

Mining Firms' Climate-Sensitive Initiatives

Background Paper for *Building Resilience: A Green Growth Framework for Mobilizing Mining Investment*

Sri Sekar, Kyle Lundin, Christopher Tucker,
Joe Figueiredo, Silvana Tordo, and Javier Aguilar

INTERNATIONAL DEVELOPMENT IN FOCUS

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The research was undertaken by a team comprising Sri Sekar (Mining & Energy Lead), Kyle Lundin (Mining & Energy Research Analyst), Christopher Tucker (Mining Specialist), and Joe Figueiredo (Extractives Policy Associate), all with Deloitte Consulting LLP, with the contribution and under the guidance and direction of Silvana Tordo (Lead Energy Economist, World Bank), and Javier Aguilar (Senior Mining Specialist, World Bank) who co-lead the ELLEDED Program.

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NOTE

1. A merger between Barrick Gold Corporation and Rangold Resources Limited was completed on January 1, 2019. The new company continues to be known as "Barrick." All references to "Barrick" or "Barrick Gold" or "Barrick Gold Corporation" in this report, refer to the activities and actions of Barrick Gold Corporation prior to the January 2019 merger and do not necessarily reflect the actions or activities of the newly formed company, Barrick.

Abbreviations

CAD	Canadian dollar
CAPEX	capital expenditure
CDP	Carbon Disclosure Project
CEO	chief executive officer
CO ₂	carbon dioxide
CSR	corporate social responsibility
DJSI	Dow Jones Sustainability Index
EIA	Energy Information Agency
EITI	Extractive Industries Transparency Initiative
EPA	Environmental Protection Agency
GEPA	Ghana Environmental Protection Agency
GHG	greenhouse gas
GRI	Global Reporting Initiative
ICMM	International Council on Mining and Metals
IMS	Integrated Management System
INSEAD	Institut Européen d'Administration des Affaires
IRR	internal rate of return
KPI	key performance indicator
LTIP	long term incentive plan
NGO	non-governmental organization
OPEX	operating expenditure
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States

1 Introduction

THE MINING INDUSTRY'S CLIMATE IMPERATIVE

The global mining industry is particularly susceptible to climate risks and is a significant cause of climate-related impacts stemming from its propensity to emit carbon dioxide across its value chain and to consume vast quantities of water during metal and mineral production and processing. As a highly capital-intensive sector requiring robust and resilient infrastructure, the spectrum of climate-related risks to which the industry is exposed is vast: fuel and electricity supply shocks, damages and supply shortages resulting from coastal storms, dependency on and failure of critical infrastructure, and the overall scarcity of water resources. Factors such as these across the global economy led 750 experts surveyed by the World Economic Forum in 2016 to state that failure to respond to climate change is the business risk with the greatest potential impact, a risk whose value is estimated to be US\$2.5 trillion globally (Myers 2016). To put it in perspective, that risk is valued at nearly three times the aggregate market capitalization of the top 40 mining companies (PWC 2018). To meet these climate challenges—which are expected to increase for the foreseeable future—mining firms will need to *adapt* not just their production processes, but their procurement and purchasing behavior in such a manner as to drive adaptive transformation throughout their value chain.

The irony of this vulnerability is that the mining sector substantially contributes to the very same climate risks it needs to mitigate. Companies in this industry generate US\$16 billion in emissions costs, and when their entire value chains are accounted for, those emissions can ratchet up by a multiple of 30—a figure that is the equivalent to India's entire annual CO₂ emissions (Soliman, Fletcher, and Crocker 2017). Overall energy costs for a mining operation can exceed 30 percent of operating costs (Cormack et al. 2017). Furthermore, mining operations can consume a copious amount water. While there is a lack of visibility into comprehensive water consumption figures for the industry—mostly owing to an absence of standardized self-reporting—there is at least some evidence of the scale of the sector's water use (IFC and ICMM 2017). For example, 70 percent of

mining operations from six of the largest global mining companies are located in water-stressed countries such as Chile, South Africa, and Australia; and water-related infrastructure accounts for 10 percent of the industry's capital expenses (IFC and ICMM 2017). The Carbon Disclosure Project (CDP) estimates that 27 percent of mining production from the 12 largest, diversified, and publicly listed mining companies will be exposed to high water stress risk by 2030 (Soliman, Fletcher, and Crocker 2017). Given the foregoing, it is at least in part incumbent on the sector to look closely at its activities, and to rethink and redesign them in a way that *limits* energy consumption, Greenhouse Gas (GHG) emissions, water use, and their corresponding impacts on the environment.

THE CLIMATE-LOCAL VALUE CREATION DYNAMIC

It is hard to ignore the extent to which mining operations are dependent on a long term, sustainable, and mutually beneficial relationship with local stakeholders proximate to the mine site and within the host nation's central government—that is, a “social license” to operate. The development stage for a copper mine even in the United States, for instance, can take up to 12 years—and that is simply to open an ore deposit for production. Productive extraction of the mineral itself can take up to 30 years (University of Arizona 2018). Even in economically developed nations, a 42-year timeline is a conservative estimate for a copper mine to achieve a threshold IRR (15 percent as a rule of thumb in the mining sector) and in the iron ore subsector mines have had an average life of over 30 years (PWC 2015; PWC 2016; University of Arizona 2018). As such, operational continuity and optimized mine uptime are priorities for any mine site—and the buy-in of local and national-level stakeholders are crucial cornerstones to achieving operational stability.

This focus on operational continuity—and the corresponding maximization of output—is a primary reason for mine site operations to invest in activities intended to share the value created by mine operations with local and national stakeholders in a manner that exceeds a pure focus on employment opportunities and tax contributions. Indeed an effective approach to local value creation rests in part on the strengthening of local supply chains; where mining firms focus on systematically helping local partners to gain the skills they need to participate in the procurement process through business development training, mentoring, and supplier development programs. Such efforts help the industry reduce reliance on global suppliers—and their incident higher logistics costs—as much as they deliver substantial economic value to host countries, creating direct and indirect jobs, enabling skills and technology transfer, strengthening business networks, and increasing tax revenues.

The notion of turning local value creation in the mining sector more strategically to such efforts—that is, those that generate scalable and sustainable economic results for host nations and communities—becomes all the more powerful when a climate lens is applied to it. The industry's climate imperatives and the corresponding context in which it operates are becoming issues on which host nation stakeholders are increasingly focused. Concerns over GHG emissions, for instance, have sparked protests and blockades leading to the halting of production from fossil fuel companies in Brazil, Indonesia, Nigeria, the Philippines, and South Africa among other countries (Deloitte 2017). Although this isn't tied directly to the mineral mining

industry, it is indicative of potential risks for mining firms going forward. More importantly, besides the risk of protests and production disruptions, the increasingly complex regulatory, compliance, and policy-related climate ecosystem poses challenges for mining firms. This ecosystem includes standard setting and climate reporting guidance from non-governmental organizations (NGOs) and international bodies like the CDP, the Council of Mining and Metals (ICMM), the Global Reporting Initiative (GRI), the Extractive Industries Transparency Initiative (EITI), etc. It also includes a patchwork of policy incentives and penalties passed at the national level to not only comply with international climate commitments like the Paris Accords, but to encourage investment into new areas of the climate economy in order to secure sustainable economic growth—a green industrial policy.

The need for mining firms to rethink and retool their local value creation efforts along with the growing reality of complex mining policies that firms must learn to navigate presents an opportunity for forward-thinking mining firms to seize a competitive advantage. As this report argues, firms that are best able to systematically tackle their climate responsibilities and adapt to climate realities through technical solutions that offer scalable economic value to host nations, are best placed to be rewarded by host nation partners that mitigate the risk of production disruptions, repeat business due to the establishment of a climate-smart reputation, and an implicit incumbency status that might ease the project development process.

THE PURPOSE AND ORGANIZATION OF THIS REPORT

This report is part of a series of background reports underpinning the report on *Building Resilience: A Green Growth Framework for Mobilizing Mining Investment*, which investigates potential for leveraging the mining industry to drive the uptake of climate-sensitive technologies and practices in emerging and developing markets. The series includes four reports: Methodology and Value Chain Analysis, Mining Firms' Climate-Sensitive Initiatives, Climate Sensitive Mining: Case Studies, and Policy Approaches to Climate Change in Mineral Rich Countries.

This report identifies existing climate-sensitive practices of mining firms that generate or have the potential to contribute to local value creation. It also suggests a future-state model in which companies and host countries would ideally leverage climate-sensitive mining practices for scalable and sustainable in-country value creation, which in turn could lead to the establishment of new green economic value chains, facilitating a diversification away from a potential over reliance on the natural resource sector.

The first part of this report—the Current-State Assessment—looks into what mining companies are doing to adapt to climate risk and mitigate their climate impacts, and showcases five publicly traded mining firms, and the extent to which their climate strategy may generate in-country value. The reason for approaching these sustainability efforts at the firm-level, as opposed to providing a catalogue of initiatives by various mining firms, is to capture at a strategic level how publicly traded mining firms with a profit motive are able to achieve positive climate outcomes while maintaining—or even increasing—their net income. Firms that have yet to take steps in this direction, might find these examples useful for setting a roadmap toward climate-smart operations

that benefit not only the global climate and their host jurisdictions, but their shareholders as well.

The second part of the report—Mining Firms' Insights and Proposed Future State—summarizes the feedback provided by sustainability officers at some of the world's largest mining firms who were consulted during the preparation of this report. Their feedback provides insights into how the industry really views local value creation, and to what extent it has used climate-sensitive efforts as a lever to generate such value. The report concludes with a proposed future state model that might help focus mining firms' investment toward climate-sensitive production and procurement processes that also drive in-country value creation.

2 Mining Firm's Climate-Sensitive Current State Assessment

This section outlines the climate strategy and related implementation initiatives of 10 companies identified by applying the methodology presented in the Methodology and Value Chain Analysis report. The sample is further reduced by applying an “organizational sophistication” filter as described in appendix A.

MINING FIRMS' SELECTION

The Methodology and Value Chain Analysis report identified priority areas and initiatives in which mining firms are currently engaged. Using this framework, 10 mining firms that address no fewer than two of the priority areas were identified for further analysis. The selection was also informed by the desire to arrive at a sample of firms that in the aggregate address all priority areas. With the understanding that the initiatives previously identified are not comprehensive, this report also relies on externally published rankings and indices of leading climate-sensitive mining firms, such as the Carbon Disclosure Project's (CDP) Digging Deep Report and Dow Jones Sustainability Index (DJSI), to augment the list. Lastly, the sample was selected with the specific objective to ensure geographic diversity and emerging market representation. The result of the firm selection exercise were shared with a group of industry experts for validation.

It is important to note that the universe of mining firms from which to select a fairly narrow list of 10, is quite large. As such, there exists an unavoidable risk of subjectivity. To minimize this risk, this report relies on independent research, published indices, and a network of experts and industry professionals, as well as the authors' professional judgment to arrive at a representative sample. An overview of each mining firm in the sample is summarized in table 2.1.

TABLE 2.1 Sample mining companies overview

DEVELOPED COUNTRY-BASED FIRMS*							
COMPANY NAME	DESCRIPTION	LOCATION	CDP DIGGING DEEP COMPANY	DJSI COMPANY	PRIORITY AREAS ADDRESSED	SAMPLE CLIMATE-SENSITIVE INITIATIVES	
						ADAPTATION	MITIGATION
Goldcorp	Goldcorp is a gold mining and production company based in Vancouver. They have an integrated value chain from exploration and extraction to processing and reclamation. It operates four mines in Canada, two in Mexico, and three more in Guatemala, Honduras, and the Dominican Republic.	Canada	No	No	(1). Mine Design and Closure Planning (2). Energy Intensity in Extraction (3). Materials Handling (4). Water and Waste Management	- Tailings Management - Zero Water Initiative	- Strategic GHG Framework - Electrifying Mining Equip.
Teck Resources	Teck is a metals and mining company based in Vancouver, and is Canada's largest diversified resources company. It's primary products are metallurgical coal, copper, and zinc.	Canada	Yes	Yes	(1). Energy Intensity in Extraction (2). Materials Handling (3). Water and Waste Management	- Strategic Water Management	- Applies a high internal carbon price and supported carbon pricing policy - Replacement of Diesel in Hauling Equipment
Barrick Gold Corporation	Barrick is the largest gold mining company in the world, and is headquartered in Toronto. Its operations are primarily based in the Americas and is supplemented by mines in Zambia, Saudi Arabia, and Papua New Guinea.	Canada	No	Yes	(1). Mine Design and Closure Planning (2). Energy Intensity in Extraction (3). Materials Handling (4). Water and Waste Management	- Strategic Water Management - Tailings Management	- GHG Targets
Newmont Mining Corporation	Newmont is an American mining company based in Colorado. Its primary products are gold, copper, and silver; and it is the world's second largest producer of gold behind Barrick. It is active in the US, Indonesia, Australia, New Zealand, Ghana, and Peru.	USA	Yes	Yes	(1). Mine Design and Closure Planning (2). Energy Intensity in Extraction (3). Materials Handling (4). Water and Waste Management (5). Downstream Processing	- Mine Conversion to Pump Storage Facility - Tailings Management - Site-Specific Water Management Charters	- Renewable Energy PPAs - Ecoefficiencies in Comminution - Fuel Switching from Diesel - GHG Targets -Strategic GHG Framework

continued

TABLE 2.1, Continued

DEVELOPED COUNTRY-BASED FIRMS*							
COMPANY NAME	DESCRIPTION	LOCATION	CDP DIGGING DEEP COMPANY	DJSI COMPANY	PRIORITY AREAS ADDRESSED	SAMPLE CLIMATE-SENSITIVE INITIATIVES	
						ADAPTATION	MITIGATION
Rio Tinto Group	Rio Tinto is one of the world's largest metals and mining corporations. The company produces many commodities but is weighted heavily toward iron ore and steel. It has operations on six continents but is primarily concentrated in Australia and Canada.	UK/Australia	Yes	No	(1). Mine Design and Closure Planning (2). Energy Intensity in Extraction (3). Materials Handling (4). Water and Waste Management (5). Downstream Processing	- Mine Closure Standard - Strategic Water Management	- Strategic GHG Framework - Renewable Energy PPAs - Haul Truck Idle Management
Anglo American PLC	Anglo American is a large diversified miner with significant mining operations in diamonds, copper, platinum and other precious metals, iron ore, coal, and nickel.	UK/South Africa	Yes	Yes	(1). Energy Intensity in Extraction (2). Materials Handling (3). Water and Waste Management (4). Downstream Processing	- "Waterless" Mining	- Hydrogen Fuel Cell Tech - Advanced Drilling and Cutting Systems - Selling Thermal Coal Assets - CEO Emissions Reduction KPI in Comp Plan
Boliden AB	Boliden is a Swedish mining and smelting company that focuses on producing precious metals, copper, and other base metals.	Sweden	Yes	No	(1). Energy Intensity in Extraction (2). Materials Handling (3). Downstream Processing		- Electronics Scrap Recycling - Highest Share of Renewable Energy - Automated Processes
Emerging Market-Based Firms							
Codelco	Codelco (the National Copper Corporation of Chile) is a Chilean state-owned copper mining company, formed through the nationalization of foreign-owned copper mines in 1976. Headquartered in Chile, it is the largest copper producing company in the world.	Chile	No	Yes	(1). Energy Intensity in Extraction (2). Water and Waste Management (3). Downstream Processing	- Strategic Water Management	- Bioleaching

continued

TABLE 2.1, Continued

DEVELOPED COUNTRY-BASED FIRMS ^a							
COMPANY NAME	DESCRIPTION	LOCATION	CDP DIGGING DEEP COMPANY	DJSI COMPANY	PRIORITY AREAS ADDRESSED	SAMPLE CLIMATE-SENSITIVE INITIATIVES	
						ADAPTATION	MITIGATION
Grupo Argos	Grupo Argos is a Colombian conglomerate with large investments in the construction materials and energy industries. Its cement/construction materials industry, which this report focuses on, has operations in Columbia, Central America, the Caribbean, and the US.	Colombia	No	Yes	(1). Energy Intensity in Extraction (2). Materials Handling (3). Water and Waste Management (4). Downstream Processing	- Strategic Water Management	- Alternative Fuels Replacement - Downstream End-User Management - GHG Targets - Cement Production Process Optimization
Vale S.A.	Vale is a Brazilian multinational metals and mining corporation, is the largest producer of iron ore and nickel in the world, and is one of the largest logistics operators in Brazil. Vale's primary operations are in Brazil, with operations in 30 other countries.	Brazil	Yes	No	(1). Mine Design and Closure Planning (2). Energy Intensity in Extraction (3). Materials Handling (4). Water and Waste Management (5). Downstream Processing	- Strategic Water Management/ Water Recycling	- Variable Compensation Targets - GHG Targets - Integrated Maritime Operation - Self Production of Energy (Hydro) - Diesel Switching

Note: CDP = Carbon Disclosure Project; CEO = Chief Executive Officer; CSR = Corporate Social Responsibility; DJSI = Dow Jones Sustainability Index; GHG = Greenhouse Gas; KPI = Key Performance Indicator.

a. Determination based on location of the firm's primary office.

MINING FIRMS' CLIMATE-APPROACH CATEGORIZATION¹

This section assesses the sample companies identified in “Mining Firms Selection” section against a Climate Strategy Framework—presented in appendix A—to assess the relative climate-sophistication of their operations, and distill a smaller sample of mining firms for in-depth analysis. To this end, five categories of analysis are considered: (1) vision, governance, goals, and objectives; (2) processes and standards; (3) programs and initiatives; (4) disclosure and communications; and (5) the presence of a company's headquarters in an emerging market to ensure maximum geographic representation of the sample. For each category, table 2.2 contains the proxy variables and maximum scores.²

Table 2.3 summarizes the scoring, and criteria applied. A narrative summary of each company's results from this assessment is presented “Climate Strategists Group: Detailed Analysis” section, organized in three groups: climate strategists, climate conscious, and emerging leaders.

TABLE 2.2 Proxy variables and maximum scores

CATEGORY	MAXIMUM SCORE	PROXY VARIABLE
<i>Vision, Governance, Goals and Objectives</i> (A firm's governance of climate-smart mining efforts)	6	<ul style="list-style-type: none"> • Presence of GHG emissions targets • Presence of water governance and policy • Presence of executive variable compensation tied in part to climate-based results
<i>Processes and Standards</i> (Max A firm's climate-smart mining strategy)	4	<ul style="list-style-type: none"> • Presence of a Water Recycling Policy/Freshwater Use Guidelines • Presence of Renewable Energy PPAs
<i>Programs & Initiatives</i> (The effectiveness of a firm's climate-smart activities)	4	<ul style="list-style-type: none"> • Energy Intensity/Trend of Processes • Water Intensity/Trend of Processes
<i>Disclosure & Communications</i> (The effectiveness of a firm's reporting of progress)	6	<ul style="list-style-type: none"> • Presence of Third-Party Assurance • Disclosures Made to CDP • Alignment with Global Reporting Initiative (GRI)
<i>Headquarters location</i> (the firm's headquarters are located in emerging markets)	1	<ul style="list-style-type: none"> • Presence of firm's headquarters in emerging markets

Note: CDP = Carbon Disclosure Project; GHG = Greenhouse Gas; GRI = Global Reporting Initiative.

CLIMATE STRATEGISTS

The firms identified in this report as “climate strategists” bear similarities among them that set them apart from other mining firms. These distinguishing characteristics include: the high-quality, detailed, and leading practice-compliant sustainability metric reporting, the strength and explicit nature of sustainability targets, and strong water and energy management policies. The main strengths and weaknesses of the selected firms are analyzed below.

Newmont Mining Corporation

Newmont's comprehensive water and energy efficiency practices lead to a steep drop in withdrawn water and energy consumption over the last five years—by a factor of 62 percent and 44 percent respectively (Newmont Mining 2018). Newmont also shows a heightened level of commitment to climate action by tying executive compensation (bonuses) to implementing numeric GHG emissions reduction targets. Furthermore, Newmont goes the extra mile in its sustainability reporting functions by establishing a reasonable—as opposed to a limited—third party assurance process.

Vale S.A.

Among the mining firms from emerging markets, Vale sets itself apart when it comes to climate-sensitive operations. It regularly discloses climate results and targets to CDP, it plans its mines to avoid risk of water stress and boasted the highest water recycling rate among the firms assessed in CDP's Digging Deep Report (Soliman, Fletcher, and Crocker 2017). Most interestingly, Vale has integrated within its firm ocean-going vessels as part of its logistics operations—one of the largest in all of Brazil. It has used those operations to drive energy efficiencies through the downstream portions of the value chain, which in turn have the impact of reducing emissions (Vale 2018).

TABLE 2.3 Mining firms' categorization

			FRAMEWORK EVALUATION CRITERIA					CUMULATIVE SCORE (MAX: 21 PTS)
			VISION, GOVERNANCE, AND GOAL (MAX: 6 PTS)	PROCESSES AND STANDARDS (MAX: 4 PTS)	PROGRAMS AND INITIATIVES (MAX: 4 PTS)	DISCLOSURE AND COMMUNICATION (MAX: 6 PTS)	EMERGING MARKET COMPANY (MAX: 1 PTS)	
Shortlisted firms	Climate strategists	Newmont Mining Corporation	6	3	4	6	0	19
		Vale S.A.	4	4	4	5	1	18
		Barrick Gold Corporation	5	3	3	6	0	17
		Anglo American PLC	6	3	2	6	0	17
		Rio Tinto Group	4	3	4	5	0	16
	Climate conscious	Teck Resources	5	3	3	5	0	16
		Boliden A.B.	2	4	3	5	0	14
		Goldcorp	3	2	3	5	0	13
	Emerging leaders	Grupo Argos	2	1	2	1	1	7
		Codelco	0	0	0	0	1	1

Detailed scoring:

	GOVERNANCE			PROCESSES AND STANDARDS		PROGRAMS AND INITIATIVE		DISCLOSURE AND COMMUNICATIONS		
	EMISSIONS TARGETS	WATER GOVERNANCE	EXECUTIVE COMPENSATION	WATER RECYCLING	RENEWABLES INCORPORATION	ENERGY INTENSITY REDUCTION	WATER INTENSITY REDUCTION	PRESENCE OF THIRD PARTY ASSURANCE	DISCLOSURES TO CDP	ALIGNMENT WITH GRI
Newmont Mining Corporation	2	2	2	2	1	2	2	2	2	2
Barrick Gold Corporation	2	1	2	2	1	1	2	2	2	2
Vale S.A.	1	1	2	2	2	2	2	1	2	2
Rio Tinto Group	2	2	0	1	2	2	2	1	2	2
AngloAmerican PLC	2	2	2	1	2	1	1	2	2	2
Boliden A.B.	1	1	0	2	2	2	1	1	2	2
Goldcorp	1	2	0	1	1	1	2	1	2	2
Teck Resources	2	1	2	1	2	2	1	1	2	2
Grupo Argos	1	0	1	0	1	1	1	1	0	0
Codelco	0	0	0	0	0	0	0	0	0	0

Note: CDP = Carbon Disclosure Project; GRI = Global Reporting Initiative.

continued

TABLE 2.3, Continued

Scoring methodology									
0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2
0 = NO TARGET	0 = NO REPORTED FORMAL OVERARCHING OR SITE-LEVEL FRAMEWORK IN PLACE	0 = NO POLICY IN PLACE	0 = DE MINIMIS LEVELS OF WATER RECYCLING	0 = NO MENTION OF RENEWABLE INCORPORATION IN REPORTING	0 = LACK OF FIGURES REPORTED	0 = LACK OF REPORTED DATA	0 = NO ASSURANCE PERFORMED	0 = NO DISCLOSURE MADE	0 = DOES NOT ALIGN
1= Some target specified, but lacks industry-leading ambition	1 = Presence of some level of formal framework	1 = Policy in place/To be in place but lacking	1 = 1-70% Recycling rates	1 = Some level of renewables incorporation into operations	1 = Figures reported but increased intensity	1 = Intensity increase or overall intensity > 100 ton/ton of ore	1 = Limited assurance	1= Disclosure made but lacking	1 = Loosely aligns
2= Target and year specified and is among the most aggressive in the industry	2 = Reported overarching framework and site-level framework/ standardized tools in place	2 = Policy in place and robust	2 = > 70% Recycling rates	2 = > 11% Renewables incorporation	2 = Trend of decreasing intensity	2 = Intensity decrease	2 = Reasonable assurance	2 = Robust disclosure made	2 = Aligns well

Barrick Gold Corporation

Barrick has put into place several best practices as an organization but seems to be somewhat constrained in its efforts by the energy intensity of its operations. Despite the fact that the company's use of energy on an absolute and intensity basis has increased since 2013, its reporting of figures remain in line with industry best practice, alignment with GRI and CDP standards, and use of the most stringent assurance process among the sample companies analyzed (CDP 2018; Barrick Gold Corporation 2018). The firm ties executive compensation to climate-based outcomes, and has progressively improved its water conservation efforts, including by launching its Water Strategy Management Framework in 2016 (CDP 2018).

Anglo American, PLC

Anglo American has aggressively targeted emissions reductions by tying it to executive compensation, and scores highest in CDP's Digging Deep report's water governance and policy metric and is noted by CDP for having group's most comprehensive company-wide water policy, and is pursuing a steep water reduction target of 19 percent against business as usual forecasts (Soliman, Fletcher, and Crocker 2017; CDP 2018). The firm also uses the more exacting reasonableness assurance standard for its reporting. Nonetheless, Anglo American still could see some progress in its incorporation of renewable energy resources, where it ranks near last among its CDP peers.³

Rio Tinto Group

While Rio Tinto subscribes to most of the same leading practices surrounding reporting and governance as the rest of the top five, it is actively selling its thermal coal assets—a move that leaves the firm less prone to energy intensity and CDP scope 3 emissions, and one that makes business sense—to divest of an asset whose market potential is likely capped. (Soliman, Fletcher, and Crocker 2017). Moreover, Rio Tinto is by far the technological transformation leader—using its “Mine of the Future” program to slash Capital Expenditure (CAPEX)—a move that reduces a mines physical footprint, and as such its energy and water demands and potential for impacting a larger portion of the local environment.

CLIMATE CONSCIOUS

Teck Resources

Like many of its peers, Teck's disclosure procedures, at least in terms of its global reporting standards appear sound (Soliman, Fletcher, and Crocker 2017). The firm has solid emissions reduction targets, it sources 28 percent of its energy needs from renewable sources, and has been explicitly supportive of carbon regulation (Teck Resources 2018; Soliman, Fletcher, and Crocker 2017). However, Teck does not have a compensation scheme tied to a climate-sensitive KPI, its water recycling rate is lower than the firms identified in the Climate Strategists group, and energy intensity figures that were slightly below its competitors (Soliman, Fletcher, and Crocker 2017). It is also worth noting that Teck is heavily invested in the fossil fuel sector, with 50 percent of its CAPEX allocated to an oil sands project—a project that inflates its risk for large scope 3 emissions. Teck was quite competitive on the climate strategy front with its peers in the Climate Strategists group. The report

only distinguishes it from its peers due to its large oil sands investments at a time when companies like Rio Tinto are divesting carbon-intensive assets.

Boliden A.B.

Boliden stands out for its rapid uptake of renewable energy—an impressive 42 percent of the firm's overall energy consumption (whether electricity or fuel) comes from renewable sources. That stands in comparison to, for instance, Anglo American who sources only 12 percent of its energy needs from renewables. In addition, this report scores Boliden favorably because of the innovative nature by which its dramatically increased its renewable consumption—compared to most of its peers analyzed in the CDP Digging Deep report. That being said, gaps in the groups governance structure led to its exclusion from the Climate Strategists group. Those gaps included a non-response to the CDP water questionnaire and no climate-based KPI tied to executive compensation (Soliman, Fletcher, and Crocker 2017).

Goldcorp

With its “Towards Zero Water,” approach to tailings management, and transparent and comprehensive disclosures and metric reporting, Goldcorp—from a climate governance and reporting standpoint—is certainly among its peers the report identified as the top five (Goldcorp 2018; CDP 2018). Where Goldcorp appeared to fall short, by contrast, is in implementation—specifically from an energy and water consumption standpoint (Goldcorp 2018).⁴ Water withdrawal, as an absolute figure, has increased since 2013, and the energy intensity of its operations since 2011 has increased by 46 percent.

EMERGING PERFORMERS: GRUPO ARGOS AND CODELCO

The two emerging market firms included in the Emerging Performers group should not be viewed as deficient in terms of climate-sensitive activities. They are instead, nascent organizations in this field, and were shortlisted for their climate innovations and recognitions. Grupo Argos was named industry leader by the DJSI, an index in which both these firms are listed. Codelco has been extremely aggressive in pursuing bioleaching applications in its operations, and Cemento Argos, a subsidiary of Grupo Argos has made significant advances in reducing the tremendous energy requirements in the cement production process.

With increased organizational sophistication and transparent reporting these firms could attain the next level. It is challenging to find, for instance, numerical emissions and water consumption targets for Codelco, metrics are inconsistently reported from one year to the next, and the firm does not employ an auditor to provide assurance over its sustainability efforts (Soliman, Fletcher, and Crocker 2017). By contrast while Argos is more precise with targets, it does not report to CDP (an omission for which it received an “F” from the CDP). It also underreported certain water figures, and though it hired an auditor to provide some level of assurance regarding the sustainability report, the auditor found significant errors. These firms are clearly on the right track, but still have to achieve a certain level of organizational maturity, and accede to international standards like CDP, in order to take the next step.

CLIMATE STRATEGISTS GROUP: DETAILED ANALYSIS

Newmont Mining Corporation

Newmont sets itself apart from other companies for its commitment to sustainability, enshrined in its mission statement, “*to create value and improve lives through sustainable and responsible mining*” and in its core values. Its sustainability and climate-related efforts have also been recognized by the DJSI World, who named the company the mining industry leader in overall sustainability for the last three years. The effort that Newmont puts into sustainability—especially in comparison to its peers—appears to have not damaged the overall value of the company relative to its peers in this report. At more than twice the size (in terms of revenue) of Goldcorp, Newmont’s stock price is nearly three times higher, and is three times higher than competitor Barrick Gold, who is a slightly larger corporation than Newmont. The company’s stock price has actually increased in the past five years, where Barrick and Goldcorp have seen stock declines. In its analysis, Morgan Stanley indicated that it favored Newmont over Barrick in part because of a “...de-risked project pipeline.”⁵ This is important to note because climate stewardship is often narrowly viewed as occurring at the price of, or at least as not accretive toward shareholder value. Newmont’s experience suggests that it is possible to create value for shareholders through sustainability investment. For Newmont, such investments start with an effective tone at the top, reflected in its mission statement, and supported by its sustainability governance structure. The detailed assessment of the scoring variables is provided below.

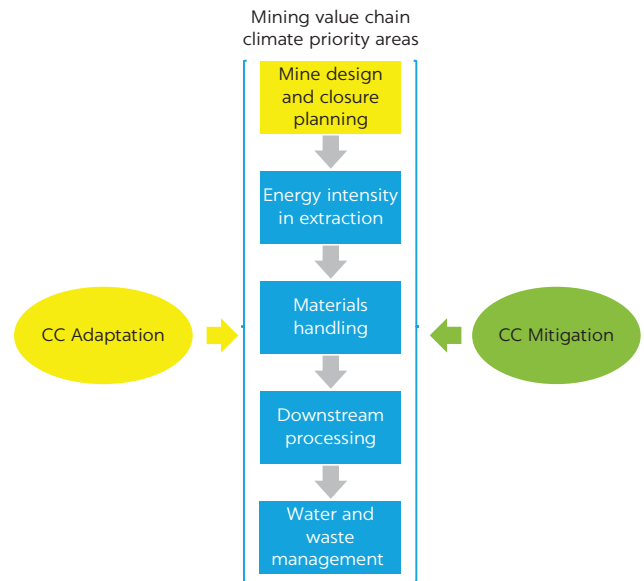
Vision, governance, goals, and objectives

Newmont’s climate change-related governance efforts begin with a well-articulated approach, and global energy and climate strategy focused not only on mitigating threats, but seizing opportunities. The prongs of that strategy include (1) securing a stable and cost effective supply of energy for operations; (2) achieving sustainable cost and efficiency improvements; (3) reducing its carbon footprint through renewable energy, energy efficiency strategies, and carbon offsetting; (4) adapting to a changing climate; and (5) collaborating internally and engaging externally on energy policy frameworks that support an effective transition to a low-carbon economy. It has operationalized its climate efforts by establishing a cross-functional Global Energy and Climate team (GECT) who develops climate plans not just at the company level, but at the regional and site level. Newmont also has an aggressive GHG emissions reduction target of 16.5 percent by the end of 2020, and established in 2018 an internal carbon price to use when making investment decisions—a good practice that all of the final five mining firms included in the Climate Strategists group have adopted to at least some degree (CDP 2018; Newmont Mining 2018). Lastly Newmont has set itself at the leading edge of climate-related governance practices by adopting an executive compensation scheme tied in part to incremental GHG reduction targets (CDP 2018).

Processes and standards

Newmont’s climate-related and process standards are best exemplified by its approach to water consumption and impacts. At the firm level, the company executes its Global Water Strategy (whose five pillars are watershed approach,

impact mitigation, operational performance, external engagement, and internal collaboration) through an overarching vision for managing water as an asset. This strategy is supported by the Water Management Standard (Newmont 2018). This Standard sets for the company and its operations managers minimum requirements to proactively plan and manage water throughout the mine lifecycle—from exploration to post closure—such that human health, stakeholder water needs, and the environment are protected. Newmont also provides standards at the mine-level, deploying Water Accounting Frameworks (WAFs) and site-wide water balances through which each site defines, measures, and reports water use by inputs, outputs, and diversion identifying water quality categories. The standard also requires compliance with regulations and sets minimum requirements for water quality parameters where they are not provided. This site-specific approach to water management sets Newmont apart from its competitors by addressing the variability of the risks and impacts of water consumption based on the particularities of any given operation. From an energy policy perspective, as mentioned above, Newmont has recently approved a carbon price at an US\$50/t CO₂—a decision that will help incorporate climate considerations and low emissions alternatives during investment decision-making (Newmont Mining 2018).



Programs and initiatives

As a global leader in climate-smart mining practices, Newmont is currently employing a number of discrete programs and initiatives aimed at achieving its climate vision. Collectively, these activities have helped the company achieve significant savings in water withdrawal and reductions in energy consumption over the last five years. Some of its more forward-thinking activities and their Planet, Profit, People impacts (3Ps assessment) are noted below and summarized in boxes 2.1–2.3.

Rolling out carbon pricing. The rising tide of carbon taxation schemes employed by governments across the world is continuing unabated, with large markets such as China set to adopt such a tax nationwide from July 2018. As of this report's publication, 40 national jurisdictions and over 20 cities, states, and regions are putting a price on carbon.⁶ In recognition of this trend, and the corresponding cost implications, the company has adopted an internal carbon price mechanism, sometimes termed a “shadow cost of carbon” to better understand how carbon costs impact its investment options. Newmont describes the effort as improving its visibility into each investment's embedded carbon risk, allowing it to compare each option's exposure to future carbon pricing schemes, spurring innovation in energy efficiency and clean energy, and promoting the long-term sustainability of the business. Since piloting the mechanism in 2017, the firm has applied an internal price of carbon to projects in Nevada, Peru, and Australia, and Ghana, using a price of US\$25/t CO₂ and US\$50/t CO₂. Using a pre-tax cost benefit analysis, a US\$50 million investment in Nevada to switch a coal power plant to natural gas implied a potential US\$117.3 million cost savings at a US\$25 carbon price, and a US\$284.6 million savings at a US\$50 carbon price.⁷

BOX 2.1

Rolling out carbon pricing: 3Ps assessment

Planet: As modern science has shown, the primary cause for climate change is the earth's atmospheric greenhouse effect of which carbon emissions are an immense contributor. Newmont's pricing of carbon, to the extent that it incentivizes lower-emitting operations, can have a substantial impact over time on the firm's climate footprint and its contribution to climate change.

Profit: There is a well noted global trend toward carbon pricing, with large jurisdictions set to adopt a version of a carbon tax in the near future. This entails—especially for the carbon-intensive mining industry—a lurking embedded cost in operations that usually persist for longer than 20 years. The extent to which organizations can price this taxation ahead of time allows them to make design and investment decisions that can avoid these costs to the

extent possible. In Newmont's rough analysis of its investment in Nevada for instance, opting for natural gas power instead of coal could result in as high as US\$284.6 million in cost savings.

People: While the establishment of a shadow price of carbon may seem attenuated from the prospect of generating real local economic value—it is worth considering the measure as a foundational element of contributing to the growth of green value chains within a host nation. By their very nature, internal carbon pricing captures a hidden cost of an investment into a carbon intensive energy source—Newmont's internal directive forces its hand to invest in greener energy infrastructure, and that brings with it the opportunity to develop a local supply chain to support such investments.

BOX 2.2

Treating water discharge: 3Ps assessment

Planet: 22 percent of the Ghanaian population lack access to safe water and 70 percent of *all* diseases are caused by unsafe water.^a The scarcity of the resource and the vulnerability of the population to surface water quality means that mine operators relying on a stable water source must work with local authorities to preserve, and to the extent possible, improve water quality during operations. Newmont's work with GEPA in constructing a water treatment plant is an example of a leading practice in this space.

Profit: Environmental remediation post mine closure can be a tremendously costly endeavor. As just one data point, the Environmental Protection Agency (EPA) spent US\$1.1 billion between 2010 and 2014 on environmental cleanup of water resources contaminated by metal and mineral mining operations.^b In 2016 the US federal government passed the burden of this remediation onto the

industry. By committing to the expense of water treatment ahead of time Newmont is likely avoiding a prohibitively large remediation expense in Ghana down the line.

People: Water treatment and sanitation is an extremely economically beneficial activity. According to UNESCO (2016a), every US\$1 million invested in the United States' water supply and treatment infrastructure generates between 10 and 20 additional jobs and the US Commerce Department estimates that each job created in the local water and wastewater industry creates 3.68 indirect jobs in the national economy (International Labour Organization 2016). Newmont's installation of a water treatment facility—especially in close coordination with GEPA—offers the opportunity for skills transfer and job creation in a sector of extreme value to the host government.

a. <https://water.org/our-impact/ghana/>.

b. <https://www.chicagotribune.com/news/nationworld/ct-epa-mining-pollution-20171201-story.html>.

BOX 2.3

Optimization of haul truck routes: 3Ps assessment

Planet: While capital-intensive projects and fleet retrofits may draw the most attention, small operational augmentations can often yield important results. Such is the case with Newmont, where its study of truck routes led to a reduction in carbon emissions.

Profit: What is good for the planet can often be good for a company's bottom line. In this instance, shorter more efficient haul routes not only reduced Newmont's carbon footprint, it also entailed a corresponding reduction in fuel consumption for material movement on a per-ton basis. Reducing fuel input costs over the life of a mine can have a huge impact on an operation's profitability.

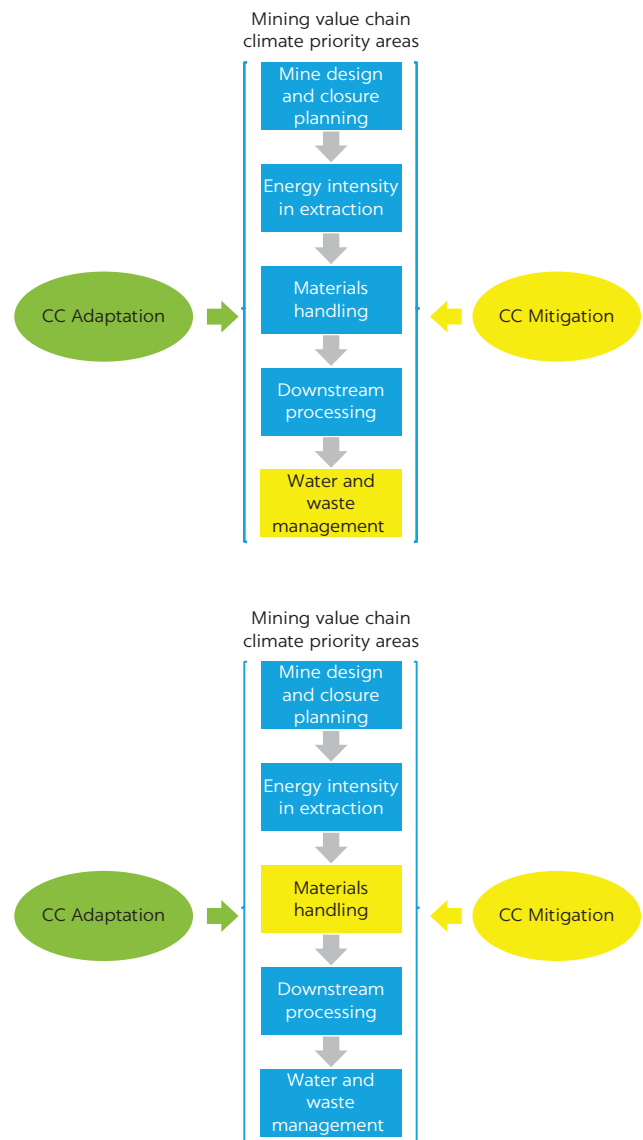
People: It stands to reason that optimized routes lead to fewer truck driver hours over time, but that being said, it can lead to the creation of job opportunities for logistics engineers that can optimize routes. Moreover, it leads to a local procurement standard where Newmont will look more favorably on trucking firms that prioritize route optimization—meaning, Newmont and companies like it operating in the developing world can leverage the procurement process to drive skills transfer (e.g., logistics optimization) to local firms.

Treating water discharge. Two of the pillars of Newmont's global water strategy are to mitigate environmental and social impacts associated with water use and to collaborate on water stewardship. This is what the company is doing in Ghana, where it is working with the Ghana Environmental Protection Agency (GEPA) and constructed a reverse osmosis water treatment plant that will ensure that water discharged from its Afaho operation is treated in a manner that meets all of GEPA's standards. It is the notion of not only making active investments but doing so in synergy with GEPA that serves to not only to mitigate Newmont's impact on the Ghanaian watershed, but also reduces the risk to Newmont that the government of Ghana or the Ghanaian people may find Newmont's environmental stewardship to be less than adequate.⁸

Optimization of haul truck routes. Not all energy efficiency gains and carbon intensity reduction in the materials handling segment of the value chain are a result of large upfront costs associated with fleet overhaul, switching fuel supply from diesel, and installing alternatives to trucks such as conveyor belts and a rail line. In addition to exploring these more costly approaches, Newmont has supplemented its efforts with the light-touch tactic of improving the routes its haul trucks take to and from the extraction site. This has resulted not only in greater operating efficiencies for the mine, but also fuel savings and lower emissions per production on a per-ton basis.

Disclosure and communications

The disclosure and communications function in the climate-smart mining space serves two functions for a mining company—(1) transparently tracking the



effectiveness of a company's efforts and (2) achieving the credibility, reputation, and goodwill in the marketplace to be preferred over competitors. Toward that end, Newmont complies with the most stringent of disclosure standards, not only following GRI standards as almost all companies analyzed in this report do, but filing regular sustainability reports with CDP, and conducting the most rigorous third party verification of its reporting by using a reasonable assurance standard (CDP 2018).

Vale S.A.

Headquartered in Rio de Janeiro, Brazil, Vale is one of the few truly global diversified mining companies that calls an emerging market home. With operations in more than 30 countries and a market capitalization in excess of US\$70 billion, Vale is built on a heavy presence in iron ore and steel, a commodity from which the company extracts approximately 70 percent of its revenue. The company is the largest commercial producer of iron ore in the world. As recently as June 2018, Vale has pushed to diversify further, funding expansion plans at their Voisey's Bay operation in northern Canada by selling rights to future cobalt production at the site and signaling a willingness to explore and invest in metals and minerals further afield from its strong history in iron ore, including increasingly targeting copper and nickel for exploration and site development.

Vision, governance, goals, and objectives

Vale's position on climate change and maintaining climate-focused standards is strong, having consistently produced sustainability reports for over a decade. Among the strengths that Vale exhibits is a newly initiated corporate governance program that uses variable compensation as a mechanism for rewarding employees and corporate leaders for contributing to the company's climate-oriented goals. This program ties sustainability targets to three impact categories (1) Environment, (2) Energy, and (3) Social, with Environment and Energy together comprising 70 percent of the total score. This program, while not unique amongst the companies analyzed in this report, is indicative of the seriousness with which Vale approaches its climate goals.

Vale couples this governance structure with more specific carbon reduction goals. It targets reducing direct GHG emissions by 5 percent by 2020 and has concrete targets for water management in addition to longer term strategic goals (CDP 2018). However, according to the company's 2017 Sustainability Report and the CDP, the company is still working towards defining tangible goals for water resource utilization. This includes a multi-year plan to significantly reduce the amount of fresh water consumed in production by 2030 (Vale 2018).

Processes and standards

Perhaps Vale's most notable process is its water recycling program, a framework that achieves recycling rates of more than 82 percent for water used in industrial processes (Vale 2018). This process stands as a strong complement to their water reduction goals and water withdrawal intensity figures for their operations that sit astride the industry average. Generally, Vale appears to be in a strong position when it comes to water management and recycling. Further, the energy intensity commitments to which Vale aspires have yielded results (CDP 2018). The company's energy intensity of production and emission metrics are relatively low when compared to notable peers such as Anglo American and Freeport-McMoRan.

Additionally, Vale touts its Integrated Management System (IMS) which serves as a definable framework to ensure, or at least encourage, the company to effectively implement its overall sustainability policy (CDP 2018). The IMS outlines processes from 1: *Policies, objectives, and goals* to 12: *Monitoring, performance indicators and continuous improvement* that the company actively apply to their climate-related targets and ambitions. Furthermore, Vale is exploring carbon pricing mechanism as a basis for company decision making, a tactic that could pair well with its pre-existing internal IMS framework (CDP 2018). The company is piloting a “shadow carbon price” that models hypothetical surges in market prices for carbon, to project the true cost associated with some of its long term investment decisions.

Programs and initiatives

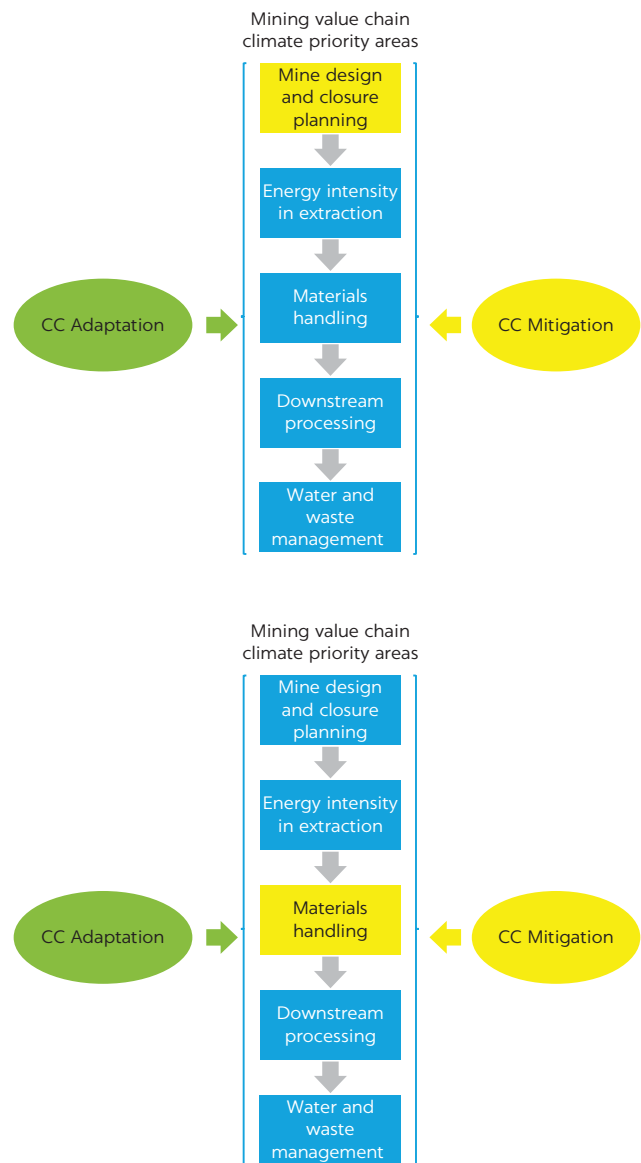
While Vale employs a number of climate-smart initiatives aimed at mitigating, or adapting to, the effects of climate change, three prominent initiatives and their 3P assessment are provided below and summarized in boxes 2.4 and 2.5.

Self-production of energy (Hydro). Vale has made a concerted effort to utilize renewable energy where possible. An example of this type of effort is the Karebbe Hydroelectric Plant, located at Vale’s nickel operation in Indonesia. Operating since 2011, the plant is capable of generating 90 MW of power used in mining operations with surplus power distributed to local communities. Karebbe is Vale’s most recent hydroelectric effort in Indonesia, joining earlier hydroelectric plants at their Larona and Balambano sites, the plans generate emission reduction impacts and have the ancillary benefit of improving community relations and standard of through the delivery of additional power generation capacity (Vale 2018).

Diesel switching. In multiple areas, Vale has made commitments to modifying its transportation mechanisms to more efficient, and less carbon intensive, fuel sources. For example, the company has retrofitted its rail operations that transport ore from mine sites in Brazil to accommodate alternative fuel sources such as ethanol. Further, the company has replaced fuel sources at numerous plants in the Tubarão Complex in Brazil, further targeting GHG emission reduction.

Disclosure and communications

While Vale presents a portfolio of strong climate change action, one area for improvement is enacting a strong framework for reporting and verifying carbon emissions. CDP noted that Vale relies on “limited” assurance when seeking verification of its emissions curtailment efforts (CDP 2018). This threshold is less exacting than its counterpart, “reasonable” assurance, which entails a more revealing third-party verification of emissions standards.



BOX 2.4

Self-production of energy: 3Ps assessment

Planet: According to the EPA, the biggest driver of global emissions is the electricity and heat production sector due to the burning of coal, gas, and oil.^a Vale's efforts to shift toward renewable sources by adding its own generation sources onto the grid helps provide more non-emitting sources of energy, for both itself and the broader grid. Quantitatively, the plant has eliminated the need to consume 13 million barrels of High Sulfur Fuel Oil and about 3 billion liters of diesel fuel each year.

Profit: By generating and sourcing its own energy Vale benefits its bottom line on two fronts. First, it will not have to pay margin on the energy it produces, unlike the energy it would typically source from the

local utility. Second, by sourcing its own power, the company has more visibility into and control over long term power costs.

People: Developing a power project locally can have a massive economic impact. In one example, the Overseas Development Institute conducted a job creation impact study on the construction of a 13 MW run-of-river hydro plant in Uganda. They found that the plant was responsible for the creation of up to 1,278 direct and indirect construction jobs (translating to 7,318 person years of work), and up to 10,256 knock-on jobs (~256,000 person years) resulting from the improved power supply to the grid.^b

a. US Environmental Protection Agency Data, <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>.

b. Overseas Development Institute, Job Creation Impact Study: Bugoye Hydropower Plant, Uganda, 2013, <https://www.pidg.org/resource-library/other-documents/odi-job-creation-impact-study-bugoye-hydropower.pdf>.

BOX 2.5

Diesel switching: 3Ps assessment

Planet: According to Energy Information Agency (EIA), diesel is the most carbon intensive fuel source next to thermal coal, so any effort by multinational mining majors to switch fuels to a comparatively cleaner, less emitting source is a positive climate outcome.^a

Profit: An exclusive reliance on any one type of fuel can leave a firm exposed to volatile input costs. According to EIA diesel prices, for instance, are set to increase by an average price of 10 percent in 2019 compared to 2018 prices. Diversification from this specific fuel source brings with it the opportunity to mitigate price shocks—gradual or otherwise.^b

People: There are a number of social benefits of a sector of an economy diversifying fuel consumption from petroleum sources to other resources. For instance a boost in the consumption of ethanol is a benefit to the local agricultural sector, and a corresponding reduction in petroleum consumption frees up more of the commodity for the country to export. Brazil, for example, as of 2016 was the world's 10th largest oil producer.^c In the midst of a recent economic malaise, and on the precipice of what might be historic oil production in 2018,^d the more it can boost the productivity of other sectors of its economy (e.g., agricultural) and export more of its petroleum, the better it may be for the country's overall economic outlook.

a. U.S. Energy Information Administration, Frequently Asked Questions, 2018, <https://www.eia.gov/tools/faqs/faq.php?id=73&t=11>

b. U.S. Energy Information Administration, Short-Term Energy Outlook, 2019. March 12. <https://www.eia.gov/outlooks/steo/report/prices.php>.

c. "Production of Crude Oil including Lease Condensate 2016," U.S. Energy Information Administration.

d. <https://oilprice.com/Energy/General/Brazil-Poised-For-Historic-Oil-Boom.html>.

However, it should be noted that the standard Vale employs remains among the norm amongst competitors from emerging economies.

Barrick Gold Corporation

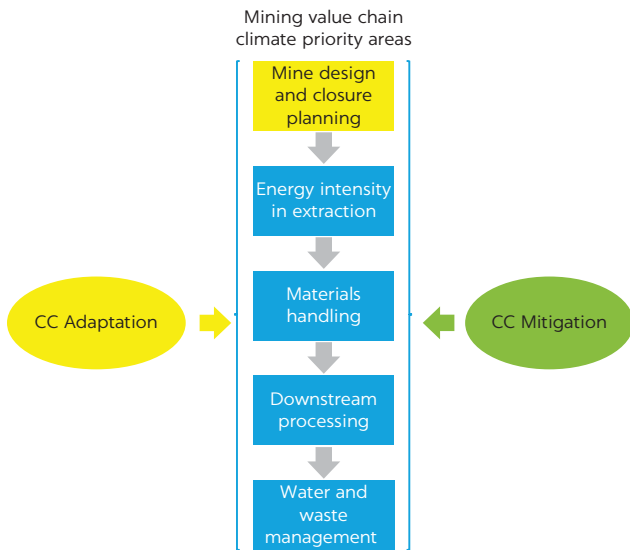
Barrick is the second of two gold-focused companies in the Climate Strategists group. Newmont and Barrick are very similar with regard to their attention to climate smart processes and strategies, although Newmont appears to have achieved a better integration of processes and strategies from the top to the mine-site. Barrick, is the largest gold mining company in the world in terms of production—it produced 5.32 million ounces of the precious metal in 2017. With a net income of US\$1.5 billion in 2017, the company is the most profitable among the three gold mining organizations analyzed in this report (Barrick Gold Corporation 2018). It is clear from its sustainability efforts, moreover, that Barrick has used its earnings to invest in climate impact mitigation and adaptation. Those efforts are described in detail below.

Vision, governance, goals, and objectives

Barrick's climate-sensitive approach starts with its corporate sustainability vision, which states in part, *“we partner with host governments and communities to transform their natural resources into sustainable benefits and mutual prosperity.”* The vision statement captures the core of a sustainable approach to climate-smart mining—a “triple bottom line” that comprises a people, planet, and profit lens. To understand how the triple bottom line focus can manifest in strategic decisions, it is helpful to consider Barrick's climate strategy, which was developed in 2017. For instance, the company tried to dovetail the business imperative of maximizing free cash flow with the climate imperative of “understand[ing] and mitigat[ing] the risks associated with climate change; reduc[ing] [its] impacts on climate change; and improve[ing] [its] disclosure on climate change” (Barrick Gold Corporation 2018). At a governance level, Barrick has charged its board's Corporate Responsibility Committee with the oversight of the company's sustainability efforts which are led by a Chief Sustainability Officer, who leads the Community Relations, Corporate Social Responsibility, and Government Affairs teams. Its GHG emissions reduction target is ambitious at 30 percent by 2030 (CDP 2018). It has also established a company-wide water management framework organized around assessment, assurance, and collaboration; but unlike Newmont, Barrick does not appear to require the establishment of frameworks at each mine site. Barrick has similarly adopted the leading practice of tying executive compensation to sustainability outcomes, but has not tied compensation explicitly to GHG emissions reductions.

Processes and standards

Barrick's approach to sustainability is unique in the degree to which it is explicitly focused on a collaborative approach with the host governments in which it operates. It begins with the vision statement quoted above, where Barrick notes its focus on partnering with host governments and communities. It then continues through to its sustainability strategy which states as one of its principles that “host government[s] and communities expect and deserve to benefit from the extraction of their resources. We do this through local hiring and contracting, investing in community priorities, and paying our fair share of taxes.” This is a key takeaway regarding the benefits of climate smart practices—creating a true



partnership with the host government can help ensure that the initiatives a company undertakes are done right, to the beneficiary's specifications, the first time. Barrick has also established several other climate-sensitive objectives and processes: a short term energy strategy to reduce energy costs by 10 percent company-wide by 2019; an internal carbon price reflective of the jurisdictions in which it operates and a shadow carbon cost for those jurisdictions that have yet to pass a carbon tax or renewable portfolio standard; a development standard that requires all new projects to evaluate potential renewable energy options; and a Water Management Standard, which is designed to facilitate site-based water stewardship (Barrick Gold Corporation 2018).

Programs and initiatives

Barrick's portfolio of programs and initiatives helped guide the company to reductions in overall scope 1 and scope 2 GHG emissions and water withdrawals in 2017, while obtaining 77 percent of its water supply for operations from recycled sources (CDP 2018). A representative example of these programs and its 3Ps assessment is described below.

Planning for backfilling during mine closure. In 1994 Barrick took control of a mine in Nevada named Bullfrog that had been in operation since 1904. The mine also had an issue of being built to such a depth that groundwater would accumulate at the bottom of the pit, forming a "pit lake." Pit lakes are problematic because the standing water deteriorates in quality over time, and is at risk of permeating into the local reservoir. In other instances of such an issue, especially at mine closure, mining companies have typically built a water treatment plant and operated it in perpetuity—at an exorbitant cost to the company. Barrick by contrast planned ahead, and in 1999 began to backfill the mine to prevent a lake from forming to begin with, by using rock stockpiled at the mine site. When in 2017 the water—as predicted—began to return, Barrick used a fine layer of soil to seal the area and facilitate evaporation at a rate that offsets water inflow. At this point, no further backfill will be needed.

Disclosure and communications

Barrick complies with the highest and best standard in the industry as it pertains to disclosure of climate-related data and sustainability reporting. It routinely files water and climate reports with CDP, it is aligned with GRI, and it engages a third party auditor to provide its disclosures with reasonable assurance—the most stringent standard (CDP 2018).

Anglo American PLC

Anglo American is a United Kingdom-based company with an operating profit of US\$5.5 and more than US\$28 billion in revenue in 2017. Compared to peers, the company's portfolio is well diversified, with significant revenue-generating holdings in copper, iron ore, platinum, and a comparatively large presence in diamonds through their 85 percent holding of De Beers, the world's leading diamond mining company. Forty-five percent of the company's GHG emissions occur in South Africa (Anglo American 2018a).²

Vision, governance, goals, and objectives

Perhaps Anglo American’s most notable instance of corporate governance is their industry-leading executive remuneration framework. The company ties executive compensation to climate-related targets and achievements, a governance technique also employed by peer mining companies. However, Anglo American appears to go one step further, producing a “Directors’ Remuneration Report” that specifically outlines the components of the Long Term Incentive Plan (LTIP) that are tied to CO2 emission levels (CDP 2018).

Anglo American’s climate-related goals were first developed in 2018 and are mapped on two primary timelines, 2020 and 2030. By 2020 the company aims to reduce GHG emissions by 22 percent, and energy consumption by 8 percent, from a “business as usual” benchmark. Similarly, by 2030, the company has targeted to reduce GHG emissions by 30 percent and improve energy efficiency by 30 percent (CDP 2018). According to company-produced reports, Anglo American appears to be trending towards meeting both of their 2020 targets. Similarly, the company posts aggressive water preservation goals for water use reduction, aiming to increase water recycling levels to 75 percent by 2020 and reduce the abstraction of freshwater by 50 percent in water-scarce regions by 2030—goals that both de-risk projects and benefit local populations (Anglo American 2018a). While the company does not appear to place a timeline on this goal, it publicly states an aggressive vision to operate completely waterless mines in water-scarce catchments.

Processes and standards

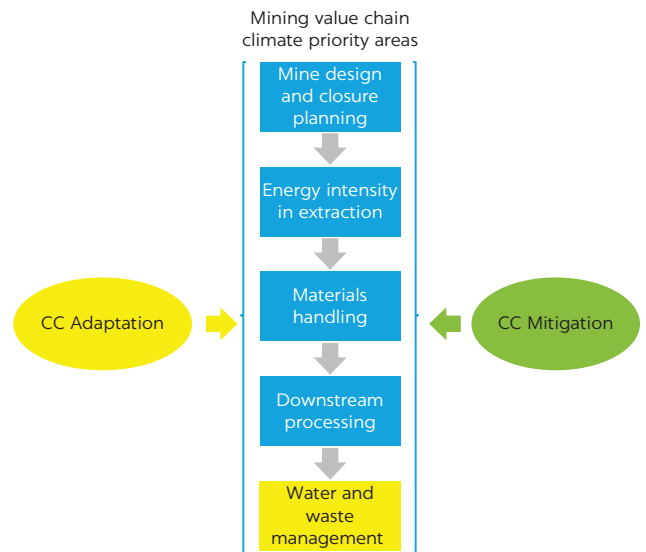
Anglo American’s Group Water Policy puts emphasis on five key principles running the gamut from the company’s people and processes to its stakeholders and supply chain. This includes acting as a “catalyst for local water management” and “embed a culture of internal water conservation.” The company actively recognizes that 70 percent of its operations are in water-scarce environments (Anglo American 2018a).

The company’s process for tackling climate change as a whole centers on the three tenets of (1) climate agility, (2) diving change, and (3) managing risks and opportunities. This third tentpole includes defining what it means to be water and energy secure and also implements carbon pricing as a strategy to tie an economic incentive to monitoring GHG emissions.

Programs and initiatives

Like other companies analyzed in this report, Anglo American deploys a variety of initiatives aimed at addressing the climate impact of its operations. The most notable are summarized below and in boxes 2.7 and 2.8.

Waterless mining. A portion of Anglo American’s FutureSmart Mining initiative is the waterless mine. This program, while not yet fully operational, is an ambitious plan to eliminate the use of freshwater in their extraction processes. The company plans to further develop a “closed loop” system that would recycle water with limited need to reintroduce fresh water into the system. Anglo American plans to continue this process by expanding two primary technologies focused on



BOX 2.6

Backfilling during mine closure: 3Ps assessment

Planet: The lengths to which Barrick went to avoid the formation of a pit lake mitigated its long term impact on the a local Nevada aquifer. This is especially important given the 15 year drought that many parts of Nevada are facing as a result of climate change.

Profit: For Barrick, backfilling the mine site to avoid the formation of a pit lake meant avoiding the cost of constructing, operating, and maintaining a water treatment facility in perpetuity, which can be prohibitively costly.

People: Nevada, one of the primary beneficiaries of the Colorado River basin, has been confronted with a historic drought in recent years. In fact, Lake Mead, which supplies 90 percent of Las Vegas' water, has

dropped to its lowest levels since 1937.^a Water in this region is scarce, and Barrick's proactive steps to ensure the integrity of the local aquifer means more of the scarce water can be put to productive use by the local community. That said, it is hard to argue that the remediation steps taken by Barrick at the old mine site somehow delivers *more* local value to the community in Nevada than the installment of a water treatment infrastructure—the ordinary course of action—would have. But such are some of the tradeoffs with which a mining firm must grapple when approaching climate related issues—some efforts may more efficiently produce a positive climate outcome while providing fewer local opportunities to benefit economically.

a. <https://oilprice.com/Energy/Energy-General/Brazil-Poised-For-Historic-Oil-Boom.html>.

BOX 2.7

Waterless mining: 3Ps assessment

Planet: Anglo American's closed loop system has the potential to reduce the firms operations' fresh water requirements, allowing the firm to adapt to the well-known climate risk of depleting water resources.

Profit: Reducing the water footprint of a mine's operation means reducing the acquisition costs for water, the maintenance and logistics cost for transporting the water, and its closed-loop reuse means a fewer costs spent on fresh water treatment due to mine discharge. All of these costs can be reduced as a result of a lower water footprint. Another major benefit is that water availability is often a major production constraint and relieving this could allow Anglo American to grow output.

People: It is worth considering here the full range of inventive new technologies that Anglo American is exploring to achieve its vision of the elimination of its use of freshwater in its extraction processes. Among its focus areas include state-of-the-art collection methods for evaporation data for use in automated systems, low cost dry tailings disposal, dry separation, and non-aqueous processing. Engaging local experts and high-skill labor at the maturation phase of any one of these new technologies—particularly in a jurisdiction whose economy is mining dependent—could have a profound skills transfer impact.

evaporation management and dry tailings disposal, innovations that are particularly promising when considering that evaporation accounts for approximately 10–25 percent of water lost at a mine site (Anglo American 2018b).

CEO emissions reduction KPI in executive compensation plan. Anglo American's board approved modifications to the company's LTIP that

BOX 2.8

Emission reduction incentive plan: 3Ps assessment

Planet: Anglo American’s approach to executive compensation provides direct executive accountability for the achievement of its strong 22 percent emissions reduction target. It means its commitment to mitigating climate impacts are not just ambitious, but they are meaningful.

Profit: Incentivizing firm leadership to achieve an emissions target frees them to achieve it in the way most beneficial to a firm’s shareholders, thereby promoting the likelihood of achieving a win-win scenario. Leadership may, for instance choose to electrify more pit operations, substitute trucks with conveyor belts to handle materials, or sign long term renewable energy PPAs.

People: Depending on the route explored by leadership to achieve company-wide emissions reductions, the social benefits delivered to the host government and citizens could span a wide range. An effort to switch to renewable energy for instance brings with it the opportunity to add more clean technology to a host government’s grid, and for it to develop large parts of a renewable energy supply chain and the corresponding jobs such economic diversification entails. Similarly, a mining company might be incentivized to build out more of its supply chain locally in an effort to cut down its direct and spinoff emissions, creating an opportunity for knock-on economic impacts for the host government.

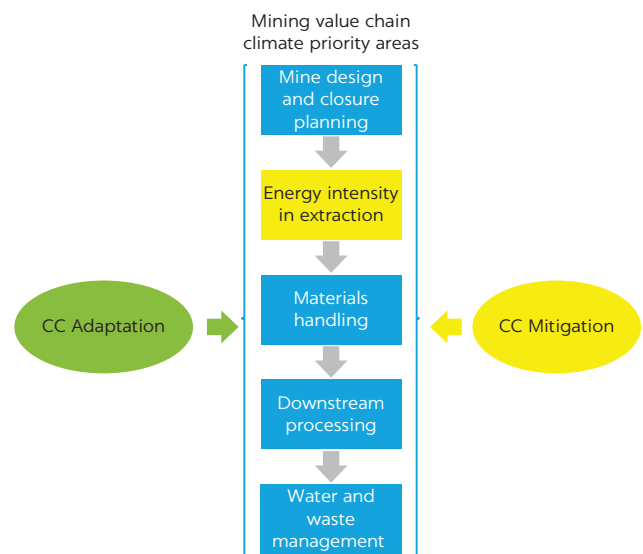
incorporate CO2 emissions performance. Compensation derived from the LTIP is calculated based on a series of key performance indicators (KPIs), one of which ties directly to the company’s goal to reduce emissions by 22 percent by 2020. This KPI accounts for 5 percent of the LTIP calculation and the KPI is fully fulfilled if the 22 percent GHG reduction mark is achieved by the end of 2019, whereas it is only 25 percent fulfilled for a 20 percent reduction for the same time frame (CDP 2018).

Disclosure and communications

Anglo American ranks well amongst its peers in terms of emission disclosure and verification practices, even if the company’s targets remain average in ambition. While the company utilizes the less stringent “limited” assurance for their Scope 1 emissions, they employ “reasonable” assurance for their Scope 2 emission verification and disclosure process, according to the CDP. Along this line, the company’s Directors’ Remuneration Report is quite detailed and represents a bold step towards tying more executive and leadership compensation to climate performance.

Rio Tinto Group

Rio Tinto Group is a global mining multinational headquartered in the United Kingdom with more than 140 years of history. Operating in more than 30 countries and across six continents, the company derives its US\$40 billion in annual revenue from a diversified portfolio, with significant holdings in iron ore and aluminum, with nearly 50 percent of its revenue arising from the iron ore alone (Rio Tinto 2018). Rio Tinto is the world’s second largest miner of iron ore having shipped 330.1 million tons during 2017, slightly less than



Brazil-based rival Vale (Rio Tinto 2018; Vale 2018). As a sign of the company's faith in the current uptick in global commodity prices, Rio Tinto plans increasing levels of CAPEX in 2018 and 2019, with approximately US\$5.5 billion and US\$6.0 billion allocated respectively, and has focused exploratory efforts on copper (Rio Tinto 2018).

Vision, governance, goals, and objectives

Rio Tinto has made a concerted effort to set GHG reduction targets since 1998, with the company's initial objective of achieving a 24 percent reduction in GHG emissions from a 2008 baseline by 2020 (CDP 2018). Company reports suggest that Rio Tinto has already exceeded its goal since it reported having achieved a 27 percent reduction in 2017 (Rio Tinto 2018). Further, Rio Tinto actively supports the intent of the Paris Agreement to limit global warming to less than 2 degrees centigrade above pre-industrial levels and the company has a longer term vision to "substantially" decarbonize their operations by 2050. One way the company is moving towards this goal is by divesting of energy-intensive holdings. Notably, Rio Tinto has divested of the last of its coal mining operations, a highly carbon intensive commodity to extract.

From a governance perspective, Rio Tinto's Sustainability Committee reviews and approves positional changes on climate change and evaluates the company's climate positions for consistency and long-term viability. When it comes to linking executive compensation to climate-based targets, however, the company is less adept, having no set structure in place as of 2018.

Processes and standards

In addition to linking their climate-oriented goals to a sustainable planet, Rio Tinto emphasizes the role climate sensitivity and active GHG reduction strategies play in de-risking their business. Since 1998 the company has factored carbon price into their investment decision making process. More recently, in 2017, the company conducted an internal risk assessment of the possible impacts of climate change, identifying areas impacted by variables such as water risk, sea level rise, and temperature. The company's long-term process for managing this risk is still in its infancy, but company reports indicate there is a concerted effort underway to design and implement a strategy in this area.

The company's water management policy offers a potential for improvement. The company has endorsed ICMM's position statement on water stewardship, which includes tenets such as setting "context-relevant water targets or objectives for sites with material water-related risks," and indicates that it will begin measuring itself against these standards going forward. However, under its current state of operation and compared to some other companies in its peer group (some of whom recycle more than 75 percent of water used in production), Rio Tinto recycles a little over 25 percent (Soliman, Fletcher, and Crocker 2017). Additionally, the company indicates that it has set specific water targets for 30 operational sites from 2013 to 2018 and that 77 percent of those sites are on track to meet their targets by the end of the 2018 timeframe (Rio Tinto 2018). However, the company does not readily disclose what the specific targets are and only indicates that it plans to develop further targets extending beyond the 2018 timeframe.

Programs and initiatives

Rio Tinto has demonstrated active steps to modernize its operations to mitigate climate impacts, including the following initiatives. Two of the most prominent initiatives and their 3P assessments are provided below and summarized in boxes 2.9 and 2.10.

Mine of the future. The company is a recognized leader in autonomous and digitally managed haul equipment, having launched its first automated haul truck in 2008 at their Pilbara iron ore operation in western Australia. This effort also marked the kickoff of the company's "Mine of the Future" initiative, an effort that turns the Pilbara in to the company's proving ground for many of its most

BOX 2.9

Mine of the future: 3Ps assessment

Planet: Rio Tinto's technological breakthroughs at the mine—from autonomous and efficient material movement—has led to the reduction of idle time and a corresponding boost in haul productivity. These improvements show promising new methods of reducing overall GHG emissions.

Profit: The profit motive to deploy such an ambitious program is rooted in the notions of efficiency and productivity. Automation allows haul trucks to operate more continuously and more consistently, and always take the route of least resistance—allowing for greater hauls over the course of a shorter period.

Those efficiencies mean lower costs, and greater amounts of commercially exploitable ore.

People: Rio has acknowledged that such automation efforts have traditionally entailed some level of job reduction in traditional mining roles, but offers new roles for skilled employees to program and maintain the new technology. While it may be true that the short term impact may reduce low skill job opportunities—and that this impact may be felt disproportionately in developing countries. On the other hand automation presents these same countries with a potential technological leapfrog opportunity.

BOX 2.10

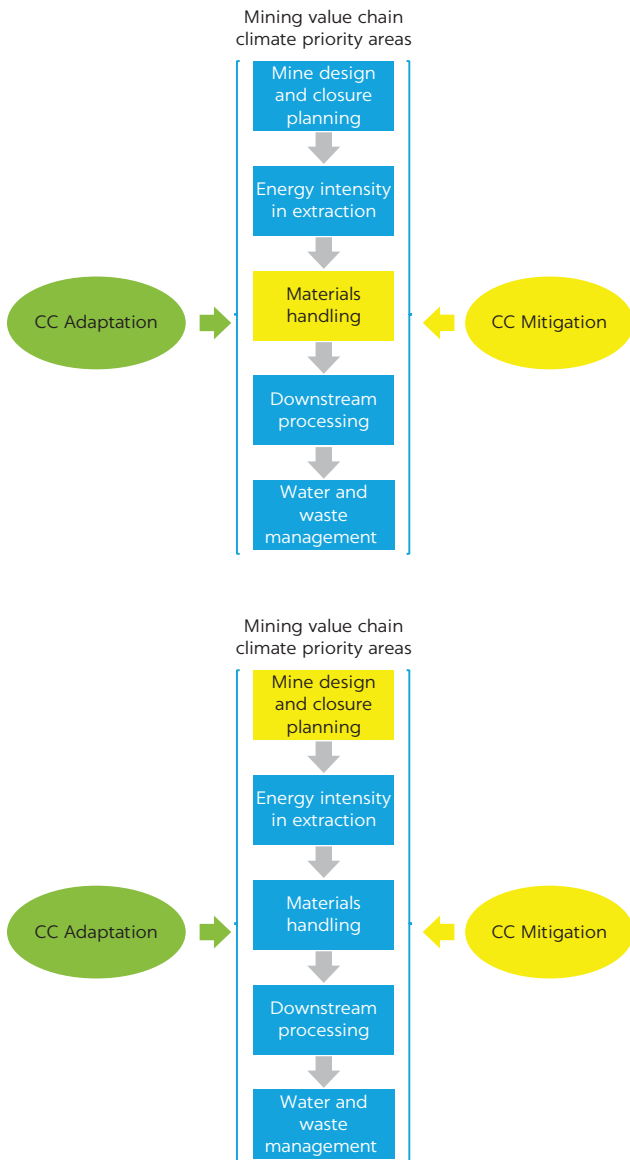
Mine closure standard: 3Ps assessment

Planet: The climate risks entailed in a firm's closure of a mine span a wide range from potential pollution of scarcer local water resources, the inability to reclaim the site for agricultural uses due to water scarcity and hotter temperatures, or in some regions heavier rainfall might lead to tailings dam failure. Rio Tinto's approach—dealing with mine closure planning at the outset of mine design and operations—allows it to anticipate these challenges and "bake-in" mitigation and adaptation strategies at the beginning.

Profit: Among the many ways a firm can benefit its profitability from proactive mine closure practices includes avoiding the risk of paying for additional

reclamation or rehabilitation costs associated with closing a mine in accordance with obsolete local policies. A leading practice approach that goes above and beyond forecloses a potential continuing expense.

People: A mine site can often take up large swaths of land for very long periods of time, removing it from productive use by the local community, and a site that is improperly closed may contaminate local aquifers. Proactively operating a mine site with an eye toward the eventual reclamation and productive use of the land and local water resources is social benefit that can accrue to a host government's citizens.



promising environmental and safety-focused innovations. The autonomous vehicles deployed there, in combination with modifying some vehicles to electric drive, are more efficient, reducing GHG emissions with improved fuel efficiency of approximately 5–7 percent (Rio Tinto 2018). The vehicles can run longer and with greater consistency than a traditional truck, increasing the amount of ore the company can transport to processing and reducing inefficient, fuel-consuming idle time. As a recent milestone, the company’s automated trucks have transported more than 1 billion tons of material at the company’s Pilbara operations, positively contributing to the bottom line through increased efficiency (Rio Tinto 2018).

Mine closure standard. Rio Tinto takes a strong stance when implementing climate-rigorous mine closure standards. This includes the stipulation that all mine sites must plan for closure from the outset of the mine and that that closure plan must include strategies to minimize financial, social, and environmental risks. The company intends to execute this strategy by maintaining a knowledge base on the climate and social implications and conditions of each mine site. A mine closure plan must address long term impacts on water quality and water resources in the impact zone of the mine site.

Disclosure and communications

Relative to peers, Rio Tinto’s emissions disclosure is strong, with an aggressive set of emissions targets. However, their emissions verification process, according to the CDP, is middling, utilizing the same “limited” assurance standard as other, less exacting mining companies (CDP 2018). Conversely, as measured by the same CDP report, Rio Tinto is one of the most publicly engaged and active companies when it comes to aware-

ness of climate-related issues, although it varies as to which side of the issue the company takes on an issue-to-issue basis.

NOTES

1. For the purposes of scoring and categorization companies were reviewed based on their activities and actions as of 2018.
2. The first four of these categories’ proxy variables are scored qualitatively on a scale from 0 to 2 (with 0 representing an absence of or minimal effort in the subject sub-criteria relative to the other shortlist companies, 1 representing an adequate presence of effort in the subject category; and 2 representing superlative effort in the category). The geographical category is measured on a scale of 0-1 with 1 denoting headquarters presence in an emerging market.
3. In part, this is due to AngloAmerican’s South Africa operations, where the dominant power utility is primarily coal-fired.

4. While Goldcorp did not hit its intended target, water consumption did decrease notably overall
5. Morgan Stanley's Piyush Sood made this assessment on June 12, 2018. <https://finance.yahoo.com/news/morgan-stanley-prefers-newmont-mining-180542185.html>
6. A trend documented in by the World Bank in its 2016 State and Trends of Carbon Pricing Report <http://documents.worldbank.org/curated/en/598811476464765822/pdf/109157-REVISED-PUBLIC-wb-report-2016-complete-161214-cc2015-screen.pdf>
7. These cost savings are forecasts and not yet realized by the company.
8. Newmont's Yanacocha project in Peru also represents a strong example of water management
9. This is largely due to the dominant power producer in South Africa relying heavily on coal-fired generation.

3 Industry Outlook: How the World's Largest Miners View their Role in a Green Economy

This section aims to gauge the motivations of the largest mining corporations to take climate action (e.g., whether to mitigate their impact, or adapt their operations to increasing climate risks) and to assess the extent to which these actions take into explicit consideration local value creation imperatives (i.e., whether corporate leaders see an opportunity in using climate-related efforts to support or drive a host nation's transition to a green economy). This was done through questionnaires addressed to, or substantive conversations with, sustainability officers from five multinational mining corporations: Barrick Gold, Goldcorp, Newmont Mining, Anglo American, and IAMGOLD.

On the basis of input received, and conversations with others, it appears that at best, some mining firms see the potential for a systematic approach of linking their climate-related initiatives with a host government's concerted effort to build green industrial value chains. By and large, however the interviewees view these two efforts as distinct, with case-by-case possibilities for overlap; and even in those instances of overlap, the miners' climate-related activity is only viewed in a local-community value creation or development context—as opposed to having a central role in supporting a broader green industry within a country. Summarized below are the findings from these interviews and questionnaires.¹

MOTIVATIONS FOR CLIMATE-SENSITIVE ACTIVITIES

When investing in an activity aimed at helping them mitigate their climate impacts or adapt to climate risks the interviewees are generally motivated by two factors:

- Bolstering their reputation with the local community in which their mine operates to secure their “social license” to operate; and
- Pure economics.

As such, the spectrum of climate-related activities in which these companies' mining operations typically engage falls into two categories: (1) activities aimed at increasing an operation's energy efficiency or shifting the sources of energy; and (2) activities aimed at increasing an operation's water usage efficiency, or securing a long-term and reliable supply of water. Each category is discussed below, and a sample of answers received is provided.

Energy and emissions reductions

With respect to investments whose effect was to reduce emissions, the primary motivator appears to be economics. Specifically, the interviewees' companies who had invested in a power plant or shifted away from a diesel production fleet did so because of cost reduction, or to hedge against a future rise in the price of the high-emitting fuels on which they are reliant. It is important to emphasize that even though some of the interviewees sought a shift to lower-carbon technologies or fuels, they were not *primarily* motivated to do so even by the likely emissions reduction implications. Rather, they made their investments on the likelihood that it would reduce operating costs over time. To the extent that such an investment would earn them a social license to operate—the interviewees viewed this notion on a range from a side benefit, to skepticism—because neither the host communities in which they operate, nor the company, view carbon emissions as a local and near term issue.

Some of the reactions from the interviewees that give voice to this perspective are summarized in box 3.1.

Water management

In contrast to energy-based climate investments, the mining corporations that were interviewed in the context of this report all viewed their water-based climate investments as driven equally—if not primarily—by its propensity to generate local value as they are driven by the miners' need to secure a stable supply of water for their operations, that is, economic considerations.

The key distinction between water management and emissions reduction is the fact that, since they tend to operate in water-stressed areas, (1) the local community can more tangibly perceive the near-term limited nature of and competing demands on water as a resource, which leads to (2) water availability often becoming a major production constraint. As such, mining corporations will often view the return of saved water to the community or the construction of a desalination plant—to use one example—as core to their sustainability and social license-building strategy. After all, even if it is in a mining operation's economic best interest to secure a long term supply of water, doing so at the expense of the local community is a sure way to diminish the long term viability of the operation.

Some of the reactions from the interviewees that give voice to this perspective are provided below and summarized in box 3.2.

BOX 3.1

Energy and emissions reductions: Reactions from interviewees

“To be honest in most jurisdictions in which we operate, climate change is not regarded as a local issue...our business decisions will be primarily influenced by whether [an energy investment] costs more or less...”With the exception of water and air quality “*local* [emphasis added] communities don't really care” about climate change or emissions reduction.

“Local socio-economic development is a side benefit” of the firm's investment in a solar power plant at the mine site.

BOX 3.2

Water management: Reactions from interviewees

With reference to an operation in South America, the company stated that it is widely understood among the industry operating in the region, that although it is not a mandated prerequisite, it is difficult to obtain approvals for new mine construction without the installation of a water desalination plant. This is in part due to necessity—there is scarce water available for mining operations that isn't already committed to community uses—so miners must resort to transporting seawater 100–200 km inland and 2,000 m above sea level before treating it and using it in mining operations.

Climate change as a general proposition is not regarded as a high priority in the communities in which the company operates, and as a result is not viewed at the mine site as a primary concern (i.e., mine site operators/managers will not typically take climate action for climate purposes alone; rather, they will be motivated first by an opportunity for cost reduction or efficiencies, and will view climate benefits as an ancillary positive impact). The few exceptions of “overlap” as one company put it, was around “site-based water management.”

IS THERE A CLIMATE-LOCAL GREEN GROWTH NEXUS THAT INDUSTRY VIEWS AS AN OPPORTUNITY?

To the extent that any of the interviewees determined that there was an opportunity to pursue climate action that drives host country economic development—particularly a transition to a green economy—the opportunity wasn't viewed as sufficiently tangible to warrant concerted and immediate investment. This suggests that the rationale for this may arise from the following three overriding themes:

1. *Site level mining operations generally have one overarching mandate—to maximize the value of their mining asset.* This means, among other things, taking steps to optimize net operating income through measures directed at reducing costs or increasing output. All investments a site manager makes are viewed through this economic lens; therefore if, like Anglo American, a firm were to invest in a “closed loop” water recycling system that reduces its consumption of freshwater from the local aquifer, it would do so primarily to increase water availability, thereby reducing production downtime and increasing output and net operating income. Similarly—as exemplified in Goldcorp's Borden operation in Ontario, Canada—if a company were to invest in an all-electric mining fleet (including boom trucks, drilling trucks, and scoops) it would do so in large part because of its ability to achieve an acceptable payback period and an expectation of an Operating Expenditure (OPEX) reduction. In the case of Goldcorp, these figures were 2–3 years and 10 m CAD/Yr., respectively, *after* a 5 m CAD subsidy from the Ontario Government.
2. *Site level mining operations do have a secondary mandate of solidifying the social license to operate with the local community—but the sought after outcomes here are inextricably intertwined with the mandate to maximize value.* All of the companies interviewed have dedicated sustainability teams engaged in community development activities at the site level. Many of these activities are well articulated, and drive real value in the communities. One such

example in South Africa's Limpopo Province, is the provincial government's joint implementation with Anglo American of the firm's "Collaborative Regional Development" approach to regional planning, which takes into account climate change issues when considering agricultural options. This is also representative of most of the interventions undertaken by community development operations at the mine-site level: they are deeply local, tailored for the communities, and are rarely if ever specifically driven by climate *outcomes*. For example, Anglo American acknowledged that "many of our interventions do not have an explicit climate lens at the moment and we could likely do more on that front." Rather, most outcomes will be project specific (e.g., agricultural yield or employment), and the residual outcome that informs all such community investments is the propensity of the activity to extend the operational life of the mine.

3. *The scope of a mining firm's activities directly addressing the climate change imperative is almost entirely confined to its headquarters-level sustainability team.* All interviewees suggested a headquarters and mine site-level dynamic with respect to the intentionality with which the firm addresses climate issues. As discussed above, at the mine site, measures to secure the long term availability of a dedicated or semi-dedicated source of potable water is primarily informed by the site's desire to maximize output, and is viewed as a climate-adaptive measure to preserve declining water resources, only after-the-fact. Similarly, any effort at the site to shift energy resources or move toward an automated fleet are motivated by a desire by the mine to reduce OPEX, should any Greenhouse Gas (GHG) reductive outcomes follow, that is an ancillary benefit. The headquarters staff, however, does aggregate these ancillary site-level benefits and reports GHG reduction and water conservation data to global standard setting bodies such as CDP. The leading climate-sensitive mining firms' sustainability teams at the headquarters comprise real experts, with real board-level authority, and climate issues are their core mission. That being said, sustainability teams very rarely have operational, site-level, investment authority. They are an overhead cost center to the firm, and the scope of their responsibilities are often confined to external metric reporting and internal auditing functions. This headquarters-site level disconnect in terms of the climate imperative for the firm can often result in missed opportunities for meaningful climate interventions and the corresponding chances for catalytic local value creation.

NOTE

1. Note that all conclusions not directly attributed to a company's representative in this section is a product of inference and analysis of the totality of firm responses to the questionnaires or phone interview questions.

4 Conclusion: A Proposed Future-State Climate-Local Value Creation Framework

This report has highlighted a gap in terms of the climate and local value-creation ambitions of a company and the crafting and implementation of a strategy to pursue those ambitions. Put simply, too many times socio-economic value creation efforts on the part of mining firms land in the realm of Corporate Social Responsibility (CSR) initiatives—too bespoke and tailored to the local community to create a truly meaningful, scalable, and catalytic economic impact at a national level. Furthermore, the mining firms interviewed in connection with this report made abundantly clear that they view their site-level initiatives that might be classified as climate-oriented and their local value creation efforts as fundamentally separate endeavors. Several of the interviewees suggested, however, that there is a real opportunity in connecting the two endeavors—and a few, like Goldcorp, had current examples of climate initiatives that are delivering real and sizable local economic value to their host jurisdictions and communities.

With that said, none of the efforts reviewed in this report rose to the level of a strategic operation driven from the top down to the site to systematically target climate-sensitive mine operations that are most likely to catalyze economic development and diversification for host jurisdictions and local communities. Instead, the initiatives identified in this report are largely a hodgepodge of investments and operations that generally fall into the following three overarching categories (or somewhere in between categories):

- **Compliance measures:** Auditable reports and internal standard setting aimed at satisfying minimum criteria established by non-governmental organizations (NGOs) and international guidance-establishing bodies like ICMM.
- **Resource planning efforts that can credibly be characterized as climate-smart:** Investments made to shift away from price-volatile fuel and electricity sources, and to lock up long-term sources of water supply, all with an eye toward increasing mine productivity while reducing costs.
- **Social license efforts with a climate element:** Local value efforts conducted by site-level CSR and community development teams continue apace in an effort to bolster the firm's social license to operate, but the vast majority of these small-scale efforts lack a climate dimension.

Table 4.1 provides a visual categorization of the climate-sensitive mining firms' initiatives presented in "Mining Firm's Climate-Sensitive: Current State Assessment" section.

It is important to note that the initiatives categorized in table 4.1 are not a representative sample of all of the climate-related efforts mining firms have under way. Rather, they explicitly reflect climate efforts that have the highest tendency to drive local value creation. As a result, the Resource Planning category is somewhat overrepresented—in part because these efforts entail the building of scalable infrastructure that offer the opportunity for large scale employment in a green economic sector, along with significant technological and skills transfer.

It is within this Resource Planning band of activities that this report concludes mining firms should devote more *strategic* focus. These activities have the capacity to address two of the mining industry's present pain points:

- The likelihood that the existing local value creation/stakeholder engagement framework in which firms are operating may not be optimally yielding the desired results—as is reflected by several high profile protests, bans, and production interruptions; and
- The growing climate dimension of a firm's social license to operate.

Increasingly, due to international pacts, accelerating climate impacts, and host nations' desire for diversification into and growth of sustainable sectors of their economy—firms must navigate and take advantage of a complex patchwork of policies aimed at boosting green industrial sectors. Developing a strategy to help host nations achieve their green industrial ambitions is a new approach to delivering local value that might differentiate a firm from its competitors.

A graphical representation of such a framework is provided in figure 4.1. The sphere is split into two hemispheres—the lower hemisphere reflects operational activities carried out by firms in the mining industry, whereas the upper hemisphere is intended to reflect the policy environment—set by nations, international pacts, and standard-setting bodies—in which the firms operate. Each of the triangle icons is associated with an initiative described in "Mining Firm's Climate-Sensitive: Current State Assessment" section, and numbered in table 4.1. The three bands of activities are loosely tied to the three categories identified in table 4.1. The outer band is about *compliance*, where most of firms'

TABLE 4.1 Mining firms' initiatives categorization

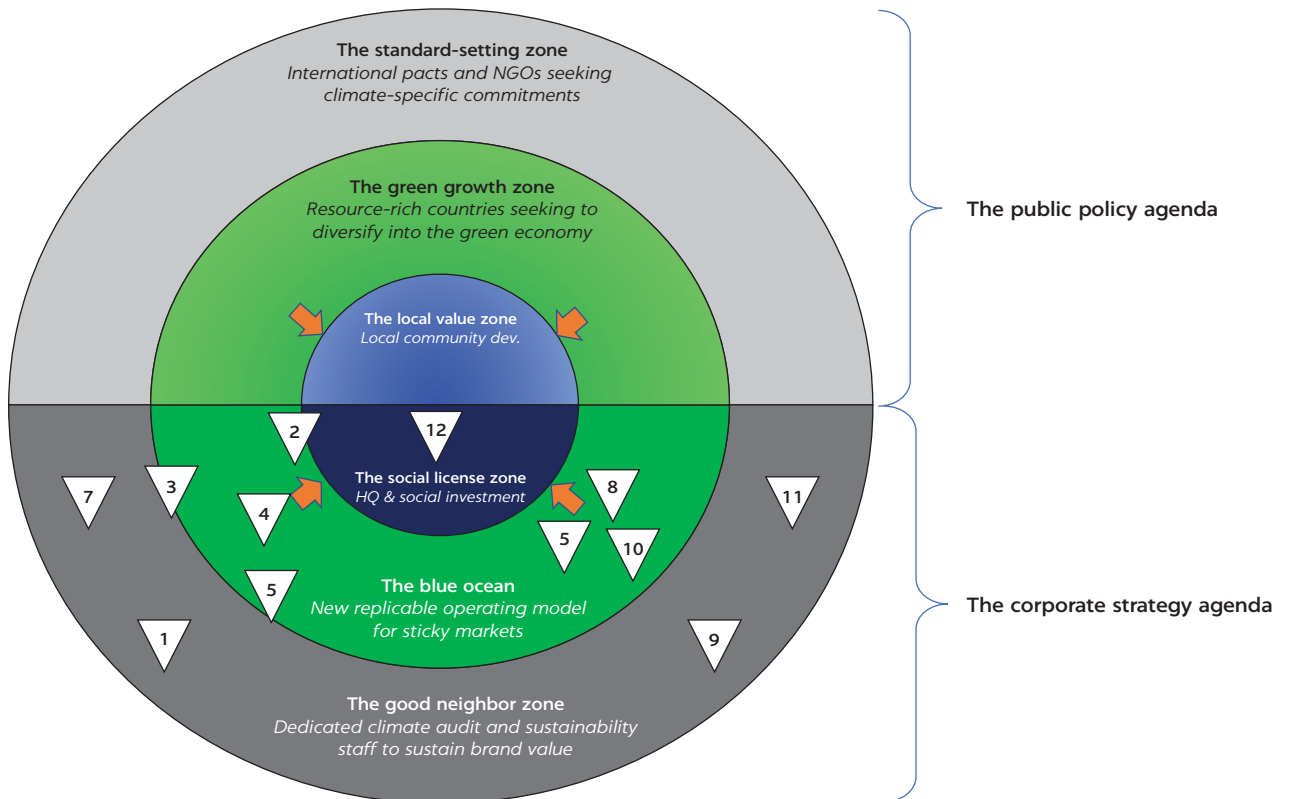
COMPANY	INITIATIVE CATEGORY		
	COMPLIANCE	RESOURCE PLANNING	CSR/LOCAL VALUE CREATION
Newmont	1 Carbon Pricing	2 Ghana Water Treatment Facility 3 Haul Truck Optimization	
Vale		4 Indonesia Karebbe Hydroelectric Plant 5 Diesel Switching	
Barrick	7 Planning for Backfilling during Mine Closure	6 Real Time Water Monitoring	
Anglo American	9 Emission Reduction KPI in CEO Compensation Plan	8 Waterless Mining	12 Collaborative Regional Development
Rio Tinto	11 Mine Closure Standards	10 Mine of the Future (Automation)	

Note: CEO = Chief Executive Officer; CSR = Corporate Social Responsibility; KPI = Key Performance Indicator.

climate-specific work appears to take place. They are motivated by the “standard setting zone” of policy, and the reporting and auditing they conduct are aimed at projecting a “good neighbor” status. The inner-most band of activities are social license-related, usually small scale, bespoke, and unlikely to create catalytic local economic value. Firms engage in these activities largely due to local communities’ desire to share in the mine operation’s value, or to not be socially or economically displaced by those operations.

The middle band of activities in figure 4.1, is really the thrust of this report’s findings—climate related activities that have a propensity to create scalable economic value are those that involve significant investments in long-lasting green infrastructure that has the potential to grow into a new economic sector within the host nation. To varying degrees, all of the initiatives in the graphic highlighted in gold reflect this type of potential—the construction of a hydroelectric plant, for instance, creates an infrastructure with 30–40 years of useful life that provides power to the community quite apart from the needs of the mining operation itself. By engaging local contractors in, and helping to develop a local supply chain that supports the design, construction, assembly, operations, and maintenance of the plant, a mining firm can help create thousands of direct and knock-on employment opportunities, and develop skills in the local work force that will be relevant for the foreseeable future, as the green economy within the host nation—and globally—matures.

FIGURE 4.1
A framework for a new green social license strategy



Note: CSR = Corporate Social Responsibility; NGO = Non-Governmental Organization.

TABLE 4.2 A green approach to local value creation: implications and benefits

OPERATIONAL IMPLICATIONS OF A GREEN APPROACH TO LOCAL VALUE CREATION	POTENTIAL REWARDS FROM PURSUING A GREEN MODEL FOR LOCAL VALUE CREATION
<ul style="list-style-type: none"> • Coordination between central office government affairs units, sustainability units, and site-level operations • Shifting climate-related resources away from CSR teams and toward site-level resource planning and investment teams • Continuing and strengthening the commitment to “Good Neighbor Zone” activities. Metrics tracking and reporting should be expanded to include economic outcomes from green infrastructure investments • Aiming for scale. Instead of simply navigating policy, helping to shape it. Brokering deals with host governments that might entail multiple green infrastructure projects potentially in exchange for an expanded mining footprint and expedited permitting. 	<ul style="list-style-type: none"> • Strengthening the partnership with host nations—who will not only be invested in a firm’s success due to the economic activity the mine is driving, but will now multiply the touchpoints with the firm given the investment in new green infrastructure. • Relying on the strengthened partnership with the central government and local communities, to mitigate the risk of production disruptions due to bans, protests, and punitive levies. • Increasing the likelihood of repeat business or market “stickiness” due to the competitive advantage entailed by the new approach to local value-generative implementation of climate mandates.

Note: CSR = Corporate Social Responsibility.

As the framework indicates, this middle band—investment activities that can be supported by green growth or green industrial policies promulgated by host nations—must ultimately crowd out the smaller scale tailored activities that currently are overrepresented in social license-building efforts. Those CSR-type initiatives will ultimately be no substitute for the jobs, revenue, and development impact of large technological and infrastructure investments. This is a “Blue Ocean” strategy for local value creation—by shifting focus from traditional social license activities toward a strategic approach to developing mutually beneficial green infrastructure and “inclusive” automation, a mining firm can deliver such considerable value in the marketplace as to have carved out a competitive advantage.¹ Table 4.2 summarizes some of the operational efforts this might entail, and the benefits this might accrue.

NOTE

1. The term “Blue Ocean Strategy” was coined by INSEAD professors W. Chan Kim and Renee Mauborgne. See *Blue Ocean Strategy, Expanded Edition: How to Create Uncontested Market Space and Make the Competition Irrelevant*, Harvard Business School Publishing Corporation, 2015.

Appendix A

Mining Firms Selection Methodology

For the purpose of identifying a representative sample of mining firms, in addition to the methodology laid out in the Methodology and Value Chain Analysis report, this report utilizes a Climate Strategy Framework. The analysis is conducted in two stages:

- First, 10 mining firms are shortlisted based on the priority areas identified in the Methodology and Value Chain Analysis report;
- Second, the shortlist is further refined by applying the Climate Strategy Framework.

SHORTLIST PHASE

The Methodology and Value Chain Analysis report identified a set of five priority areas based on a scoring exercise that gauged the relative climate risks to and impacts of mining processes across the value chain within multiple metal and mineral subsectors. Those priority areas were:

- Planning for the Risks Associated with Scale and New Geographies
- Energy Intensive Extraction
- Procurement and Management of Material Handling
- Downstream Processing
- Water and Waste Management

The shortlist of 10 leading mining companies comprise those companies that have actively made investments in or addressed in a tangible manner *at least two of these priority areas*. The sample selection was designed to include companies whose activities in the aggregate address all priority areas. The report also leverages external resources such as the CDP (formerly the Carbon Disclosure Project (CDP), and now focused on broader climate indicators), indices such as the Dow Jones Sustainability Index (DJSI), and interviews with mining sector experts to arrive at a list that is fully representative of the climate-smart work being done by mining companies. In addition the report seeks to include companies headquartered in developing economies.

MINING FIRMS' CATEGORIZATION PHASE

This report utilizes a “Climate Strategy Framework,” described in further detail below, to identify five representative companies for in-depth analysis. To this end, the shortlisted companies are scored across the four categories of climate strategy operational sophistication, along with a fifth category awarding a preference for companies whose operations are headquartered in emerging markets. The four climate strategy categories are:

- Vision, Governance, Goals, and Objectives
- Processes and Standards
- Programs and Initiatives
- Disclosure and Communications

Companies that rank highest across these four categories and the emerging market preference category are further analyzed in this report.

THE CLIMATE STRATEGY FRAMEWORK

The analysis carried out in this report employs two primary frameworks: the Climate Strategy Framework to select five best practice companies from the shortlist, and as a mechanism to describe a company’s approach to climate impact mitigation and adaptation; and the Climate-Sensitive Mining Reference Framework, to tie company-specific programs and initiatives back to the priority areas identified in the value chain analysis report. A detailed description of each framework is provided below.

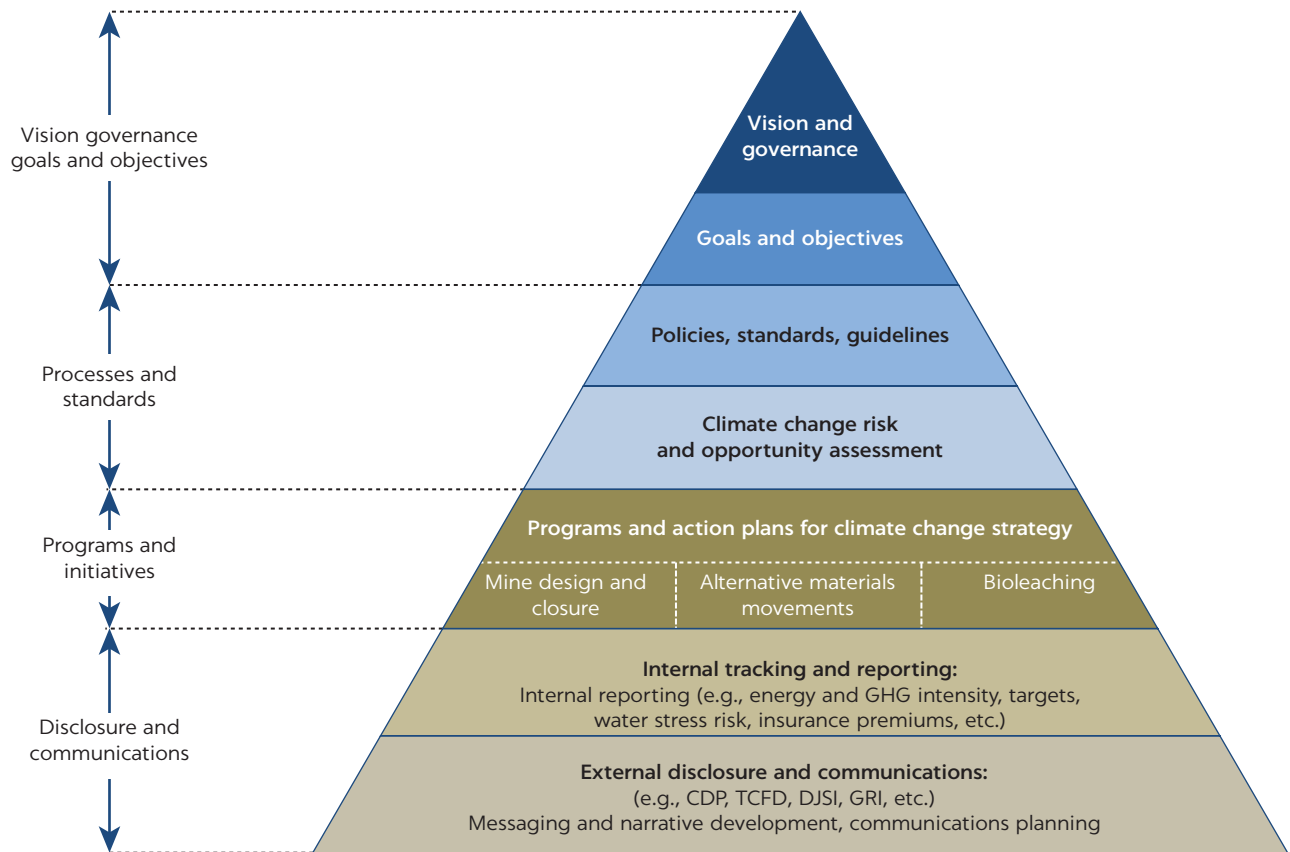
Climate Strategy Framework

Since this report is aimed at capturing the practices of leading businesses in the mining sector it is appropriate to view their climate-sensitive efforts through an organizational strategy and business process lens. In doing so, the report utilizes the Climate Strategy Framework depicted in Figure A.1 in an effort to provide the organizational context in which the efforts are taking place. Successful businesses do not stumble into their activities—climate-related or otherwise—by accident. Each action is assessed for cost and benefit to the organization and its impact on shareholders. This planning process begins with a unifying and directional tone at the top of the organization, which drives action planning, organizational activities, and reporting on progress toward goals. The processes underlying the leading practices of companies, as identified in the Climate Strategy Framework, are described below.

Vision, governance, goals, and objectives

Senior leadership must establish the vision, direction and level of ambition for the firm’s climate impact adaptation and mitigation strategy, and once that is decided, leadership must also put in place the necessary governance structure to oversee the development and implementation of the strategy (e.g., Climate Change Committee, Board Oversight, etc.) Senior leadership must similarly establish goals and objectives that define the strategic priorities and pillars of the climate strategy. This will form the basis of the metrics used to measure whether the firm’s activities are helping the firm to achieve its vision.

FIGURE A.1
Climate strategy framework



Note: CDP = Carbon Disclosure Project; DJSI = Dow Jones Sustainability Index; GHG = Greenhouse Gas; GRI = Global Reporting Initiative; TCFD = Task Force on Climate-related Financial Disclosures.

Processes and standards

In this, the activity planning stage, the organization develops policies, standards, and guidelines to inform and direct the firm's implementation of its climate strategy. This can include, among other directives, a policy regarding water use at mine sites, guidelines regarding hauling fleet procurement, and mine design standards. In developing these policies, the firm should conduct an assessment of the risks and opportunities posed by climate change (e.g., regulatory risks, supply shock risks, climate scenario analyses, and reputational opportunities).

Programs and initiatives

In the implementation stage, the firm should develop programs and action plans to execute on the climate change strategy. The relevant types of initiatives in which mining firms can engage, and the initiatives on which this report focuses are those that address the climate priority areas identified in the value chain analysis report. Representative initiatives include, for instance, procuring for alternative movement of material, and incorporating climate change into mine closure planning at the design phase of a mine. Each of the representative company programs or initiatives this report seeks to highlight not only have a substantial impact from a climate perspective by mitigating the company's impact on climate change or adapting to those changes, but they also achieve that impact while

being accretive to the firm’s bottom line, and have the potential to put the firm and mine site in a position to create shared value at the local level. To reflect these interrelated impacts the report uses a “triple bottom line” or “3Ps” analysis—in which the report endeavors to reflect on the *planet*, *profit*, and *people* implications of the climate initiative. It is worth noting that the initiatives vary in terms of their potential to drive local value creation—the *people* prong of the analysis—and yet the initiatives on which the report elaborates represent some of the *best* efforts by *leading* climate-conscious mining firms. This is the gap that this report aims at addressing by suggesting a potential framework for a solution.

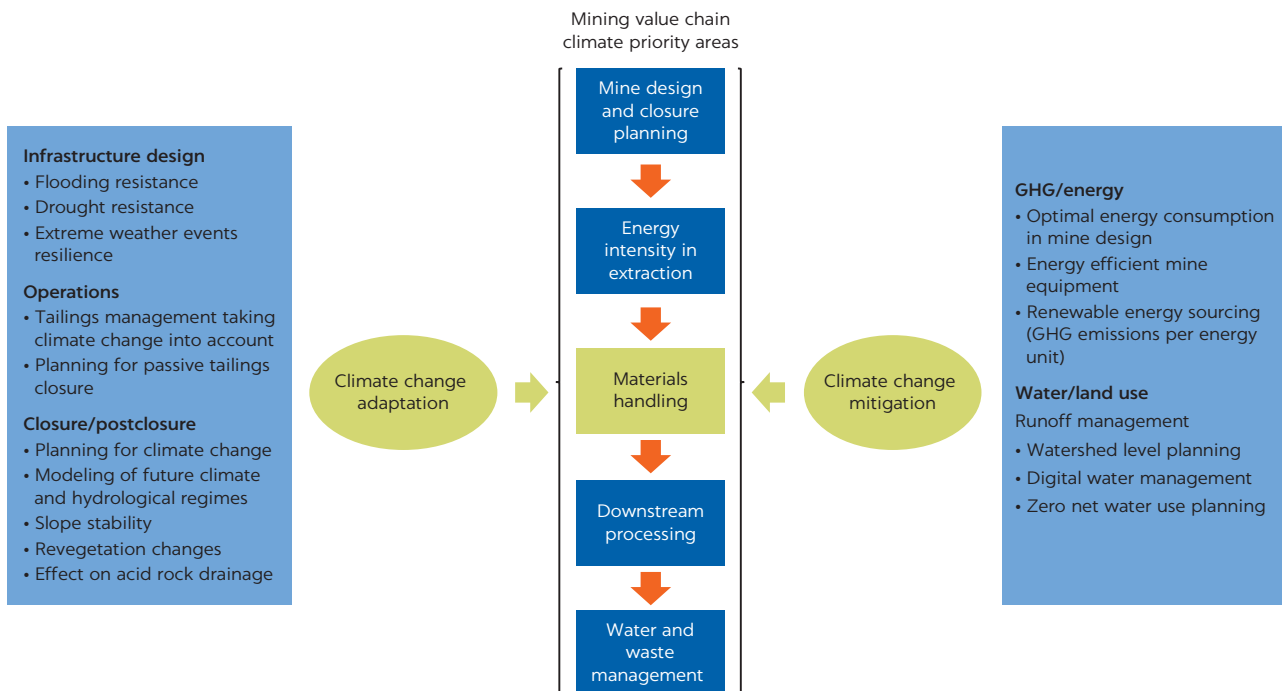
Disclosure and communications

Once the plan is in place and the strategy is being implemented, the firm must track progress toward its goals and vision. As such, it should develop KPIs for monitoring and reporting on programs and key metrics to internal stakeholders. Moreover, it should exploit the opportunity to improve its goodwill and reputation by enhancing external disclosures and communications on climate change to external stakeholders.

CLIMATE-SENSITIVE MINING REFERENCE FRAMEWORK

This report focuses on both climate impact *adaptation* and *mitigation* activities in which companies are engaged, throughout their value chain.¹ To orient the reader as to which type of effort in which segment of the value chain/identified priority area a company is conducting, the report uses the framework/graphic

FIGURE A.2
Reference framework for mining companies’ priorities



Note: GHG = Greenhouse Gas.

presented in figure A.2. Specifically, the report uses the core graphic at the center of figure A.2, highlighting the areas implicated by the reference company's activities. At the left and right of the graphic are representative examples of adaptation and mitigation activities in which a mining company might engage.

NOTE

1. Adaptation efforts comprise those activities in which companies engage to limit the impacts of climate risks to their operations, costs, and revenue. Mitigation efforts, conversely, are those activities intended to reduce the impact of a company's operations on the climate through, among other initiatives, reducing fuel and water consumption.

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The need for mining firms to rethink and retool their local value creation efforts, along with the growing complexity of climate policies, presents an opportunity for forward-thinking mining firms to seize a competitive advantage. As this report argues, firms that systematically tackle their climate responsibilities and adapt to climate realities through technical solutions that offer scalable economic value to host nations are best placed to contribute to sustainable growth in their countries of operation.