
</tr>
</tbody>
</table>

\(^{vi}\) Note to NR0201-15 – Disclosure shall include the number, duration, and reason for the stoppage.
APPENDIX IV: Analysis of 10-K Disclosures | Coal Operations

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

<table>
<thead>
<tr>
<th>TYPE OF DISCLOSURE ON SUSTAINABILITY TOPICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Operations</td>
</tr>
<tr>
<td>0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%</td>
</tr>
<tr>
<td><strong>Greenhouse Gas Emissions</strong></td>
</tr>
<tr>
<td>82%</td>
</tr>
<tr>
<td><strong>Water Management</strong></td>
</tr>
<tr>
<td>91%</td>
</tr>
<tr>
<td><strong>Waste Management</strong></td>
</tr>
<tr>
<td>91%</td>
</tr>
<tr>
<td><strong>Biodiversity Impacts</strong></td>
</tr>
<tr>
<td>100%</td>
</tr>
<tr>
<td><strong>Community Relations &amp; Rights of Indigenous Peoples</strong></td>
</tr>
<tr>
<td>91%</td>
</tr>
<tr>
<td><strong>Workforce Health, Safety, and Well-being</strong></td>
</tr>
<tr>
<td>91%</td>
</tr>
<tr>
<td><strong>Labor Relations</strong></td>
</tr>
<tr>
<td>91%</td>
</tr>
<tr>
<td><strong>Reserves Valuation &amp; Capital Expenditures</strong></td>
</tr>
<tr>
<td>82%</td>
</tr>
</tbody>
</table>

IWG Feedback*

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

4. Author's calculations based on Bloomberg data: BICS value of industry revenue data using globally listed companies accessed on June 19, 2013.
5. Data from Bloomberg Professional service accessed on June 12, 2014, using the ICS <GO> command. The data represents global revenues of companies listed on global exchanges and traded over-the-counter from the Coal Operations industry, using Level 3 of the Bloomberg Industry Classification System.
6. Data from Bloomberg Professional service accessed on June 20, 2014, using the FA <GO> command for individual company tickers.
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