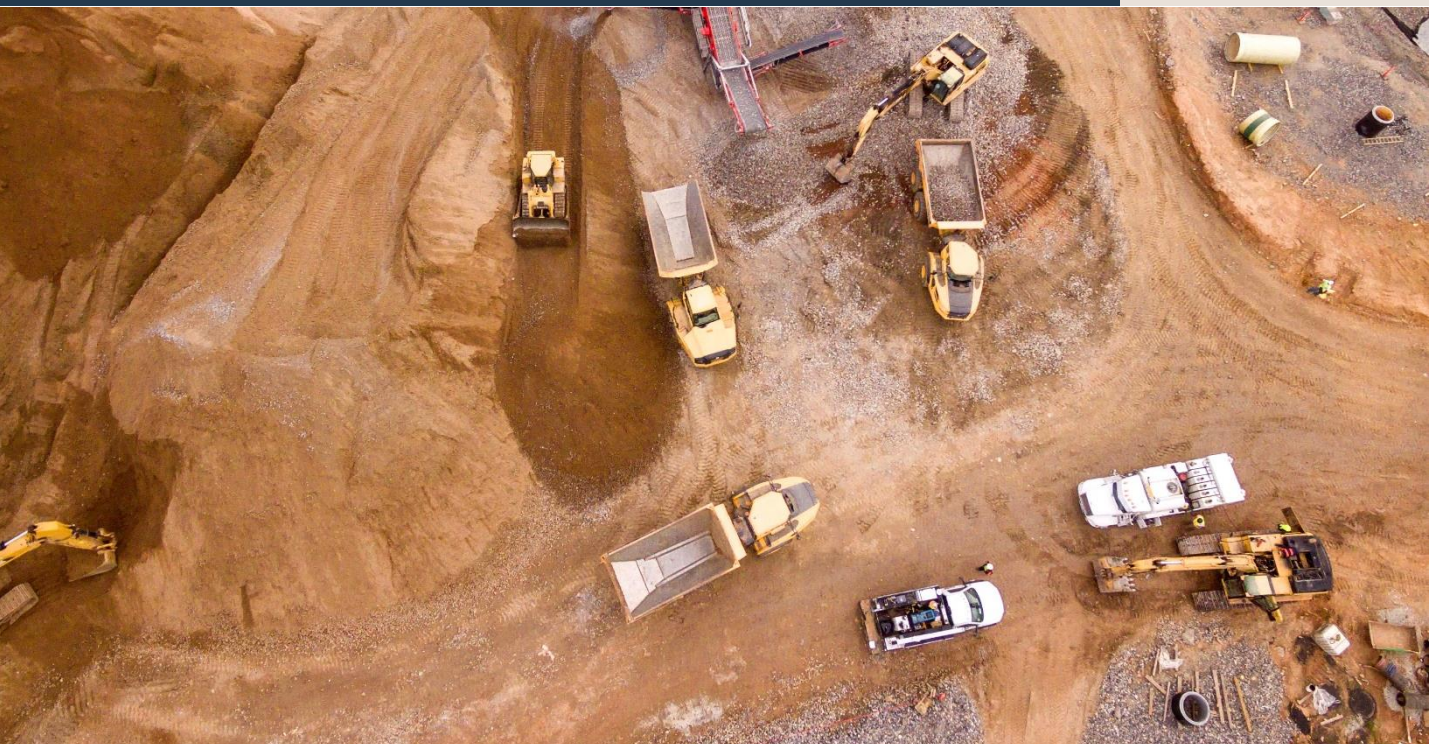


Resources: Metals and Mining

Sustainable Development Sector Analysis Framework

December 2019



This is a methodological document aimed at clarifying how Mirova takes into account sustainable development issues in the framework of the environmental, social and governance analysis of each sub-sector of activity.

An affiliate of:

Metals are crucial to the global economy through to their pervasive use in our daily lives: from industrial equipment and buildings, to cars and mobile phones, metals are used in a variety of modern applications. Yet their resources are finite and their recyclability rates remain low today. We will thus expect vertically-integrated companies to increase the share of metal recycling in their portfolio. In addition, while metals have no exclusive use, some are indispensable in sustainability applications that contribute to the transition to a low carbon economy, such as platinum used in catalytic converters to reduce pollution from traditional engines, and lithium in electric vehicle batteries. Because of their exposure to these metals, some mining companies will therefore be indirectly exposed to sustainability applications. From a sustainability perspective, the industry faces structural challenges related to working conditions and human rights and also engenders significant environmental impacts through to access to resources and waste disposal. Such spillovers are unlikely to decrease in light of falling iron grades globally and the consequent larger and deeper underground operations needed to attain them. Therefore, appropriate risk management will play a crucial role in our assessment of mining companies.

Sectors: Exploration & production of aluminium, diversified metals & mining, gold, precious metals & minerals, silver, and steel



Table of contents

Sustainability Opportunities	4
Sustainability Catalysts.....	4
Metal recycling.....	5
<i>Exposure to Opportunities</i>	7
Environmental and Social Risk	8
Environmental Impact of Process.....	8
Occupational Health and Safety	10
Human Rights and Local Communities	12
Human Resources.....	13
Business Ethics	13
Sustainable Development Governance	14
<i>Risk Assessment</i>	15
Conclusion	16
Our Approach to sustainability assessment	17
Sources	21



Sustainability Opportunities

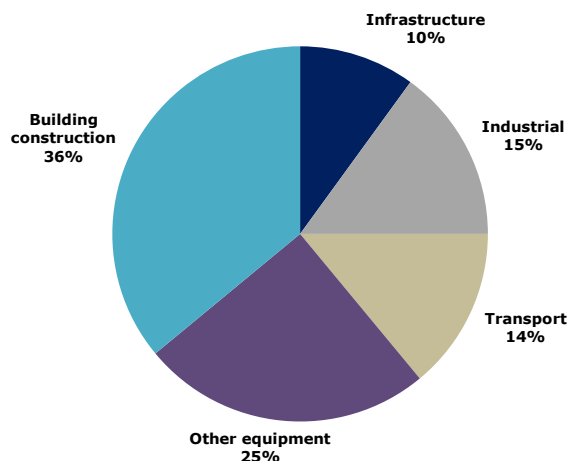
Sustainability Catalysts

Since the industrialisation, the way metals are used has evolved, with a number of new applications requiring the use of different types of metals, often in small quantities, such as IT, mobile equipment and renewable energies (e.g. solar panels). Traditional sectors, such as medical equipment and transport, have seen an evolution in the way metals are used and combined through technological development. Furthermore, with the exclusion of some specific technologies, such as lithium for batteries, metals usually have multiple end-uses.

Abundant metals

Bulk commodities such as iron ore and its derivative product, steel, are primarily used in the construction sector (over 50% of demand) (World Steel Association) as well as in the transport sector, especially advanced high-strength steels (AHSS) which we expect to make between 15% and 20% of light-weight vehicles until 2020 (Mirova, 2013). Steel is often combined with other base metals, such as zinc (60% of its end use) and nickel (70% of its end use) to improve its properties. Other base metals, such as aluminium and copper, have a wider field of application and can also be used in technologies related to the energy transition such as wind power (e.g. copper cables) and light vehicles (e.g. aluminium sheets). About one-third of the global aluminium production is used in the transport sector (e.g. aircraft components), due to its properties that reduce vehicles' weight and thus lower fuel consumption and related CO2 emissions. However, this gain in the carbon footprint is offset by the fact that aluminium production is very energy intensive (Mirova, 2013). Copper, on the other hand, is widely used both within the renewable energy sector (primarily wind turbines) as well as in electric vehicles where it finds application in a variety of electronic components and cables. However, while copper demand could potentially increase by 43% by 2035 (McKinsey Global Institute, 2017), such increase will be driven by copper's vast applicability in a number of sectors (Figure 1) - primarily the electronics industry - and not specifically by the energy transition. On the other hand lithium, which is also an abundant metal, has seen a surge in demand due to electric vehicle batteries, which constituted over 40% of total demand in 2017 (McKinsey Global Institute, 2018). While this demand could dramatically increase with the rise of lithium-ION batteries, lithium extraction causes environmental concerns, particularly due to a significant water use (~2000 m3 of water are used to produce one tonne of lithium) which is a source of tension between the mining companies and the local communities, especially in Argentina and Chile where lithium reserves are more abundant (Mirova, 2019).

Figure 1: Copper usage by end-sector



Critical metals

According to the European Commission, there are a number of metals that may hinder the development of technologies related to the energy transition because of their scarcity. These so-called “critical” metals include, among others, cobalt, rare earths and a precious metal, platinum. Widely used both in traditional and hybrid vehicles, rare earths find increasing application in the electrification of transport. With regard to precious metals (gold, silver, platinum) and diamonds, these are also used in different sectors, including primarily consumer products through jewellery (~50% for gold, ~30% for platinum and ~20% for silver). Precious metals are also used in other industrial applications, in particular platinum and its associated metals (palladium and rhodium) which are widely used in autocatalysts, both in thermic and hybrid vehicles (~2 grams per vehicle) and, increasingly more so, in electric vehicles (~20 grams per vehicle) (Mirova, 2019). In addition, cobalt, which today represents ~40% of Lithium-ION batteries, is often mined as a by-product of nickel and copper, and is present in very limited supply. Due to high extraction prices and very concentrated production (~60% of cobalt is extracted from the Democratic Republic of Congo, or DRC) the amount of cobalt has seen a ten-fold decrease in the latest battery technologies, and it could be completely substituted by other metals by 2030 through to further technological progress (Mirova, 2019).

Coal

While also derived from mining activities, coal is dealt with in more detail in our analysis of the Energy sector focusing on Fossil Fuels. We note that coal mining presents significant social and environmental risks related to extraction, while also causing significant pollution when burned. In addition, coal creates the highest emissions per unit of energy produced. Therefore, we exclude from our investments mining companies with 10% or more of coal production within their commodity portfolio.

We value metal and mining companies producing and marketing metals that derive a significant proportion of their current and/or projected demand from technologies with sustainability value-added. As of today, we have identified platinum and lithium as metals with a demand significantly driven by autocatalysts and electric vehicles, which have direct contribution to pollution reduction and the electrification of transport.

KEY INDICATORS

- Revenue from production and/or sale of metals with sustainability value-added
- Capex and/or R&D spending dedicated to metals with sustainability value-added

Metal recycling

In contrast to fossil fuel resources, mineral resources can theoretically be recycled infinite times, therefore prolonging their finite lives. In practice, however, recycling rates of metals are typically very low across the globe (UNEP, 2013). This is due to a few key obstacles: the quality of the raw material present in the end-use products to be recycled, and the treatment cost.

Quality of raw materials is essentially determined by the type of product and its complexity: metals mainly used for simple (bulk) products in large quantities, such as nickel, lead, zinc, copper, aluminum and steel are typically easier to recycle, while others that are found in small quantities in electronic components such as mobile phones or modern car circuits, present technological challenges for recovery with little economic value associated to it due to the cost of treatment. Such cost of treatment, and thus the economic yield of metal recycling, is influenced by a variety of factors including the price of raw materials (which explains why



precious metals typically display high recycling rates), the infrastructure for collecting and disassembling the end-use products, as well as their geographical location.

These factors have a combined influence on a metal's end-of life recycling rate (EOL-RR), which describes the fraction of metal in discarded products that is reused so as to retain its functional properties, as well as the recycled content (RC), i.e. the percentage of recycled scrap as a proportion of input in metal production. A United Nations panel has recently estimated that out of 60 elements only 18 (mainly base metals and precious metals) have an EOL-RR of 50% or above and an equivalent ratio of metals is seldom, if ever recycled. Furthermore, even for metals that display high recycling rates, research shows that these are recycled only a few times before being lost to waste. Despite displaying a high EOL-RR, metals usually display a lower recycled content. For instance steel has an EOL-RR of 85%, but a global recycled content of only ~40% (World Economic Forum, 2015). This is due to higher demand in developing countries lacking recycling infrastructure, and supply-demand gaps for scrap metal.

Although recycled metals can only partly contribute to future demand, they can increase the available supply and also have a better environmental profile overall than non-recycled virgin metals: they provide social and environmental benefits, primarily associated with the reduction of the extraction of virgin ores and related biodiversity impacts. Therefore, the metal recycling process generally also has lower energy content with consequent climate benefits.

In order to increase recycling rates of end-products, design for resource efficiency needs to be scaled up, with a focus on product recycling rather than material recycling. In addition, both customer awareness around recycling issues and collection of materials need to improve, in order to enable higher metal recycling rates.

Despite the challenges to recycling exposed above, we believe recycling is the key to reduce the environmental and social risks deriving from mining activities that will be described later on. Therefore, integrated mining companies and steel producers that increase the amount of recycled ore in their productions will be exposed to sustainability-related growth drivers and, consequently, less to the risks related to traditional mining operations. We will therefore value mining companies adopting a strategy that emphasises metal recycling, regardless of the type of metal recycled. We recognise that mining companies involved solely in the extraction phase are not exposed to significant recycling opportunities. In addition, mining companies are not responsible for collection and recycling of the end-products where their materials are used. However, integrated mining companies that have a significant rate of recycled materials within their smelting operations may present investment opportunities related to sustainable development. In addition, companies involved in the metal recycling value-chain, from collection to refining, and those providing ancillary products and services to these activities will also present sustainable-development opportunities.

In order to provide a sustainable supply of metals with environmental benefits, companies within the metals and mining sector need to be increasingly involved in metal recycling. Non-integrated mining companies that are not exposed to such trends do not present sustainable development opportunities related to metal recycling.

KEY INDICATORS

- Revenue from metal recycling
- Capex and/or R&D spending dedicated to metal recycling activities
- Targets and objectives to increase recycling capacity



Exposure to Opportunities

Indicators considered: % revenues from production and/or sale of metals with sustainability value-added and/or from activities related to metal recycling	
High exposure	>50%
Significant exposure	Between 30% et 50%
Low or no exposure	<30%
Negative exposure	>10% coal production Activities related to metals aimed at purposely speculating on commodity prices

The analysis of CapEx and R&D budget devoted to the activities identified as bearing opportunities will qualitatively nuance the analysis based on revenues.



Environmental and Social Risk

Environmental Impact of Process

Environmental impacts associated with mining activities occur primarily during the mining phase, when land is cleared and ores are extracted from the ground. The magnitude of such impacts depends on many factors, including the type of mine (i.e. underground, open-pit, fluvial), the topography of the soil and the method used for collecting tailings. Although extraction activities are carried within the concession area, mining operations require infrastructure and processing facilities that may extend well beyond.

Environmental impacts can be both direct (i.e. directly stemming from the mining operations, such as land clearing) and indirect, such as contamination by pollutants in waste sites. Studies show that such impacts stem primarily from natural resources access and waste management (WRI, 2003).

Waste management presents significant challenges to ecosystems through the processing and storage of residual materials in tailing ponds, and sometimes reversal in water streams. In addition, mining requires the use of toxic chemicals for ore treatment, such as cyanide, which frequently entails pollution of air, water and soil if not handled properly. Sometimes concerns over pollution may halt initiated projects, as in the case of Pascua-Lama, a Chilean gold mine straddling the border with Argentina, which was suspended in 2013 by Chile's Supreme Court over fears that it would pollute rivers. The two international mining companies involved in the project had already spent USD5 billion on the mine (The Economist, 2016).

Mining companies are legally responsible for environmental damages deriving from their operations. However, while usually required by local legislation, biodiversity assessments often fail to capture interdependencies between the environment and human health, and thus overlook the broader impacts of mining projects. In some countries, such as South Africa, which hosts a significant proportion of the earth's metal resources – such as the world's largest reserves of manganese and platinum group metals (PGMs), and some of the largest reserves of gold and diamonds – mining companies are also economically responsible for associated indirect impacts of their projects. Nevertheless, countries around the world have different regulations about environmental protection and biodiversity restoration. Often times in low-income countries the perceived socio-economic benefits of the exploration activities may be seen as outweighing the environmental costs. However, environmental accidents such as failures of tailing ponds and pollution of water streams may cause irreversible damage to local ecosystems and thus magnify the environmental costs of extraction operations.

Access to natural resources may translate into land and aquatic habitat degradation and associated loss of species, alteration of ecological processes (e.g. disruption of the local hydrological cycle), and competition for natural resources, particularly water in water-stressed countries. In Chile, which hosts the world's largest copper reserves, water stress has forced several mining companies to curb output, pitting them against local communities. As in the case of Escondida's mine project in Chile, companies have also been forced to build desalination plants in order to reduce freshwater intakes to pursue operations, with significant consequences for the overall cost of the project (total investment at Escondida's desalination plant was estimated at over US \$3bn in 2015 so as to reduce freshwater intake by about 50%). Desalination plants, although increasingly common, drive increased energy consumption for mining operations and thus, in most cases, a higher associated CO2 footprint.

Greenhouse gas emissions are also associated with mining operations: while at the extraction phase these are primarily related to blasting, infrastructure development and ore separation and transportation, carbon emissions are higher during the smelting phase, thus for integrated mining companies. GHG emissions related to smelting vary according to the metal treated (e.g. ferrous vs. non-ferrous metals) and the type of feedstock used. However, as ore grades decline globally, the energy intensity of mining is set to increase and thus the industry's overall carbon footprint.



Finally, mines do not last forever: at some point operations need to be closed and companies need to rehabilitate the mine area to safe standards for productive post-mine land use. However, the majority of large-scale mines are still in operation today and only a few smaller ones have been closed. Therefore, given scarce first-hand experience in this area, it is fair to assume that rehabilitation costs may well be underestimated and that more emphasis on rehabilitation is required before a mine is approved. Land rehabilitation presents several challenges, such as tailing pond safety, water and groundwater risks, and possible radioactivity. In addition, big companies often sell their mines to less experienced operators at a low cost, thereby passing along the rehabilitation cost and associated environmental and financial risks which, if not appropriately addressed, ultimately fall to the governments of the host countries.

When national legislation on environmental protection is weak, mining companies need to implement and share voluntary best-practices and demonstrate a proactive approach in avoiding operations when environmental impacts, including the associated indirect impacts, are potentially significant. Moreover, thorough rehabilitation studies should be carried before inception whereby companies should bear the financial burden of these processes.

Environmental impact of products

As metals are employed in a variety of sectors and applications, end-use environmental impacts will essentially depend upon the lifecycle of specific products. As examined above, metals generally display low recycling rates, thus bearing a significant impact on the environment through waste disposal, despite being recyclable virtually endlessly. While ferrous metals (i.e. iron and steel) and precious metals display higher recycling rates, other non-ferrous metals generally display lower recycling rates depending on the end-use product. Therefore, sectors where such metals are used in small quantities and complex combinations, such as electronics and information technology, need to improve product design in order to reduce their environmental impacts.

In addition, some metals are toxic for human health. Some of them can either be naturally occurring, such as asbestos and arsenic, or they may be formed as the result of nuclear reactions, such as enriched uranium. Some toxic metals are classified as “heavy” due to their density, such as lead, mercury, cadmium and chromium. Some heavy metals, albeit ubiquitous to the environment, can be toxic in large amounts in certain forms. Several heavy metals are used in everyday applications, such as lead batteries and paint, as well as some plastics and industrial equipment. If not recycled properly, toxic metals can lead to environmental contamination and thus endanger ecosystems and, ultimately, human life. Thus improving collection and recycling of materials, while fostering substitution when possible, are key solutions to reduce the environmental impact of metals at the product consumption level.



We engage with the companies in this sector to reduce the environmental footprint of their operations through extensive environmental assessments prior to the initiation of projects, the adoption of a precautionary approach to avoid operations in biodiversity hotspots, and improved investment in GHG emissions reductions. With regard to waste management and prevention of environmental accidents, such as tailing pond leakages/breaks, we expect companies to exhibit strong environmental risk-management systems and track records. We also expect them to conduct thorough due diligence for environmental and social performance when operating in collaboration with external partners.

With regard to the environmental impact of products, we consider that the role of mining companies in the correct handling and disposal of metals in the environment is limited to the processing phase. Therefore, investment opportunities related to safe collection, disposal and recycling of end-use products containing metals will be treated in the industrial sector review.

KEY INDICATORS

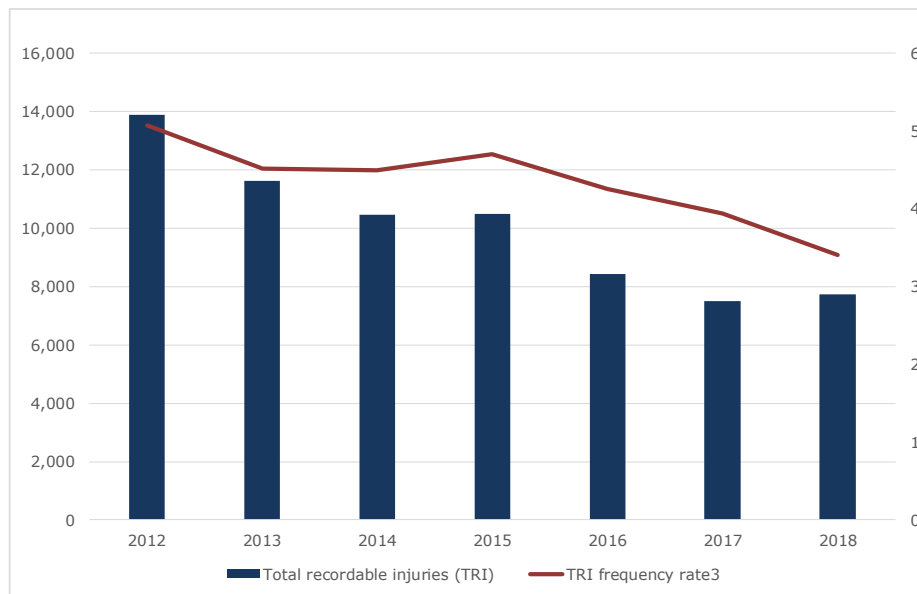
- Group-wide policy to avoid and reduce pollutant emissions to air, water and land
- Contingency planning for process safety and environmental accident prevention measures
- GHG emissions reduction policy and targets
- Water reduction and recycling targets
- Biodiversity policy including a commitment to avoid exploration in World Heritage sites and pristine environments
- Group-wide disclosure of key ESG metrics such as water use, GHG emissions, fauna and flora

Occupational Health and Safety

Operational security at work is a longstanding challenge for the mining sector: according to the ILO, mining is the most hazardous occupation when the number of people exposed to risk is taken into account. Although the mining industry as a whole has made significant progress in reducing frequency of injuries and fatalities over the past decade, attaining a zero-fatality goal will still be a long time coming. In 2018, the International Council of Mining and Metals (ICMM), which counts 23 global member companies, registered 51 fatalities, just a 2% decrease since 2017 but a consistently better picture than the numbers registered in 2012 and 2013 (~90 fatalities). Similarly, there is little change in the fatality frequency rate since 2014, which shows that after registering significant progress, the industry's overall safety performance has been stalling over the past five year (Figure 2). In addition, these figures are much smaller than the actual performance registered in the sector globally, as national and smaller operators are not represented. According to the ICMM, which helps the industry share and promote best practices, about 70% of fatalities in 2018 could be attributed to fall of ground in underground mines, machinery and transportation. However, some of the most terrific accidents can derive from occasional structural failure which, despite representing the least recurrent cause of fatalities according to ICMM statistics, can lead to large human life losses due to the potential magnitude of accidents. As an example, the Brumadinho mining dam failure in Brazil in early 2019 costed the lives of over 300 people, mostly workers at the mine premises. Current statistics show that underground mines present heightened safety risks for workers, especially as degrading ores stretch operations deeper underground. In such an environment, use of automation is limited and thus exposure to potential accidents deriving from fall of ground, seismic activity and rock falls is heightened. While companies cannot easily change modus operandi in underground mines, there is opportunity for improvement by monitoring accidents and near misses as well as by strengthening the safety culture.



Figure 2: ICMM total recordable injuries and frequency rate (2012-2018)



Source: ICMM, Mirova (2019)

Other health hazards associated with mining activities derive from noise, generated by drilling, blasting, ventilation, cutting and ore processing. Controlling noise is very difficult and noise-induced hearing loss in mining is still common (Donoghue, 2004). Other types of physical harm is induced by excessive heat, especially in underground mines, body vibrations induced by mobile equipment, which can lead to spinal disorders, and a multitude of chemical hazards from exposure to toxic minerals such as crystalline silica, which increases risks of contracting serious illnesses, especially for miners affected by HIV. In addition, a number of toxic chemicals are used in ore treatment and smelting operations, such as cyanide as a solvent for metals like copper and gold in hydrometallurgical processes, and mercury in some gold mining operations, especially in developing countries (Donoghue, 2004). Furthermore, mine workers are exposed to the risk of tropical diseases such as malaria and dengue in remote mining operations. It should be stressed that – although it is treated in the fossil fuel sector review - coal mining presents heightened physical hazards, primarily due to the presence of gas ignition explosions.

In addition to physical hazards, mining creates psychosocial hazards due to the difficult working conditions and remote locations. Most mines operate 24h per day, 7 days per week, so shift work is very common. When ore resources are small, companies do not build new villages to accommodate workers and their families, but adopt a policy of mobility, which requires workers to live separate from their families and communities for extended periods. In addition, fatal and traumatic injuries also have psychological consequences on co-workers and managers, on whom the burden of internal and legal proceedings following severe accidents often falls. As a consequence, sleep deficiency and drug and alcohol abuse are a common issue in the sector, which has led to increased monitoring and prevention mechanisms in many large operations, although progress still needs to be made in this area.

We expect companies to put in place occupational health policies and management systems and to show progress and monitoring of performance, with transparent reporting. Efforts toward improvement via automation should also be regarded positively when they prove to reduce occupational accidents and fatalities. Furthermore, we will be looking at mechanisms to monitor and improve well-being of workers.



KEY INDICATORS

- Policy, performance indicators, quantified targets on occupational safety issues (lost time injury rates, fatalities, etc. both for company employees and contractors), training mechanisms, and presence in industry groups for the improvement of safety standards
- Performance changes over recent years and actions put in place in response to specific recurring incidents/poor performance
- Number and severity of controversies associated to occupational accidents

Human Rights and Local Communities

Although mining may provide an important revenue stream to national governments, local communities do not always reap the benefits. To counter this widespread phenomenon, also known as the “resource curse,” the Extractives Industry Transparency Initiative (EITI) was launched in 2003 to increase governments’ transparency around the use of royalties from the extractive sector, which today counts 31 countries compliant with their standards. Despite this initiative and stakeholders’ pressure, several resource-rich countries around the world still lag behind in terms of social equality and welfare. For instance, according to a study conducted by the World Resources Institute (WRI), three of Papua New Guinea’s five mining provinces have basic human development indicators (education, welfare, access to services and participation) below the national average (WRI, 2003). Disadvantaged communities need to be involved in negotiations and dialogue before extraction activities begin, as these will affect their lives profoundly, often through land seizure, relocation and ecological impacts on local ecosystems. Communities are usually compensated for these efforts. However, benefits have not always been equally distributed, especially in regions where rival clans coexist, which may exacerbate existing local tensions, as it is the case with Papua New Guinea’s Porgera mine (WRI, 2003).

Communities may benefit from improved infrastructure, such as roads for construction and transportation channels, as well as schools and hospitals that allow for the relocation of miners and their families in remote areas, as it is the case of extended mining complexes. However, in other cases local communities living off small-scale agriculture and farming are forced to leave their activities to find alternatives elsewhere or be employed at the mine. In addition, mining operations can have irreparable consequences for the nearby communities. Indeed, they compete with local water resources, and their extraction and processing techniques require the use of toxic chemicals, which often result in pollution of land, air and water. In China, the operators of the largest open-pit copper mine in Asia were recently prosecuted for dumping tonnes of untreated waste water in the river Le’an for years, which had serious health repercussions on the residents of nearby villages.

Complexity arises when mining operations are set to occur where aboriginal communities live, which can constitute a huge obstacle to operations if not handled properly. In India, an international mining company had to give up its plans to co-build a bauxite mine in the state of Odisha after local tribes claiming religious rights on the land unanimously trumped the plan in a referendum and won the case with the Supreme Court in 2013.

When communities resist the creation or expansion of mining projects, governments and companies may recur to security forces, with consequent use of force which may lead to severe accidents and fatalities among demonstrators. Such accidents are more recurrent when companies do not carry appropriate, prior informed consent to the local communities before proceeding with the operations. This is often done with the complacency of the local governments, especially where there is scarce protection of citizens’ human rights.

Although governments are ultimately responsible for enforcing and protecting human rights issues, companies are equally responsible for adopting best-practice standards and engaging in constructive dialogue with the communities both prior to and during mining operations.



Companies need to put in place human rights policies and systems that encompass training of security forces and community consent both before and after operations with monitoring and grievance mechanisms. We will also take into account companies' track records and their efforts toward improvement. We look namely at the number of trespasses or of episodes of sabotage that occur at a site. Transparency on whether such episodes resulted into harm or death of both perpetrators and the company's personnel are important in our analysis.

KEY INDICATORS

- Formal human rights policy encompassing contractors (including security forces)
- Human rights risk-management system with tracking of key indicators such as community outreach and grievances
- Reporting of number of trespasses occurred at the sites or episodes of sabotage and related use of force

Human Resources

Employee relationships are particularly difficult to manage within the mining industry: high level of occupational hazard, integration of indigenous communities within the workforce and rapidly shifting market conditions constitute key structural challenges that companies need to wisely address. As a consequence, relationships between workers and companies are often conflictual, as demonstrated by the recurrence of large strikes in different geographies. In 2012, South Africa which hosts the world's largest platinum mines, witnessed one of the most violent uprisings since the end of Apartheid, after a group of platinum miners staged a wildcat strike action. Several workers died during clashes with police and companies' security forces. Since then, soaring costs in the South African mining industry, also due to the higher electricity and operational costs of aging mines, have threatened thousands of jobs.

Without proper employee-relationship management, such tensions are particularly evident in periods of slow commodity demand as companies tend to halve operations, with consequences for the workers that depend on the mines. Cost cuts may also hinder the sometimes precarious relationships with the local communities, which often provide precious human resources on the ground, and may jeopardise companies' license to operate.

We expect companies to increase transparency around working conditions, including through whistleblowing systems and psychological support. We also look for transparent policies around unionisation, and reporting on worker demonstrations, including incidents and use of force.

KEY INDICATORS

- Policies around responsible workforce restructuring
- Mechanisms to attract and retain talent
- Whistleblowing channels for workers
- Reporting the number of unionised workers

Business Ethics

The mining sector is highly exposed to corruption risks due to mining approval regimes that require a close interaction between corporates and governmental administrations. According to Transparency International, such risks are present irrespective of a country' stage of economic development, political context or maturity of its mining sector. In its latest Bribe Payers Index in 2011, the same organisation ranked the mining sector at the bottom 25% of 19 sectors, at 15th place. As a consequence, anti-corruption legislation specific for the mining



sector is intensifying globally: the UK Bribery Act and the SEC demand higher transparency of payments from companies developing resources such as minerals.

Transparency over the royalties paid to governments for the extraction of natural resources is also an issue of concern. Poor management of the wealth created by the extraction of mineral resources may incite conflict between governments and citizens and raise questions on the licence to operate of the multinational companies involved in the exploitation of these resources. To tackle this issue, a number of countries have become signatory of the Extractive Industry Transparency Initiative (EITI), a global standard to promote increased accountability of precious commodities at the government level. However, currently there are only 52 countries compliant with the EITI, and international mining companies do not disclose information for non-signatory countries that require confidentiality that would allow for better traceability of resource sharing in the form of royalty payments.

We encourage companies to put in place strong, global anti-corruption risk-management systems that go beyond local requirements. We expect evidence of whistleblowing systems and high involvement of the Board in corruption-related issues. We also consider the frequency and severity of controversies and the company's response. With regard to royalty transparency, we encourage full disclosure in accordance with EITI standards and push companies to engage with policy-makers to encourage transparency in countries where the Standard is not implemented. We analyse companies' respect of local communities within the human right angle, under the social pillar.

KEY INDICATORS

- Presence of group-wide anti-corruption policy mechanism, including contractors
- Presence and disclosure of whistleblowing data
- Reporting of royalties paid in accordance to EITI standards
- Severe controversies relating to business ethics and related responses

Sustainable Development Governance

Companies within the sector should integrate the management of key environmental and social issues at the Board-level so as to bring them to the heart of their business strategies: climate change, human right conflicts, safety and anti-corruption are issues that require concerted effort for companies with global, high-impact operations such as those within the fossil fuel sector. To this regard, we expect companies to integrate key corporate social responsibility (CSR) criteria within the remuneration of their employees with managerial responsibilities as well as top management and Board executives. In particular, with regard to the Board's remuneration, criteria such as climate change mitigation, health and safety performance and accident rate, including process accidents (aside from operational safety), should be reflected in both short-term and long-term variable components because they are increasingly becoming strategy drivers with the potential to either create or destroy company value.

Due to the importance of such issues, companies should also have board representatives with extensive experience in key sustainability issues for the sector, and when necessary also set up a Sustainability Committee to the board with oversight of environmental and social risks, including corruption, so as to advise the Board on its decision-making.

We encourage companies to set up stretching sustainability targets and reflect these in the variable remuneration of top management and employees with managerial responsibilities so as to incorporate these issues in business performance. We also look for proactive participation of the Board in such matters via ad hoc sustainability committees that provide periodical oversight to the Board and the appointment of Directors with expertise in sustainability. Finally, we press companies to disclose their expenditures (both investments and research and development) by type of technology,



so as to be able to measure their effort toward facilitating the energy transition within their operations.

KEY INDICATORS

- Presence of sustainability performance indicators and targets in the annual reports
- Disclosure of capex and R&D spending per type of technology (i.e. fossil fuels, alternative energy and renewables)
- Presence of measurable CSR criteria in the variable remuneration of the executive Board members as well as employees with managerial responsibilities

Risk Assessment

	Criteria
Positive	<p>Not fulfilling the criteria that move the opinion to « risk » AND</p> <ul style="list-style-type: none"> - Absence of severe and recurrent controversies <p>AND appropriate management of operational H&S topics</p> <p>AND appropriate management of human right issues and human resources issues</p> <p>AND appropriate environmental risk-management</p>
Neutral	All other cases
Risk	<ul style="list-style-type: none"> - Response of the company to repeated ethical controversies deemed inadequate or inappropriate OR - Inappropriate management of operational H&S topics OR - Inappropriate management of human right issues and human resources issues OR - Inappropriate environmental risk-management



Conclusion

Today, companies within the mining sector provide limited sustainable development opportunities: very few integrated companies in the mining sector use a significant portion of recycled metals in their smelters, and product recycling still presents technological and logistical challenges. This is why service companies providing metal recycling solutions are rated highly in our investment philosophy. The sector has also a limited role to play in the energy transition: so far we have identified few metals (lithium and platinum) that are key to sustainable development opportunities and receive (or are projected to do so) a significant portion of their demand from these opportunities, while others, such as cobalt, may play a less important role in the energy transition due to high costs and associated exploitation risks.

However, while sustainable development opportunities in the sector are scarce, social and environmental challenges abound: operational health and safety, human rights and environmental impacts of processes are important aspects that, due to the nature of mining operations, have significant impacts on various company stakeholders and can ultimately jeopardise their licence to operate. In addition, as mining operations' demand for water and energy is increasing due to degrading ores and increased water scarcity in some areas, we anticipate rising sustainability risks in the sector. Therefore, companies that provide products or services that meet sustainable development challenges but fail to show appropriate management of their environmental and social risks will not be eligible for investment.



Our Approach to sustainability assessment

Acting as a responsible investor requires interpreting the economic world within its social and environmental context. This approach calls for understanding the interactions between different private-public players, small-medium-large companies, developed and developing economies to ensure that each player's growth is consistent with the balance of the rest of the system. It is a long-term approach that guarantees that today's choices will not lead to negative consequences for future generations. Understanding these complex relationships demands:

- Clear understanding of sustainable development issues facing our societies,
- Assessing the possible interactions between the assets of our investment strategies and these sustainability issues.

The SDGs as a Guide

Following the Millennium Development Goals created in 2000, the United Nations set out a new framework for sustainable development in 2015. It contains 17 Sustainable Development Goals (SDGs), broken down into 169 specific targets designed to address the main social and environmental issues between 2015 and 2030. In addition to having been adopted by all members of the United Nations, the SDGs offer several advantages.

First, they establish a comprehensive framework concerning environmental and social issues, applicable to all economies regardless of their level of development. Thus, while some issues such as ending hunger or ensuring access to water for all are often more relevant for low- and middle-income countries, other objectives such as fighting climate change or making cities safe, resilient and sustainable, are applicable at all levels of development.

Moreover, the SDGs can be considered as a frame of reference for sustainable development issues for a variety of actors, from governments to companies and investors. The private sphere is increasingly considering environmental and social issues, illustrating new forms of governance where subjects of general interest are no longer solely the prerogative of the public sphere. Considering the SDGs can help companies to think on how they create environmental, economic, and social value.

Finally, the SDGs help investors to question the long-term resilience of their assets and portfolios to the ongoing transformations. Then, investors can go even further by looking at their exposure to new solutions and economic models that will respond to long-term economic transformations. For example, the targets associated with the SDGs to significantly increase the share of renewable energy and to double energy efficiency by 2030 imply a profound transformation within the energy sector.

We consider the SDGs squarely in line with our mission. As a result, in 2016, Mirova decided to use this framework to define its responsible investment approach.



Figure 3: The 17 Sustainable Development Goals

	End poverty in all its forms everywhere		Reduce inequalities within and among countries
	End hunger, achieve food security and improved nutrition and promote sustainable agriculture		Make cities and human settlements inclusive, safe, resilient and sustainable
	Ensure healthy lives and promote well-being for all at all ages		Ensure sustainable consumption and production patterns
	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		Take urgent measures to combat climate change and its impacts
	Achieve gender equality and empower all women and girls		Conserve and sustainably use the oceans, seas and marine resources for sustainable development
	Ensure availability and sustainable management of water and sanitation for all		Protect, restore and promote sustainable use of territorial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
	Ensure access to affordable, reliable, sustainable and modern energy for all		Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all		Strengthen the means of implementation and revitalize the global partnership for sustainable development
	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		

Source: United Nations



Assessing Environmental and Social Quality by the SDGs

We believe that the SDGs will transform the economy as we know it. Acting as a responsible investor starts with taking a broader view of the way investors think about the environmental and social profile of the assets they finance. These interactions can be grouped into two categories:

- **Materiality:** how the current transitions are likely to affect the economic models of the assets financed either positively or negatively.
- **Impact:** how investors can play a role in the emergence of a more sustainable economy



We believe that these two approaches are closely linked. Our evaluation methodology thus seeks to capture the extent to which each asset contributes to the SDGs. From our perspective, this approach provides a relevant vision on both the "Materiality" and "Impact" aspects.

A Five-level Qualitative Analysis

Mirova has based its environmental and social evaluation method on four principles:

A RISK/OPPORTUNITY APPROACH

Achieving the SDGs requires taking two different dimensions into account that often go together.

- **Capturing opportunities:** when companies center their strategies on innovative business models and technologies focused on technological and societal transformation, they can often capture opportunities related to the SDGs.
- **Managing risks:** by proactively managing risks related to these transitions, companies can reduce and re-internalize their social and environmental externalities, which often takes the form of general management of sustainability issues.

This analysis structure gives equal importance to opportunities and risks. It is the first prism through which we analyze sustainable development issues.

A LIFE-CYCLE VISION

To identify the issues that could impact an asset, the analysis of environmental and social issues must consider the entire life cycle of products and services, from raw material extraction to end-of-life phase.

TARGETED AND DIFFERENTIATED ISSUES

Our risk/opportunity analysis focuses on the elements most likely to have a real impact on the assets studied and on society in general. Additionally, the issues that economic players face

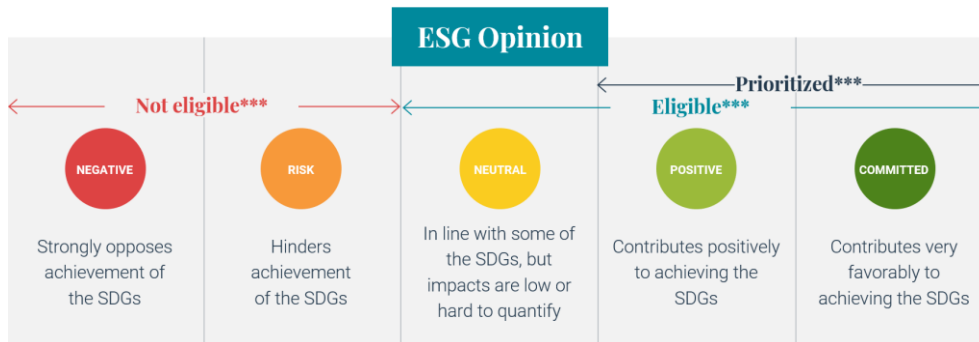


are very different depending on the sector, and can even vary within the same sector¹. For example, it is important for us to focus on work conditions for suppliers in the textile industry, while for automobile manufacturers, the focus will be more on energy consumption during product use.

So, our analysis focuses on a limited number of issues adapted to the specificities of each asset.

A QUALITATIVE RATING SCALE

Our analyses are summarized through an overall qualitative opinion on five levels. This opinion assesses to what extent an asset contributes to the SDGs.



***2

This rating scale is based on the SDGs and their achievement. As a result, opinions are not assigned based on a distribution set in advance: we are not grading on a curve overall or by sector. Mirova does not exclude any industry on principle, and carries out a thorough analysis of the environmental and social impacts of any asset. For some sectors, this analysis may lead to the exclusion of all or some of its actors. For example, companies involved in fossil fuel extraction are considered "Risk" at best, while renewable energy companies are generally well rated.

An indicative grid provides some overall guidelines regarding the links between opportunities, risks and the overall sustainability opinion.

Sustainability Risks Review	Positive	Risk	Positive	Positive / Committed	Committed
	Neutral	Negative / Risk	Neutral	Neutral / Positive	Positive / Committed
	Risk	Negative	Negative / Risk	Risk	Risk
		Negative	Low or no	Significant	High
		Sustainability Opportunities Exposure			

¹ For every sector, defining key issues is the subject of a specific study. This document is available on Mirova *website*. <https://www.mirova.com/fr/recherche/comprendre#vision>

² *** For Mirova's investments



Sources

- Donoghue, A. (2004). Occupational health hazards in mining: an overview.
- European Commission. (2002). Heavy Metals in Waste . Récupéré sur http://ec.europa.eu/environment/waste/studies/pdf/heavy_metalsreport.pdf
- Gordon, J. (2013). Evaporating water supply poses costly risk for miners. Récupéré sur <http://www.reuters.com/article/us-mining-water-idUSBRE94T04Q20130530>
- ILO. (s.d.). Mining (coal; other mining) sector. Récupéré sur <http://www.ilo.org/global/industries-and-sectors/mining/lang-en/index.htm>
- MacNeill, P. (2008). International Mining Fatality Database.
- McKinsey Global Institute. (2017). How technology is reshaping supply and demand for natural resources. Récupéré sur [https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/How%20technology%20is%20reshaping%20supply%20and%20demand%](https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/How%20technology%20is%20reshaping%20supply%20and%20demand%20)
- McKinsey Global Institute. (2018). Lithium and Cobalt - a tale of two commodities. Récupéré sur <https://www.mckinsey.com/~media/mckinsey/industries/metals%20and%20mining/our%20insights/lithium%20and%20cobalt%20a%20tale%20of%20two%20commodities/lithium-and-cobalt-a-tale-of-two-commodities.ashx>
- Mirova. (2015). Electric vehicle really on track.
- Mirova. (2019). The Electrification of Transport - a solution of ecological transition. Récupéré sur <https://www.mirova.com/fr/idees/electrification-des-transports-une-solution-de-transition-ecologique>
- Secombe, A. (2016). SA's mining sector has bled 47,000 jobs in three years. Récupéré sur <http://www.bdlive.co.za/business/mining/2016/02/08/sas-mining-sector-has-bled-47000-jobs-in-three-years>
- Sharplez, N. (2012). Growing renewable energy needs more copper. Récupéré sur <http://www.windpowerengineering.com/uncategorized/growing-renewable-energy-needs-more-copper/>
- SouthAfrica.info. (2015). Fatalities at South Africa's mines drop. Récupéré sur <http://www.southafrica.info/news/business/mine-deaths-27115.htm#.V6SEvYR95pg>
- The Economist. (2016). From conflict to co-operation. Récupéré sur [http://www.economist.com/news/americas/21690100-big-miners-have-better-record-their-critics-claim-it-up-governments-balanceFrom conflict to co-operation](http://www.economist.com/news/americas/21690100-big-miners-have-better-record-their-critics-claim-it-up-governments-balanceFrom%20conflict%20to%20co-operation)
- UNEP. (2013). Metal Recycling: opportunities, limits, infrastructure .
- WEF/BCG. (2015). Mining & metals in a Sustainable World 2050 .
- World Steel Association. (s.d.). Buildings and Infrastructure. Récupéré sur <https://www.worldsteel.org/Steel-markets/Buildings-and-infrastructure.html>
- WRI. (2003). MINING AND CRITICAL ECOSYSTEMS: Mapping the Risks.



DISCLAIMERS

This document is a non-contractual document for information purposes only. This document does not constitute, or form part of any offer, or solicitation, or recommendation to buy, or concede, or subscribe for any shares issued or to be issued by the funds managed by Mirova investment management company. The presented services do not take into account any investment objective, financial situation or specific need of a particular recipient. Mirova shall not be held liable for any financial loss or for any decision taken on the basis of the information contained in this document, and shall not provide any consulting service, notably in the area of investment services.

The information contained in this document is based on present circumstances, intentions and guidelines, and may require subsequent modifications. Although Mirova has taken all reasonable precautions to verify that the information contained in this document comes from reliable sources, a significant amount of this information comes from publicly available sources and/or has been provided or prepared by third parties. Mirova bears no responsibility for the descriptions and summaries contained in this document. No reliance may be placed for any purpose whatsoever on the validity, accuracy, durability or completeness of the information or opinion contained in this document, or any other information provided in relation to the Fund. Recipients should also note that this document contains forward-looking information, issued on the date of this presentation. Mirova makes no commitment to update or revise any forward-looking information, whether due to new information, future events or to any other reason. Mirova reserves the right to modify or remove this information at any time without notice.

The information contained in this document is the property of Mirova. The distribution, possession or delivery of this document in some jurisdictions may be limited or prohibited by law. Each Recipient must ensure he complies with these requirements and prohibitions.

Non-contractual document written in December 2019 by Marina Iodice.



MIROVA

Portfolio Management Company - French Public Limited liability company
RCS Paris n°394 648 216 - Regulated by AMF under n°GP 02-014
59, Avenue Pierre Mendes France – 75013 – Paris
Mirova is an affiliate of Natixis Investment Managers.

NATIXIS INVESTMENT MANAGERS

French Public Limited liability company
RCS Paris 453 952 681
43, Avenue Pierre Mendes France – 75013 – Paris
Natixis Investment Managers is a subsidiary of Natixis.

NATIXIS INVESTMENT MANAGERS INTERNATIONAL

Portfolio management company - French Public Limited Liability Company
RCS Paris 329450738 - Regulated by AMF under n° GP 90-009
43, Avenue Pierre Mendes France – 75013 – Paris
Natixis Investment Managers International is an affiliate of Natixis Investment Managers.

MIROVA U.S., LLC

888 Boylston Street, Boston, MA 02199, USA. Tel: 212-632-2800
Mirova US is an affiliate based in the USA and detained by Mirova. Mirova US and Mirova entered into an agreement whereby Mirova provides Mirova US investment and research expertise. Mirova US combines Mirova's expertise with its own, when providing advice to clients.

An affiliate of: