Climate Action 100+
Global Investors Driving Business Transition

Investor Expectations for Diversified Mining

Investor foreword

The resources diversified miners provide are a vital and substantial component of the global economy. A transition towards net zero is underway, but this global economic transformation needs to accelerate for warming to be limited to 1.5°C. All but a handful of nations agreed to pursue efforts to meet this goal under the 2015 Paris Agreement, and the severity of climate impacts we are seeing today are a stark reminder of the importance of this aim.

Mining will be pivotal to this transition. To build out the clean energy technologies and grid capacity needed, mining of key materials – many of which have historically only been mined at low volumes – will have to grow at unprecedented rates. This requires miners to deploy capital to accelerate production of key transition minerals whilst also pre-empting and avoiding potential negative social and environmental consequences.

Concurrently, the mining sector and its value chains will also need to decarbonise. For some commodities, this means reducing production. In net zero scenarios, coal production declines towards zero, with thermal coal declining faster than metallurgical coal. Other commodities, such as iron ore, bauxite, and alumina – necessary inputs for making steel and aluminium – will still be needed in a low-carbon world. However, the downstream processing of these commodities often dominates miners' indirect (scope 3) emissions, and these value chains must also be decarbonised to achieve net zero.

Investors often have exposure not only to the mining sector, but to many other sectors that are underpinned and enabled by mining. For example, the autos, property, steel and manufacturing sectors are highly dependent on the commodities produced by miners. By focusing on the strategic role of mining in the net zero transition, investors can boost the resilience of their overall portfolio.

Investor Expectations for Diversified Mining is a supporting resource to be used in conjunction with the *Net Zero Standard for Diversified Mining*. The Standard is an adaptable and rigorous framework for institutional investors to ascertain how mining companies are navigating the multi-faceted and complex sector-specific aspects of the global transition to net zero. Assessment of mining company public disclosures against the Standard will offer investors clear and comparable insights into how miners are managing the net-zero transition. These assessments, coupled with the context and guidance outlined in *Investor Expectations for Diversified Mining*, are designed to support investor engagement with mining companies in line with the goals of the global Climate Action 100+ investor initiative, and bring impactful insight and understanding to these dialogues.

Shaped by institutional investors and refined with input from mining companies, sector experts and other stakeholders, both the Standard and Investor Expectations are ambitious but credible resources for investors and mining companies to ensure this critical sector supports a just and orderly transition to net-zero at a crucial time in this essential global economic transformation.

Laura Hillis
Director of Climate & Environment, The Church of England Pensions Board

Cristina Cedillo Torres
Senior Engagement Specialist, Robeco

Kim Farrant
General Manager of Responsible Investment, HESTA

Guidance developed by:

Lead Authors:

Institutional Investors Group on Climate Change (IIGCC): Dr Sam Cornish, Dan Gardiner, Jheel Baldi

Investor Group on Climate Change (IGCC): Kate Donnelly, Dani Siew

TPI Centre, Grantham Research Institute on Climate Change and the Environment, LSE: Antonina Scheer

With grateful thanks to additional contributions from the following investors:

AustralianSuper, Baillie Gifford & Co., BCI, Church of England Pension Board, Fidelity International, HESTA, HSBC AM, Legal & General Investment Management, Lombard Odier IM, M&G, MFS Investment Management, PIRC, Rest Super, Royal London Asset Management, Robeco, TCorp, UBS AM, UniSuper.

The Climate Action 100+ investor networks:

Asia Investor Group on Climate Change (AIGCC), Ceres, Investor Group on Climate Change (IGCC), Institutional Investors Group on Climate Change (IIGCC) and Principles for Responsible Investment (PRI).

The following expert stakeholders:

Australian Council of Superannuation Investors (ACSI), Chronos Sustainability, Climate Bonds Initiative, Climateworks Centre, Elaine Prior Consulting, Energy Transitions Commission (ETC), Ian Woods Advisors, International Council on Mining and Metals (ICMM), The International Energy Agency (IEA), Institute for Energy Economics and Financial Analysis (IEEFA), Science Based Targets initiative (SBTi).

And the following companies:

Anglo American, BHP Group, Glencore, Rio Tinto, South32, Teck Resources.

How to use this document

This document, *Net Zero Standard for Diversified Mining*, sets out metrics that diversified mining companies engaged with under Climate Action 100+ will be assessed against, and the scoring methodology that will be used. These metrics are additional to the Climate Action 100+ Net Zero Company Benchmark, and this document shows how the new metrics relate to the indicators and sub-indicators of the Net Zero Company Benchmark. The accompanying document, *Investor Expectations for Diversified Mining*, places the metrics presented here in the context of supporting background and rationale.

Disclaimer

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Glossary

Alignment metrics	The Standard assesses alignment with Net Zero goals through 14 metrics testing company disclosures against a scenario consistent with limiting warming to 1.5°C above pre-industrial levels (typically from the IEA NZE). There are four additional existing alignment metrics in the CA100+ Net Zero Company Benchmark.
BECCS	Bioenergy with Carbon Capture and Storage is a carbon removal technique which extracts energy from biomass and captures and stores the carbon released
Beta indicators	CA100+ Company Benchmark 2.0 indicators where assessments will not be made public
CBD	Cumulative Benchmark Divergence [1] quantifies the projected cumulative emissions performance of a corporate (or real asset) relative to a Paris-aligned decarbonisation pathway, over a defined timespan.
CCS	Carbon Capture and Storage refers to a technology and supporting infrastructure designed to capture carbon emissions from a point source, and transport and store the carbon in geological formations
CDR	Carbon Dioxide Removal refers to the process of removing CO_2 from the atmosphere
CO_2e	The equivalent mass of CO_2 of one or more greenhouse gases, as determined by global warming potential over a defined time period
CuEq	Copper Equivalent volume is defined as the weight (in tonnes) of copper that has a revenue equal to that of the commodity in question. Calculating CuEq requires establishing the market price of copper and the product to be converted. The ratio of these two prices is called the “price factor”
DACCS	Direct Air Capture with Carbon Capture and Storage refers to a technology and supporting infrastructure designed to remove carbon dioxide directly from the atmosphere and compress it to be injected into geological storage
Disclosure metrics	Metrics that aim to capture the presence of company disclosures. The Standard has 76 disclosure metrics.
GWh	Gigawatt hour
IEA	International Energy Agency
ICMM	International Council on Mining and Metals
IRMA	The Initiative for Responsible Mining Assurance
KTM	Key Transition Materials: lithium, copper, graphite, tellurium, nickel, cobalt, neodymium
M&A	Mergers and acquisitions activities, including divestment
Mt	Mega-tonnes (million metric tonnes)
NbS	Nature-based solutions which remove emissions from the atmosphere (see also CDR)
Net Zero	References to net zero (and net zero alignment) in this report refer to emissions pathways and climate scenarios consistent with the ambition of the Paris Agreement to limit the rise in global warming to 1.5°C with limited or no overshoot. These scenarios are characterised by emissions falling to net zero by 2050 while not exceeding the carbon budget for 1.5°C.
NZAM	Net Zero Asset Managers initiative
NZE	The IEA’s (International Energy Agency) Net Zero Emissions by 2050 scenario and report
NZIF	Net Zero Investment Framework
NZS	Net Zero Standards
OTM	Other Transition Material (for full list, see Page 26)
PAAO	Paris Aligned Asset Owners initiative
PPA	Power Purchase Agreements
REC	Renewable Energy Certificates
REE	Rare Earth Elements (neodymium, dysprosium, praseodymium, terbium, others)
REGO	Renewable Energy Guarantees of Origin
SBTi	Science Based Targets initiative
Scope 1/2/3 emissions	Scope 1: direct emissions from activities under an organisation’s ownership or control. Scope 2: indirect emissions from energy (electricity, heat, steam, cooling) purchased or acquired by the organisation. Scope 3: all other indirect emissions occurring within the value chain of the organisation, both upstream and downstream.
TCFD	Taskforce on Climate-related Financial Disclosures
tCO_2e	Tonnes of carbon dioxide equivalent
tCH_4	Tonnes of methane
TJ	Terajoules
TM	Transition Material: a material that is needed for the energy transition
USGS	U.S. Geological Survey

Executive summary

Hundreds of institutional investors globally have committed to align their portfolios with the Paris Agreement objective of limiting global average temperature increase to 1.5 degrees. Their aim is to support real-world emissions reductions consistent with the principles of the target-setting initiatives they are using. To achieve these commitments, investors will need the corporate assets they hold to outline and deliver upon their own transition plans.

Investors therefore need frameworks that can interrogate the ambition and credibility of company transition plans, track progress and, where plans are not forthcoming or are inadequate, inform engagement conversations. The multi-criteria Climate Action 100+ Company Benchmark [2] does just that for 166 companies across multiple sectors. However there is also growing recognition that, for complex sectors particularly, more detailed frameworks capable of capturing the nuances of different company strategies are needed.

The diversified mining sector is both particularly complex and set to play a significant role in the transition. As the name suggests, its outputs are inherently diverse. Of all the diversified miners covered by CA100+, no two have the same portfolio – and the sector's energy and non-energy commodities play important but very different roles. Rapid cuts in the consumption of coal, particularly thermal coal, are needed over the next decade to constrain emissions within a 1.5°C budget, giving rise to significant transition risks for the remaining miners still exposed. The transition also creates opportunities for miners, with demand for key commodities needed for the roll-out of clean energy technologies forecast to grow significantly by 2030. Meeting this demand requires urgent and significant investment.

The Net Zero Standard for Diversified Mining is a company assessment framework designed to support investors' engagement activities. These detailed engagement conversations require data capturing the sector's unique transition risks and opportunities. The Standard thus covers a range of commodities and themes, including coal, transition materials, iron ore and bauxite/alumina, coal mine methane and how the mining sector interacts with a just transition. For all these topics the Standard tests for the presence of publicly available company disclosure and, where possible, the alignment of the disclosure with outputs from integrated assessment models (typically the IEA NZE scenario).[1] The Standard metrics are designed to integrate with and complement the recently updated sector neutral CA100+ Company Benchmark [3]. It also classifies transition materials as a climate solution, consistent with the definition established by the Net Zero Investment Framework (NZIF).

The development of the Standard has been investor led but in consultation with mining companies and industry stakeholders. Development of the Standard has been led by IGCC and IIGCC following an initial investor and company roundtable in November 2021. Over the last 18 months metrics were refined and tested in a series of roundtables where investors and companies provided feedback. IGCC and IIGCC are grateful to all members and companies that have participated in this process. A final consultation in May 2023 provided a further opportunity for stakeholders to provide feedback.

Next steps. This Investor Expectations document provides the rationale for the metrics set out in the accompanying Net Zero Standard document. These metrics will now be piloted by assessing selected miners with the objective of testing their practicality. Feedback from these pilots will be used to further refine the metrics into a final list, with which it is expected public assessments will be made.

1 CA100+ recognises that, in light of strategic, regulatory, jurisdictional or other relevant considerations, some companies may not be in a position to provide all of the relevant disclosures that are tested for in the Standard. CA100+ notes that it is at the discretion of each individual company to make their own public disclosures as appropriate, in line with their own independent capabilities, strategies, policies and practices.

CA100+ Indicators		NZS Diversified Mining Metrics				Relevant Section in this document
		Topic	Disclosure	Alignment	Climate Solutions	
1	Net-Zero GHG Emissions by 2050 (or Sooner) Ambition					Section begins on Page 14
2	Long-Term Targets		2.i.a	2.i.b		Section begins on Page 15
3	Medium-Term Targets		3.i.a	3.i.b		Section begins on Page 15
4	Short-Term Targets		4.i.a	4.i.b		Section begins on Page 15
5	Decarbonisation Strategy	Contribution of measures	5.i.a-c			Section begins on Page 31
		Transition materials			5.ii.a-g	Section begins on Page 29
		Operational emissions	5.iii.a,c-f	5.iii.b		Section begins on Page 32
		Methane	5.iv.a,b,d	5.iv.c		Section begins on Page 35
		Thermal coal production	5.v.a,c,f,g	5.v.b,d,e		Section begins on Page 37
		Met coal production	5.vi.a,c,f,g	5.vi.b,d,e		Section begins on Page 39
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		Scope 3 cat. 10	5.viii.a,c-h	5.viii.b		Section begins on Page 45
		Shipping emissions	5.ix.a,c	5.ix.b		Section begins on Page 47
6	Capital Allocation	Total	6.i.a			Section begins on Page 48
		Coal capex	6.ii.a-f			Section begins on Page 48
		Emission reduction	6.iii.a			Section begins on Page 50
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7	Climate Policy Engagement					Section begins on Page 51
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9	Just Transition	Commitment	9.i.a-b			Section begins on Page 54
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		Accelerating TM mining	9.iii.a-c			Section begins on Page 55
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		Scope 3 emissions	10.iii.a-e			Section begins on Page 60
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11	Historical GHG Emissions Reductions					Section begins on Page 63

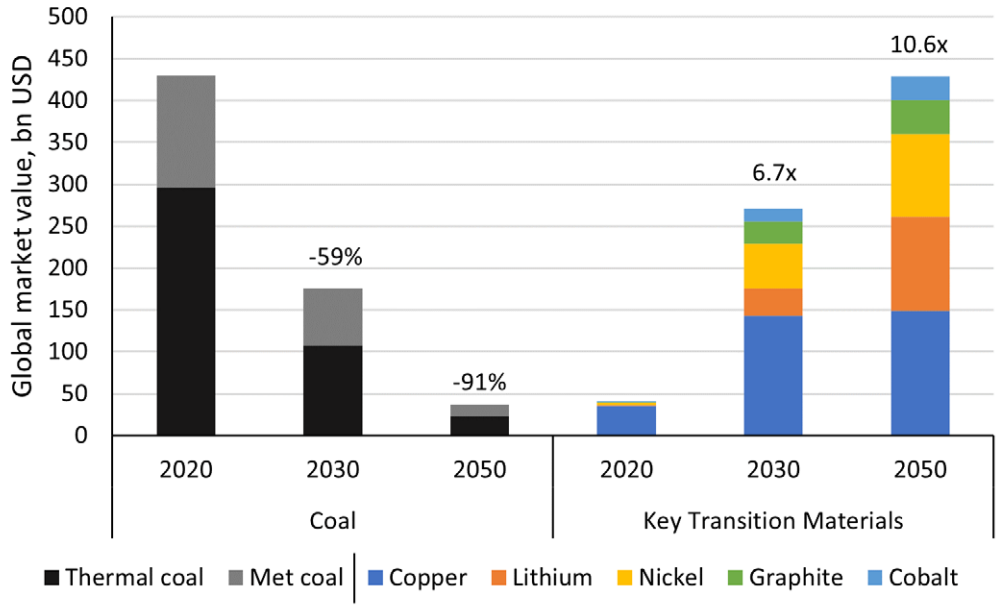
Introduction

The impact of the transition to Net Zero on the mining sector

The Paris Agreement's objective of limiting the global average temperature increase to 1.5°C (which will involve reaching net zero by 2050) requires a substantial transformation of the whole global economy over the next decade and beyond. The mining sector is key to the transition. In particular, the shift to net zero requires:

- Rapid cuts in the consumption of coal, particularly thermal coal
- Rapid growth in the supply of Key Transition Materials[2]

Exhibit 1: A 1.5°C Scenario (such as the IEA NZE) implies dramatic shifts in mining industry production by 2030 and beyond



Note: Global market value (using 2019 USD value) of coal products (left) and key transition materials (right). Data from IEA NZE, Ch. 4; price of materials based on conservative price estimates of c. 10-20% increase to 2050. Changes against 2020 indicated above bars in 2030 and 2050, as a % for declining values and a multiple for increasing values. We distinguish thermal and met coal here by assuming met coal will continue to trade at c. twice the price of thermal coal.

The aims of the Paris Agreement are supported by large parts of the industry already. The members of ICMM, an industry body representing 26 miners, acknowledge the need for *"an urgent global response to the threat of climate change, across all areas of society and the economy"* and *"to support the goals of the Paris Agreement to limit the increase in the global average temperature to 2°C and pursue efforts to limit the increase to 1.5°C"* (recognition statements 1 & 2 respectively) [4]. Accounting bodies such as ISSB and national regulators are increasingly mandating listed companies to supplement their financial reporting with climate-related disclosure [5].

2 For definition see page 19

The investor perspective

A growing number of investors have made commitments to align their portfolios with the goals of the Paris Agreement. There are several frameworks being used to make these commitments but the most widely adopted currently is the Net Zero Investment Framework (NZIF). Today, it has been adopted by more than 160 investors globally. NZIF encourages portfolio decarbonisation through emissions reductions associated with assets held [6; 7]. Therefore, to implement NZIF, investors need confidence that the climate commitments made by the assets they own are credible.

Diversified mining companies are important within investor portfolios. The ten largest account for $706 bn of market capitalisation[3] alone. They can also be significant in terms of their emissions footprint, particularly where they produce coal, and, as already highlighted above, are also set to play a vital role in facilitating the transition through the materials they produce. Thus investors need to understand the credibility of mining company transition plans both to assess company-specific transition risks and opportunities but also the broader prospects of the transition.

More specifically, investors want to know if mining company climate commitments are:

- Ambitious (i.e., consistent with the goal of the Paris Agreement to limit climate change to 1.5°C)
- Credible (can they be delivered)
- Measurable (how they can be assessed)

Current assessment of diversified mining company transition plans

Investors currently use CA100+ Net Zero Company Benchmark data (amongst other tools) to interrogate miners' transition plans and inform their portfolio assessment and engagement conversations [3]. This multi-criteria indicator framework assesses 166 emissions intensive companies across multiple sectors; while it neatly captures the main elements of transition strategies across this broad universe, the diversified mining sector is particularly complex. As the name suggests, its outputs are inherently diverse and the different materials (energy and non-energy commodities) play important but very different roles in the transition. It is difficult for any sector neutral framework to capture these nuances.

3 Data from FactSet, 14 Apr 2023.

The aims of the Net Zero Standard for Diversified Mining

The Standard concept evolved from the recognition that productive engagement conversations require investors to understand how companies are responding to transition risks and opportunities specific to their sector. This requires robust data focussing on these topics. The framework developed by the Standard aims to assess both company climate-related disclosure and test the alignment of that disclosure against net zero scenarios where possible. Recognising the intrinsic variability of the sector, these tests do not claim to provide a definitive view on net zero alignment but simply aim to elicit data that can be a useful starting point for engagement conversations (subject at all times to restrictions on confidential information exchanges, as set out in the Disclaimer above). The ultimate aim of the Standard is to provide the data investors need to support their engagement, voting and investment decisions. More specifically it is designed to:

- Improve the ability of investors to assess the credibility of companies' climate commitments and strategies against climate scenarios
- Allow investors to directly compare companies' disclosures and net zero alignment using relevant sector specific metrics
- Support investment decisions around transition materials ("climate solutions") or fossil fuel production
- Identify issues related to the transition that investors and companies in the diversified mining sector wish to address in collaboration

To accomplish these aims it is envisaged that the metrics developed by the Standard will be used to publicly assess CA100+ Diversified Mining companies in due course. The assessments will be based on publicly available information and/or information that is not competitively sensitive. It is expected these assessments will be carried out by an independent assessment provider using a process consistent with that currently used to collect and display the CA100+ Company Benchmark data. This process includes providing companies the opportunity to review the data in advance of publication.

Activities covered by the Net Zero Standard for Diversified Mining

Not only do diversified miners have varied commodity portfolios, they can play different roles in commodity value chains. Some only extract the commodity, leaving it to partners to refine and distribute. Others may both extract and refine while some may refine or trade products extracted by others. A miner's position in the value chain can vary by commodity and location.

By taking a value chain approach to assessing emissions, one that includes scope 1, 2 and 3, this Standard aims to capture all these different types of business model fairly, without seeking to favour one type or another (consistent with Principle 1 – see below). However, where additional assessments focus on a specific emissions scope, this can be impacted by business model type and investors should be cognisant of this potential limitation when interpreting the results.

Development of the Standard

The development of the Standard began in November 2021 led by IGCC and IIGCC, the regional network partners of the CA100+ in Australia and Europe respectively. Following an initial investor and company roundtable, provisional indicators were developed and tested in three additional roundtables with investors and companies. Feedback on topics presented was collated after each roundtable. In total 19 investors, 11 expert stakeholders and six diversified miners as well as the CA100+ network partners have contributed to the development of these indicators. On behalf of CA100+, IGCC and IIGCC would like to acknowledge and thank all those that have taken part (for a full list see Page 3).

Principles

Consistent with the approach taken for other Net Zero Standards, the development of the Net Zero Standard for Diversified Mining has been underpinned by six principles:

1. **Strategic flexibility.** The Standard aims to recognise and capture the inherent diversity of the sector and the many potential strategies to reach net zero. Companies are assessed for net zero alignment against established emissions budgets where available, but are free to choose the most efficient technology and strategic path based on their own independent decision-making processes and criteria. The principle of strategic flexibility is particularly relevant when considering miners' transition materials strategy; not all companies will have the resources or skills to invest in transition materials. The Standard therefore scores these activities separately from decarbonisation disclosure and net zero alignment. The Standard seeks to balance the need to capture the nuances of the decarbonisation journey for the sector and the diversity of approaches a miner might take with the aim of simplicity (Principle 5). Finally, because metrics will be assessed against miners' public disclosures, the Standard should not be seen as a rubric that restricts the manner in which disclosures are made.
2. **Separately testing for disclosure and net zero alignment.** Improving climate disclosure enables investors to make better-informed investment decisions and is therefore beneficial in its own right. The metrics here are designed to map onto Disclosure Indicators of the CA100+ Company Benchmark. However, the ability to assess "alignment" by testing this disclosure against integrated assessment models is particularly valuable. This Standard focusses on encouraging disclosure (where permissible) which can be assessed for net zero alignment.
3. **Primarily focused on transition risk but also seeking "impact" and identifying opportunities.** This Standard primarily assesses the reduction in company transition risk associated with the adoption of a comprehensive net zero strategy and measured using emissions in its supply chain. However, it also examines the implications of a company's decarbonisation actions for wider real-world emissions reductions, which are needed to mitigate physical climate risk. Finally, miners will be exposed not only to transition risk but also opportunity. This is most clearly seen in the huge projected growth in demand for materials for the energy transition.
4. **Make use of existing frameworks where available.** The Standard recognises that disclosure expectations are growing. Therefore it aims to reference existing disclosure frameworks where possible.

5. **Simplicity.** The Standard aims to encourage the minimal amount of disclosure needed to achieve its objective. Adherence to this has a practical benefit for those providing, collecting, processing, displaying and ultimate using the data.
6. **Transparency.** The Standard is based on established, scientifically published principles where possible, cited within. Responses to consultation feedback have been shared amongst all reviewers on an anonymised basis.

What is not covered in the Standard

The Standard focusses on the actions miners should take to address climate transition risks consistent with NZIF (see above). As such two important topics, for which guidance is being developed separately and is not yet integrated into CA100+ Company Benchmark or NZIF, are not directly covered:

- Physical impacts of climate change (on companies)
- Nature and biodiversity (including land use change emissions)

Both are important topics with specific relevance for the mining sector. The Standard recognises the need to integrate considerations of the potential co-benefits and trade-offs of the climate transition on the natural world. For instance, expanding mineral extraction and supporting infrastructure can lead to land use change emissions and impacts on biodiversity as forests are cleared [8]. Mines, due to topography and processes (quarrying and tailings), can be exposed to devastating physical impacts.

Investor expectations on nature will be developed under Nature Action 100, which is an investor engagement initiative focused on encouraging greater corporate ambition and action on reducing nature loss. These expectations can be expanded and tailored to the mining sector in the future. IIGCC is developing further guidance for investors on climate resilience and is leading the second phase of the development of the Physical Climate Risk Methodology [9; 10; 11].

There are additionally several topics specific to mining and its value chains that are not covered here:

- Social and environmental impact of mining materials that are ‘neutral’ with respect to the transition
- Resource efficiency and recycling

As a climate document, the Standard’s focus on social and environmental impacts is limited to materials that have clear production pathways (whether scaling up or down) in relation to the transition to a net zero global economy. Additionally, while the Standard recognises the vital role resource efficiency and recycling could play in mitigating potential material supply gaps associated with the transition [12], it does not currently assess miners against criteria pertaining to these topics. Further, focussing on the needs of the transition as a whole, the Standard does not integrate geopolitical dimensions, which may be relevant to the security of supply of energy transition materials. These geographic and geopolitical issues are covered in detail in other resources [13; 12; 14]

Consistent with investors’ role as owners, rather than managers of companies, and the principle of simplicity set out above, disclosure requests focus on high level actions and strategy, not on detailed operational implementation.

Disclosure Indicator 1:
Net-Zero Ambition

The CA100+ Net Zero Company Benchmark 2.0 evaluates [3] companies based on whether they have:

[1.1] **"set an ambition to achieve net-zero GHG emissions by 2050 (or sooner)" which includes:**

[1.1 a] **"a qualitative net-zero GHG emissions ambition statement that explicitly includes at least 95% of scope 1 and 2 emissions" and an**

[1.1 b] **"ambition [that] covers the most relevant scope 3 GHG emissions categories for the company's sector, where applicable."**

The Net Zero Standard does not add sector specific metrics to this disclosure indicator. As diversified mining companies produce fossil fuels (predominantly coal) which is burned downstream and iron ore which largely rely on fossil fuels for processing, scope 3 emissions are clearly relevant for investors considering transition risk in this sector. This is supported by ICMM which recognises that scope 3 is material and encourages its members to commit to "set scope 3 targets if not by the end of 2023, as soon as possible" [4]. Currently four of 11[4] CA100+ diversified miners have made commitments covering scope 3. This standard does recognise that the materiality of scope 3 to an individual mining company varies substantially by product mix and the unique challenges of setting scope 3 targets in the mining sector. These issues are discussed in more detail in the following target setting sections.

The commitment should be comprehensive covering all business divisions and activities, all gases (methane and other gases if material as well as CO_2) and an organisational boundary that includes all equity stakes and all geographies to prevent "leakage". Further discussion on consolidation boundaries is set out on page 18.

4 CA100+ currently classifies ten companies as diversified miners including MMC Norilsk Nickel PSJC "Nornickel" where engagement is currently suspended. While PT Aneka Tambang Tbk (ANTAM) is currently classified as a Coal Mining company, its broad mix of commodity outputs mean the Standard is also relevant to this company.

Disclosure indicators 2, 3 and 4: Long, Medium and Short Term (companywide emissions) targets

The CA100+ Company Benchmark assesses emissions targets in the diversified mining sector using the TPI methodology [15]. Its emissions intensity approach aggregates scope 1, 2 and scope 3 category 10 and 11 emissions (processing and use of sold products respectively) to calculate a numerator which is then divided by Copper Equivalent (CuEq), a measure of total output that enables differing value of commodities to be reflected. Company level intensity is calculated and projected based on disclosed targets. This pathway is compared to a benchmark calculated in the same way to determine net zero alignment at specific points in time.

An intensity approach to assessment has several advantages including the ability to compare companies of different sizes, growth rates and underlying progress on decarbonisation through economic cycles. Two of the 11 CA100+ diversified mining companies choose to set intensity targets. Targets to reduce absolute emissions can be converted to intensity and be assessed for net zero alignment by making assumptions that the company output growth will be consistent with the wider sector; this is the TPI approach [15].

This approach works well at a high level and captures most lifecycle emissions (categories 10 and 11 typically account for 95% of total miners' scope 3). Therefore the Standard does not alter the TPI methodology or the existing CA100+ Company Benchmark target metrics within indicators 2, 3 and 4 which rely upon it.

However the current approach does miss some nuances of emission target setting within the sector. For example most mining companies express targets as reductions in absolute emissions – reflecting concerns about the comparability of an intensity denominator and investors' increasing desire to see companies reduce absolute emissions as well as intensity. Absolute emissions targets enable strategies that include wind down components to be tracked. Companies reporting progress against absolute targets in line with the GHG Protocol are guided to re-baseline the emissions of their base year, according to the acquisition or divestments of assets that were emitting at the time of the base year [16 pp. 34-39]. This recalibration means that absolute targets can remain reflective of real-world emissions. Appropriate methodologies for assessing the net zero alignment of absolute targets directly (rather than convert into intensity) may emerge over time.

For this reason, the Standard encourages companies to disclose targets in both absolute and intensity terms. Those setting targets to reduce absolute emissions should state the expected impact (within a narrow range if appropriate) in intensity terms. Those disclosing intensity targets are similarly encouraged to indicate their expected impact on absolute emissions. This approach is consistent with that introduced in the recently published Net Zero Standard for Oil and Gas companies [17], the recent modifications disclosure indicator 3 in the CA100+ Company Benchmark 2.0 and the flexible approach set out by the ICMM. The Standard adds the following two metrics to sub-indicators 2.2, 3.2 and 4.2:

Disclosure metric [2/3/4].i.a:

Has the company provided the [LT/MT/ST] emissions target in terms of both absolute emissions and emissions intensity, stated either as a point or narrow range (<10% of base year value)

Alignment metric [2/3/4].i.b:

[Not operational] Is the reduction in absolute emissions implied by the [LT/MT/ST] target in line with or below the relevant Net Zero pathway

The approach that companies take to meeting their overall targets is assessed in Disclosure Indicator 5: Decarbonisation Strategy (main). This includes the use of "neutralising measures", which can include point-source carbon capture and geological storage, and carbon dioxide removals (see Sub-indicator **5.vii**: Neutralising measures).

A disaggregated approach to assessing miners' emissions targets

The Standard leaves the existing CA100+ Company Benchmark emission target metrics unchanged but it recognises that investors require additional insight to evaluate transition strategies in this sector. As such, it takes a disaggregated approach to assessing targets to appropriately reflect the nuanced and varied decarbonisation journey for diversified miners.

Firstly, the Standard separates scopes 1 and 2, or operational emissions, from emissions produced upstream or downstream within value chains (scope 3). Miners arguably have greatest control over the emissions associated with the energy they directly consume, and it should be possible to assess these emissions against separate benchmarks in time.

The majority (c. 95%) of major diversified miners' emissions are scope 3 (Exhibit 2). Within scope 3, four commodities and their value chains dominate miners' emissions: iron ore for steel; bauxite/alumina for aluminium; metallurgical coal, used in blast furnaces as a heat source and reducing agent in steelmaking; and thermal coal, used primarily for electricity generation.

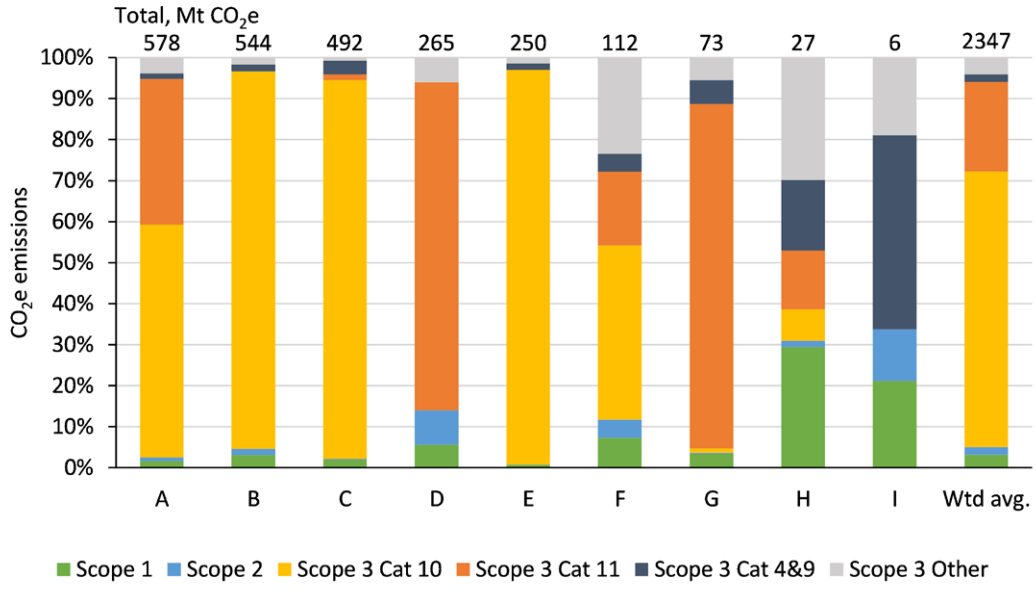
The value chain of each of these major commodities has a different decarbonisation pathway, indeed "some commodities face greater technological and collaborative barriers than others" (ICMM [4 p. 5]). Indeed it can be argued that the transition risk associated with each commodity varies according to the differing implications of value chain decarbonisation for the demand of that commodity. Steelmaking in a net zero world will still require iron ore, for example, while the demand for met coal may fall by 80-90% [22; 12]. There is nonetheless transition risk related to selling iron ore to steel-makers using fossil fuels.

There is also potential double-counting in scope 3 where a company mines commodities that are part of the same value chain: again consider the steel value chain, in which the processing emissions associated with iron ore are dominated by the combustion of met coal – a company producing both commodities might have its emissions overstated[5]. This can undermine the robustness of a single total scope 3 figure.

For both of these reasons a disaggregated approach to scope 3 is required for sophisticated decarbonisation strategies and engagement conversations in this sector. The Standard assesses the four commodities separately: iron ore (cat. 10; processing of products), bauxite/alumina (cat. 10), metallurgical coal (cat. 11; use of products) and thermal coal (cat. 11). (Note that the differing implications for transition risk described above are reflected in the scope 3 category that dominates the emissions associated with a commodity.)

In addition, some miners set targets on scope 3 categories beyond 10 and 11. While these are often relatively small in the context of category 10 and 11 (c. 94% of the 'average' miner's scope 3 emissions; Exhibit 2), they are substantial in their own terms and relative to a miner's scope 1 & 2. These should arguably recognised, however assessment is difficult given the inevitable heterogeneity of the underlying sources of emissions. The Standard assesses emissions from shipping (scope 3 cats. 4 & 9), which is a ubiquitous and separable element of miners' scope 3 emissions.

Exhibit 2: Disclosed emissions profiles of nine of the largest diversified miners

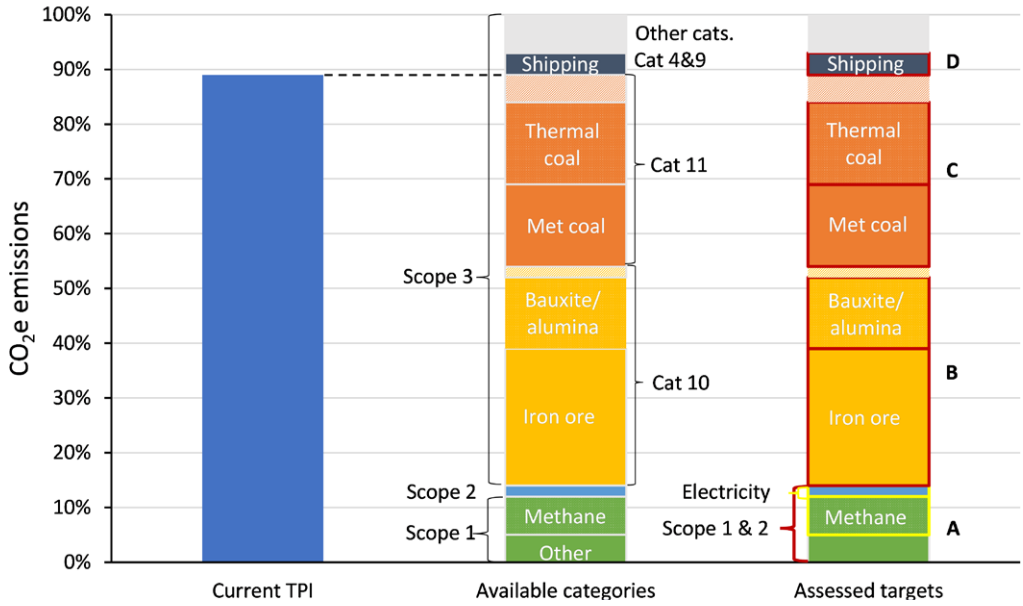


Note: Company emissions data from CDP and company reporting. Total emissions shown at top. Weighted average column shows the fraction each emissions scope or category comprises of the total emissions (2,347 Mt CO2e) of miners considered.

This supplemental, disaggregated approach to assessing emissions targets, and how it relates to the existing TPI methodology, is illustrated in Exhibit 3. It has received strong support from investors and broad support from companies during the development of the Standard.

5 The TPI addresses this by adjusting the emissions from met coal where the company produces both met coal and iron ore, but an industry-wide consensus on the best approach has not been established.

Exhibit 3: Approach to assessing mining sector emissions



Note: Depicts the emissions breakdown of a hypothetical diversified miner. The target assessment boundaries are marked in red and, where a subset thereof, in yellow. The Standard separately assesses: A) Scope 1 & 2: separating methane and electricity components thereof; B) Scope 3 cat. 10 (assessed via engagement commitments): separating iron ore and bauxite/alumina where relevant; C) Scope 3 cat. 11: separating met coal and thermal coal; D) Scope 4 & 9 (partial) shipping. 82% of investors polled 'agreed' or 'somewhat agreed' that this approach provides and appropriate level of detail. Cross-hatched boxes indicate 'other' sources of emissions within a category.

Further detail on the chosen emissions categories and how the Standard assesses them is provided between pages 31 and 47. As this disaggregated approach essentially helps investors evaluate how miners will deliver on their overall commitments, the metrics are located in Disclosure Indicator 5: Decarbonisation Strategy (main).

Disclosure Indicators 5 and 6: Climate Solutions (Transition Materials)

Many clean energy technologies rely on certain metals and minerals ("transition materials[6]") in their construction. For example, a MW of electrical power capacity from an offshore wind farm requires nearly 15 times the mass of transition materials as the equivalent from a gas-fired power station, and an electric car requires over six times the mass of these materials as a conventional car [23].

Given that net zero requires the rapid deployment of these technologies, it ultimately hinges on a rapid increase in supply of transition materials. The IEA's NZE scenario projects growth in material demand for clean energy technologies by a factor of between 2.5 and 9 across the materials classified by the Standard as key transition materials by 2030 relative to 2022. Much of the additional demand comes from batteries for electric vehicles and grid-scale storage, along with strong growth in electricity networks and low carbon power generation – mainly wind and solar [23; 24].

Some of the commodities required represent relatively small markets at present which will have to grow dramatically over the next decade as the transition accelerates. This is expected to stretch supply, with some analysis suggesting shortfalls which would limit progress [23 p. 119; 25; 26; 27; 12]. Diversified miners thus have a vital role to play in facilitating the energy transition. Along with boosting supply, high levels of resource efficiency and recycling may also be able help reduce potential supply gaps [12], and responsibility for such actions promoting circularity will be distributed through supply chains.

Investors wish to understand how companies in their portfolios are positioned to support this transition. In part they want to grasp the size of the commercial opportunity but they may also want to invest in and support companies producing materials that will accelerate the transition. However they recognise that not all miners will have the resources or skills to invest in transition materials. Therefore, consistent with strategic flexibility (Principle 1), the Standard separately assesses these activities, with scoring here not impacting the overall decarbonisation score.

In addition, consistent feedback from investors contributing to the Standard shows a resolve that these materials should be sourced in a socially and environmentally responsible manner; pressures on supply should not lead to the cutting of corners.

To understand the extent to which miners are supporting the transition, investors require a robust analytical framework that can assess their exposure to transition materials, the systematic contribution the company is making, and the credibility of its strategy to deliver. This information can inform their engagement, voting and investment decisions, while also supplying data for the "climate solutions" component of NZIF.

The following section sets out the methodology the Standard uses. As noted in What is not covered in the Standard, geopolitical considerations are out of scope.

6 The term *'transition materials'* is short for 'energy transition materials', and should not be confused with transition metals, which in chemistry refers to a certain set of elements in the periodic table. The Standard refers to 'materials' rather than 'minerals' to accommodate the diversity of commodities considered and to span the production stages from mined bulk ore to final demand with consistent terminology.

Method for Classifying Transition Materials

The Standard lays out a tiering of transition materials into 'key' transition materials (KTMs), as the highest priority, and 'other' transition materials. The two comprise 'total' transition materials. The standard uses the IEA's dataset of critical minerals [24] as a starting point for the full complement of 'total' transition materials. The Standard additionally assesses some other commodities (bauxite, alumina, iron ore, uranium) as detailed below. The Standard then sets out a methodology to assess all materials to establish which qualify as KTMs (see Eligibility), as well as determine the boundary between other transition materials and neutral materials. The Standard then screens the KTMs to assess whether their production is consistent with social and environment criteria (see Do no significant harm (DNSH) screening).

Eligibility

The Standard assesses each commodity on three criteria designed to determine its systematic importance to the transition:

1. % transition-related demand in 2022
2. % overall primary demand growth between 2022 and 2030
3. Absolute expected increase in market size between 2022 and 2030

Data for each criterion are sourced from publicly available information; primarily from the IEA Critical Minerals Demand Dataset [24], which provides clean energy technology-related demand in 2022 and into the future under different scenarios, and the US Geological Survey (USGS [28]), which provides global mined production data for 2022, and market prices over 2018-2022[7].

Criterion 1 is determined through comparing the mass of clean energy technology-related demand in 2022 for each material from the IEA [24], and the mass of total production of that material from the USGS, on a metal-equivalent basis. For steel (iron ore) and aluminium (bauxite and alumina), this clean energy technology-related demand datapoint is not directly available from the IEA dataset, so we estimate it by aggregating demand for these materials from relevant clean energy sectors, using data from multiple sources [29; 30; 31; 32; 33; 24]. Criterion 2 seeks the relative growth in demand over 2022-2030 in the NZE for each commodity that will be met by primary – and therefore mined – production. Data on total aluminium and steel demand in 2022 and 2030 are available in the IEA's NZE scenario. For other commodities where it is just the clean energy technology-related demand that is available from the IEA dataset, total 2030 demand is estimated as the sum of 2030 clean energy technology-related demand in the NZE scenario and non-transition related demand in 2022, with the assumption that this non-transition related demand in 2022 is constant[8]. We use present and forecasted rates of secondary production from the NZE to calculate primary production for steel and aluminium in 2022 and 2030. We do not account for secondary production for the other materials, for which secondary production is generally much less important now and by 2030 [29 p. 158].

7 We endeavour to accurately adjust for different approaches to reporting in all cases (material masses and prices are sometimes given in terms of the mass of the pure metal/element, and sometimes as the mineral or bulk ore in which they are most commonly found). We perform all calculations on the basis of metal-equivalent (or element-contained) values.

8 An alternative approach which applies a constant growth rate to the non-transition related component of production is possible but requires additional assumptions. The Standard will continue to evaluate and refine this methodology as new data become available. Some materials are expected to exhibit declines in certain non-transition applications (e.g. PGM use in catalytic converters within internal combustion engine vehicles).

For Criterion 3, originally an "investment required" approach was researched, but there were insufficient data and technical challenges in establishing clear relationships between investment required and production growth. Instead, change in market size aims to capture the absolute investment required and the investment opportunity. It is calculated using the change in total expected commodity demand met by primary production in 2030 versus 2022, multiplying by the 5-yr average market price (over 2018-2022) of the mined materials, on a metal-equivalent basis[9].

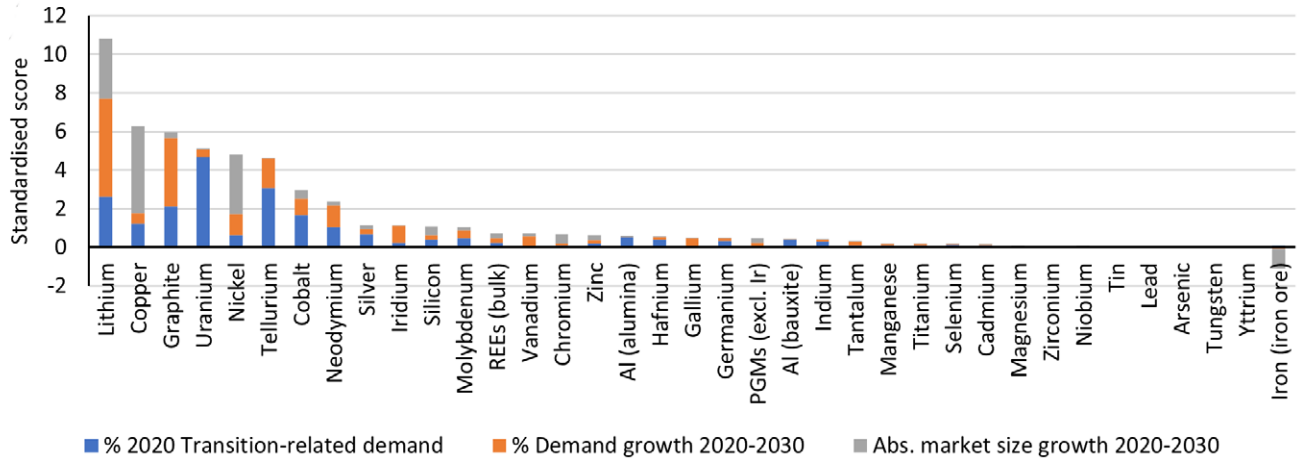
Once calculated, values for each criterion are standardised to ensure each is considered on an equal footing. The score for each criterion represents the number of standard deviations a commodity ranks above zero for each metric. This method preserves the full range of variability among the materials' scores. These standardised scores are then summed to form an overall score, which forms the basis of the eligibility ranking.

Results

The results of applying the three criteria to commodities are shown in Exhibit 4. Exhibit 4a shows the low score of iron ore relative to all other materials (due to negative primary demand growth and market size change). The negative score of iron justifies its exclusion from the list of transition materials, and instead it is classified as a neutral material. Removing iron ore (Exhibit 4b), and uranium (rationale discussed below), rebases the scores of all other commodities.

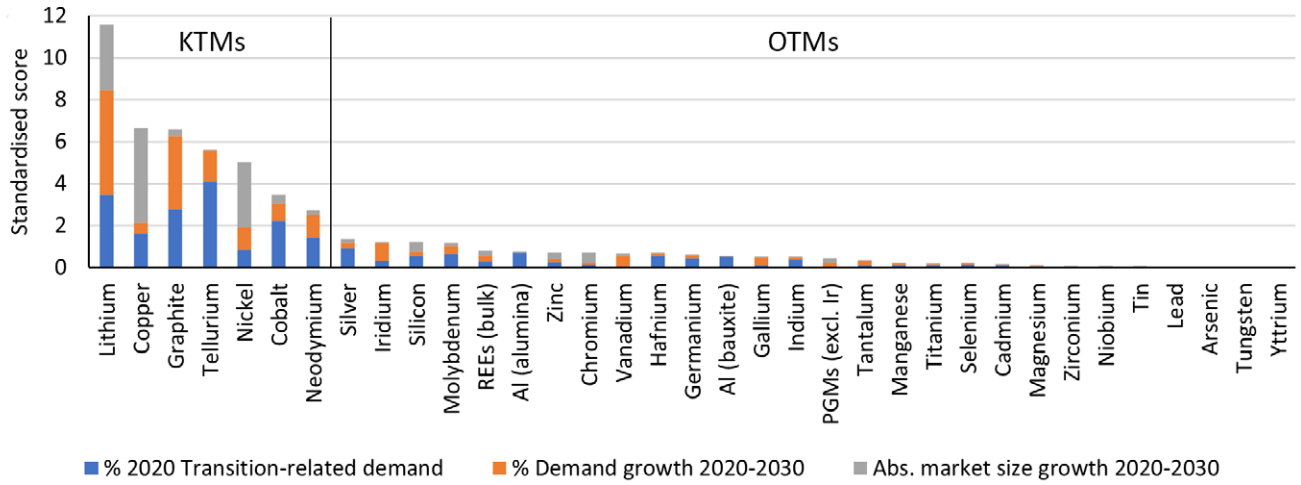
The Standard classifies materials with a score of over 2 as Key Transition Materials (KTMs). The KTMs are: lithium, copper, graphite, tellurium, nickel, cobalt and neodymium. Lithium, graphite, nickel and cobalt are primarily required for batteries, needed for grid-scale battery storage and EVs. Nickel also sees significant demand from hydrogen technologies and wind power. Tellurium is used in thin-film solar power technologies. Neodymium is used in wind power and EVs. Copper is used in a wide range of applications, including electricity networks, renewable power generation, batteries, EVs and grid-scale storage.

Exhibit 4a: Raw transition material scores based on three criteria



9 While prices cannot be expected to remain the same, the analysis assumes they cannot be forecast with any confidence. We use a 5-yr average to reduce distortion due to price volatility.

Exhibit 4b: Scored and categorised materials after applying exclusions



Note: The Transition materials are assessed on three criteria. For each of these criteria they are given (unitless) standardised scores, represented by the coloured bars. The bars sum to give the final score.

Discussion on particular commodities

- **Iron ore.** Iron ore ranks significantly lower than all other commodities (Exhibit 4a). This is because a small share of total production is destined for transition activities and demand for primary steel (using mined iron ore) is set to decline to 2030 in the NZE, resulting in negative scores for criteria 2 and 3. On the basis of its overall negative score, iron ore is not included in the class of transition materials; instead it is a '**neutral**' material.
- **Bauxite and alumina.** We include bauxite and alumina in our analysis as miners may be involved in producing one or both materials in the aluminium value chain. They should be expected to score differently as not all (76%) of bauxite is refined through the Bayer process to make alumina or aluminium hydroxide [28], and the two commodities have different prices. While a relatively large proportion of the eventual demand for these commodities in 2022 is destined for transition activities, the increase in demand met by primary production in 2030 versus 2022 is minimal, limiting the overall score of these commodities.
- **Nickel.** Refined nickel can be divided into class I, suitable for inclusion in batteries, and class II, which is mostly used in steel. The former has a far higher proportion of transition-related demand and expected growth. It is primarily produced from sulphide ores, but can also be produced from laterite deposits after intensive hydrometallurgical treatment [34]. As neither of our primary data sources provide the necessary data we have not made the distinction between class I and class II nickel here. If there is sufficient investor demand, a future iteration could separate the two using some simple assumptions.

- **Uranium.** Uranium scores highly due to near 100% use for low carbon energy generation in nuclear power. However, it does not receive the same broad support from investors involved in the Standard consultation process as other materials for the energy transition, due to both social and environmental reasons (particularly the longevity of hazardous nuclear waste and the use of uranium in nuclear weapons). The material itself (not simply the way it is mined) raises important DNSH concerns. Reflecting this and the intention for the Standard to have wide utility for all institutional investors, we classify it as **neutral** here. However, the Standard recognises this is a topic of differing opinions and will continue to consider this classification as it evolves.
- **Tellurium.** Tellurium is used in thin-film solar cells [35], and with a high proportion of demand going towards solar technologies, it scores highly in the classification. However it represents a relatively small market in comparison to other KTMs and hence absolute market growth is also small. Based on the quantitative score it warrants KTM classification, but the Standard acknowledges investors may struggle practically to invest in this commodity, particularly as tellurium is only extracted as a by-product of refining other metals [26]. Additionally, as commodity with a limited technological end-use, its future projections are subject to greater uncertainty than other KTMs. These points serve as an 'asterisk' to its inclusion as a KTM.
- **Neodymium and other Rare Earth Elements (REEs).** Neodymium is a rare-earth element that is used in permanent magnets, with applications in electric vehicles and wind power [23; 37]. Other REEs, such as dysprosium and praseodymium, are also important in these applications. While there are many REEs, our analysis targets neodymium, which is the most widely used in clean energy technologies [23]. Neodymium is the final material in the KTMs classification. Its inclusion is consistent with the ETC's key materials for the energy transition [12], IRENA's critical materials list [38], and the IEA's focus list of critical minerals [29].
- **Potash.** A source of the essential macronutrient potassium, Potash is used as an agricultural fertiliser. While the world will need potash in the future, the Standard's remit as a climate document is to focus on energy transition materials that will enable a net-zero global economy. As such, potash is not included in the analysis and is considered **neutral** in this context.

There are similar classifications of transition materials from independent analysts, companies and national policy makers. Unsurprisingly these are inconsistent, with companies keen to highlight how their output is aligned with the needs of the transition and national policy makers keen to prioritise and promote domestic resources. The Standard has reviewed analysis from European Commission [39], the ETC [12], IEA [40; 29], IFC [41], IMF [42], IRENA [43], LSE GRI [44], McKinsey & Co. [45], and World Bank [46], but ultimately adopted an independent approach based on IEA data and in consultation with investors to ensure it meets their requirements. Nevertheless, it is useful to see how the Standard compares. Exhibit 5 highlights how the classification compares to recent similar demand analysis from the LSE, IEA, ETC, IRENA, and the IEA's policy review.

The Standard intends to continually review its classification. As technologies evolve and material prices shift, certain materials inevitably will be substituted, changing demand forecasts. This classification will be updated to include revised forecasts and improvements to data as they become available.

Exhibit 5: Transition Minerals classification vs other schemes

		Transition Materials	Eligibility Score in the Standard[10]	LSE GRI TCMs Transition Demand Risk[11]	Critical Minerals classifications			IEA Critical Minerals Policy Tracker[12]							
					IEA[13]	ETC[14]	IRENA[15]	Total	US	EU	Japan	Brazil	Aus	Canada	Colombia
Key Transition Materials	1	**Lithium**	**11.6**	**7.3**	✓	✓	✓	**6**	✓	✓	✓	✓	✓	✓	
	2	**Copper**	**6.7**	**6.7**	✓	✓	✓	**3**				✓		✓	✓
	3	**Graphite**	**6.6**	**6.4**		✓		**5**	✓	✓		✓	✓	✓	
	4	**Tellurium**	**5.6**	**1.3**				**3**	✓		✓			✓	
	5	**Nickel**	**5**	**6.6**	✓	✓	✓	**4**	✓		✓	✓		✓	
	6	**Cobalt**	**3.5**	**7.4**	✓	✓	✓	**6**	✓	✓	✓	✓	✓	✓	
	7	**Neodymium**	**2.7**		✓	✓	✓								
Other Transition Materials	8	Silver	1.4	2.8				0							
	9	Iridium	1.2												
	10	Silicon	1.2	2.9	(✓)			4		✓	✓	✓	✓		
	11	Molybdenum	1.2	2.1				3				✓		✓	✓
	12	REEs (bulk)	0.8	3.6			(✓)	6	✓	✓	✓	✓	✓	✓	
	13	Alumina	0.8	2.5				4	✓			✓	✓	✓	
	14	Zinc	0.7	1.5				2	✓					✓	
	15	Chromium	0.7	2.3				4	✓		✓		✓	✓	
	16	Vanadium	0.7	29.4				6	✓	✓	✓	✓	✓	✓	
	17	Hafnium	0.7	2.2				0							
	18	Germanium	0.6					0							
	19	Al (Bauxite)	0.5	2.5				4	✓			✓	✓	✓	
	20	Gallium	0.5	1.4				5	✓	✓	✓		✓	✓	
	21	Indium	0.5	1.6				5	✓	✓	✓		✓	✓	
	22	PGMs (excl. Ir)	0.5					0							
	23	Tantalum	0.3	3.5				7	✓	✓	✓	✓	✓	✓	✓
	24	Manganese	0.2	5				5	✓		✓	✓	✓	✓	
	25	Titanium	0.2	2.1				6	✓	✓	✓	✓	✓	✓	
	26	Selenium	0.2	1.4				0							
	27	Cadmium	0.1	1.3				0							
	28	Magnesium	0.1	1.6				0							
	29	Zirconium	0.1					3	✓		✓		✓		
	30	Niobium	<0.1	9.2				0							
	31	Tin	<0.1	2.1				3	✓			✓		✓	
	32	Lead	<0.1	1.5				0							
	33	Arsenic	<0.1					0							
	34	Tungsten	<0.1	2.1				0							
	35	Yttrium	<0.1												

0	<0.1-1.9	2.0-3.9	4.0-6.9	7.0+

10 See Method for Defining Transition Materials for more details on the Standard's scoring methodology.

11 LSE Grantham Research Institute's demand-induced pressures for Transition-Critical Materials (TCMs) [44] are based on (i) technological innovation and material substitutability, and (ii) climate transition pathway, both in terms of climate ambition and transition trajectory.

12 Data from IEA critical minerals policy tracker, showing strategic and critical mineral designations of selected countries, and the total number of countries providing such designations to each mineral in the left-hand column [97]. Countries use different criteria as the basis for national prioritisations, including: importance to national economy, risk of supply disruption, importance for national defence or security, and whether the country has significant resources of that mineral available.

13 IEA critical minerals, Energy Technology Perspectives 2023 [29 p. 150]. Polysilicon is additionally included in its list of critical materials (with a post-processing focus), hence partial tick under silicon.

14 ETC key materials, as identified in Material and Resource Requirements for the Energy Transition, 2023 [12].

15 IRENA critical materials [38]. The rare-earth element dysprosium is included alongside neodymium, hence partial tick in REEs.

Do no significant harm (DNSH) screening

While recognising the fundamental and positive contribution to the energy transition that mining of these materials will make, investors wish to ensure commodities classified as Key Transition Materials (KTMs) are mined responsibly; accelerated transition material mining must not incur unacceptable costs in terms of environmental and social impact, and carbon emissions. This is also important if miners are to retain the support of affected communities as the production of these materials grows. In response to this need, the Standard sets out two additional DNSH lenses to assess the production of KTMs:

1. **The social and environmental impact.** This screening is evaluated at a mine-level by testing for mine certifications from an independent body such as IRMA, TSM or The Copper Mark. This approach is consistent with indicator **9.iii.a**, which tests for company commitments to achieve responsible mining certifications as part of section **9.iii**, 'Aligning with core best practice to accelerate transition material mining' (see section **9.iii** for more details).

2. **The emissions intensity of production.** The emissions intensity of production for each commodity can be assessed to ensure that KTM production does not come at an unacceptable carbon cost. The IEA publishes average emissions intensities from mining and processing for certain transition materials [47], illustrating how company disclosures could, in theory, be tested against a benchmark and used to screen KTM production based on using the most relevant boundary (mining, processing or the sum of the two). However, miners' positions in the value chain vary and KTMs can be the by-product of mining other materials making it difficult to establish appropriate benchmarks. Thus further work and industry-wide data is needed to firmly establish these benchmarks. At present, the Standard focuses on miners merely disclosing mining and processing emissions intensities for all KTMs and these activities being covered by an accepted net zero operational (scope 1 & 2) emissions target (metric **5.iii.a**).

With its climate focus, the Standard's assessment of social and environmental criteria focuses on materials with clear growth or decline production pathways in relation to the energy transition. The DNSH screening developed here applies the principles of just transition, covered more comprehensively in Disclosure Indicator 9: Just Transition, to KTMs, which are expected to grow rapidly.

How the Standard assesses Transition Materials

The Standard tests for transition materials disclosure at multiple parts of the production chain. By looking at both the input (capital expenditure) and the expected output (production), investors can assess the coherency of a company's overall strategy.

To summarise and enhance the usefulness of the disclosures tested, the Standard uses a Transition Materials data table to present information (Exhibit 6). The table shows which data points will be collected directly from miners' disclosures (yellow), which can be calculated either by the Standard's assessment providers or disclosed by the company in aggregate form (green), and which will be calculated by the Standard's assessment providers, based on company disclosures, in a consistent way across companies (blue).

The metrics focus on KTMs. These are the materials investors are most interested in and where supply must increase most rapidly in a net zero scenario. As KTMs are relatively few in number, this reduces the disclosure and assessment burden (consistent with Principle 5).

Of the potential output metrics, the Standard focuses on production. This metric is most closely aligned to the systemic change investors are looking to assess and ultimately encourage. Unlike a revenue metric it is not distorted by price volatility or any sales of third-party products.

To understand a company's overall exposure to TMs, compare it to its peers and understand its growth, investors inevitably will also want to additionally see aggregated (not just commodity-specific) KTM and OTM production. However, aggregating production figures stated in mass is problematic. Bulk, lower-value, commodities are likely dominate any total, leading to a figure that neither provides meaningful information on a company's overall climate impact or its economic exposure to TMs.

Calculating total KTM/OTM revenue negotiates this issue and is straightforward to sum. However, it does have other limitations. Volatile commodity prices mean that a total revenue figure and any annual change estimate derived from it, may reflect changing prices rather than production increases. Revenues can also include sales of commodities extracted by third parties. Both points limit the usefulness of this datapoint for investors wishing to understand the company's contribution to the transition.

To add insight the Standard additionally measures total KTM and OTM production in copper-equivalent (CuEq) measured in million tonnes. CuEq converts the value of any TM production into a weight of copper production with an equivalent value. By using long run price averages the impact of pricing volatility can be smoothed. Reflecting consultation feedback that different calculation methods would undermine comparisons of company reported CuEq, the Standard calculates this independently from company disclosure using the methodology set out by the TPI [15]; companies do not need to disclose aggregate TM production in CuEq. If the company discloses total company-wide commodity production in units CuEq (**10.iv.a**), this can be compared to the respective transition material totals. No other disclosures are sought in or translated to CuEq.

The Standard tests for the disclosure of both current KTM production and targets. The definition of 'targets' here is flexible but should provide investors with forward-looking guidance on production over a defined timescale. Disclosure of production targets by KTM commodity is important to investors. By comparing these targets to the projected growth required by a 1.5°C scenario such as the IEA NZE, investors can understand if a company's plans are contributing to reducing projected supply shortfalls, and to what extent miners are aiming to capture opportunities presented by the expansion of these markets.

In the TM data table, investors can evaluate the alignment with these IEA NZE growth trajectories by looking at the production market share in the last financial year and on a timeframe disclosed in the company's targets; both will be calculated by the Standard's assessment providers based on company disclosure. This approach of providing visibility on present and future market share seeks to enable investors to see both the contribution to the market today, and the alignment of the growth rate in this production with the NZE. This avoids issues of solely relying on relative growth, which can penalise incumbents and exaggerate the contribution of entrants.

Meeting production targets is unlikely to be possible without accelerating investment (capex) – which, given long lead times – is needed urgently. As such, to assess the credibility of any production targets on transition materials, investors want to see capex disclosure. The Standard tests for the presence of current capex disclosure towards KTMs and other TMs, and guidance on forward-looking plans for KTMs. Current capex in TMs can be compared against total company capex if this is disclosed (**6.i.a**). At this time, the Standard does not intend to separate investment in organic growth from acquisitions, though it acknowledges that the latter may not contribute to increased global supply.

Exhibit 6: TM data table

Corresponding metrics	Time	Disclosure sought	Lithium	Copper	Cobalt	Nickel	Graphite	Tellurium	Neodymium	Total KTM	Total OTM	Total TM	Company total
5.ii.a, 5.ii.b, 10.iv.a	Last Financial Year	Production	kt							(CuEq)	(CuEq)	(CuEq)	(CuEq)
5.ii.a		Production market share	%							%			
5.ii.c, 5.ii.d		Revenue	$m							$m	$m	$m	$m
5.ii.e		All mines certified?	Y/N							Y/N			
5.ii.f		Emissions intensity	tCO_2/t										
Alignment test based on 5.ii.f		Below intensity threshold?	Y/N							Y/N			
6.iv.a, 6.iv.b, 6.i.a		Capex	$m							$m	$m	$m	$m
5.ii.g	Forward-looking	Target time horizon	YYYY										
5.ii.g		Target production	kt										
5.ii.g		Target market share of production	%										
6.iv.c		Capex guidance time horizon	YYYY										
6.iv.c		Capex guidance	$m										

Note: Units within cells indicate the units of displayed data. Yellow cells can be completed using company disclosures. Green cells may be calculated based on commodity-wise disclosures or disclosed directly by the company. Blue cells will be calculated based on company disclosures. *This Alignment test is not yet operational.

Transition Materials metrics

*[The following metrics: **5.ii.a-5.ii.f** and **6.iv.a-6.iv.c** apply only to companies that produce transition materials as defined here.]*

The Standard tests for disclosure on the current production of individual KTMs and other TMs (OTMs). If this commodity-specific disclosure is made, it then aggregates production across KTMs and OTMs in units Copper-equivalent (CuEq). Note that while individual KTM production figures will be presented in the TM data table, only the summed CuEq figure will be displayed for OTMs.

[This metric only applies to companies that mine KTMs]

Climate Solutions metric 5.ii.a:

Has the company disclosed production of each KTM it produced in the last financial year (in units of mass)

[This metric only applies to companies that mine OTMs]

Climate Solutions metric 5.ii.b:

Has the company disclosed production of each OTM it produced in the last financial year (in units of mass)

The Standard then tests for disclosure on the revenue derived from the production of KTMs and other TMs. While it tests for individual disclosure of other TMs, it is the summed figure that will be displayed in the TM data table.

[This metric only applies to companies that mine KTMs]

Climate Solutions metric 5.ii.c:

Has the company disclosed revenue for each KTM it produced in the last financial year

[This metric only applies to companies that mine OTMs]

Climate Solutions metric 5.ii.d:

Has the company disclosed revenue for OTMs it produced in the last financial year (either per commodity or as aggregated; if the latter, materials outside OTM scope should not be included)

The Standard then tests for disclosures that will be used in the DNSH screening on KTM production. If these disclosures are available, and there is a net-zero target on operational emissions (**5.iii.a**), it then calculates the share of the production meets these criteria.

*[Metrics **5.ii.e-5.ii.g** only apply to companies that mine KTMs]*

Climate Solutions metric 5.ii.e:

Has the company published disclosure establishing that, for each KTM it produces, all production is from mine sites certified by an independent responsible mining standard (in line with JT indicator **9.iii.a**)

Climate Solutions metric 5.ii.f:

[IF **5.iii.a** = Yes] Has the company disclosed the emissions intensity of production of each KTM (with a mass of production denominator), OR absolute scope 1 & 2 emissions and production for each KTM (disclosure should include all parts of mining and processing undertaken using a comprehensive emissions accounting boundary)

The Standard tests for the presence of production targets on KTMs. The TM data table will additionally present the implied market share of production based on projected demand growth in the IEA's NZE [24]. If the market share increases or stays the same, the production growth is consistent with the NZE.

Climate Solutions metric 5.ii.g:

Has the company disclosed forward-looking guidance, with a timeline (minimum 5 years ahead), for the production of each KTM it produces (or will produce)

In indicator 6, the Standard tests for disclosures of current capex in transition materials (both 'key' and 'total'), as well as forward-looking capex guidance in KTMs.

[This metric only applies to companies that mine KTMs]

Climate Solutions metric 6.iv.a:

Has the company disclosed total investment (organic capex plus acquisitions) in production of KTMs in the last financial year (on a per-commodity basis)

[This metric only applies to companies that mine OTMs]

Climate Solutions metric 6.iv.b:

Has the company disclosed total investment (organic capex plus acquisitions) in production of OTMs in the last financial year (either per commodity or as aggregated; if the latter, materials outside of the OTM scope should not be included)

[This metric only applies to companies that mine KTMs]

Climate Solutions metric 6.iv.c:

Has the company disclosed forward-looking guidance for total investment (organic capex plus acquisitions) in production of KTMs (on a per-commodity basis; minimum 5 years ahead)

Disclosure Indicator 5: Decarbonisation Strategy (main)

Investor attention is increasingly focussing on the credibility of companies' plans to deliver their emissions targets (its "Decarbonisation Strategy"). The CA100+ Company Benchmark already tests for disclosure explaining how the company intends to deliver its medium- and long-term targets and quantify the contribution of these measures (metrics **5.1a** and **5.1b** respectively).

The standard goes slightly further by assessing whether disclosure quantifies the contribution of actions amounting to at least 90% of the short-term reduction, 75% of the medium-term reduction and 50% of the long-term reduction. It acknowledges that it may be difficult for companies to provide precise guidance here; they may not be able to quantify all the measures needed to deliver the target, and the expected measures may change over time as technologies evolve. Nevertheless investors increasingly view targets without plans to deliver them as lacking credibility and therefore it is important companies seek to set out their plans in as much detail as possible. The Standard includes a metric covering short-term actions here in response to feedback and due to the importance of near-term action in being well-positioned for the transition. It is also the timeframe over which companies are likely to be best able to fully outline the measures comprising their targeted emissions reductions.

Disclosure metric 5.i.a:

Has the company disclosed the contribution of measures that account for over 50% of the emissions reduction implied by its main LT target (where companies have set separate scope 1 & 2 and scope 3 targets the reduction will be looked at on an aggregate basis, but typically scope 3 will account for the majority of the reduction)

Disclosure metric 5.i.b:

Has the company disclosed the contribution of measures that account for over 75% of the emissions reduction implied by its main MT target (where companies have set separate scope 1 & 2 and scope 3 targets the reduction will be looked at on an aggregate basis, but typically scope 3 will account for the majority of the reduction)

Disclosure metric 5.i.c:

Has the company disclosed the contribution of measures that account for over 90% of the emissions reduction implied by its main ST target (where companies have set separate scope 1 & 2 and scope 3 targets the reduction will be looked at on an aggregate basis, but typically scope 3 will account for the majority of the reduction)

Version 2.0 of the CA100+ Company Benchmark adds tests for disclosure on offsets and negative emissions (**5.1c**), the share of measures that are technologically and economically feasible (**5.1d**) and climate solutions (**5.2**). The climate solutions element of Decarbonisation Strategy was covered in the previous section. This section sets out the rationale for other elements of Decarbonisation Strategy disclosure the Standard tests for.

Consistent with the approach set out in Principle 1, the Standard aims to capture a full range of possible approaches, reflecting the diversity of the sector and allowing maximum strategic flexibility. However, consistent with disaggregated approach to evaluating emissions targets set out in A disaggregated approach to assessing miners' emissions targets the Standard does test commitments on individual commodities or emissions scopes against relevant emissions pathways where possible.

Sub-indicator 5.iii: Operational emissions (scopes 1 & 2) including electricity

Operational emissions (scope 1 & 2) are typically a small (c. 5%) proportion of miners' overall emissions. Nevertheless, they do have direct responsibility for scope 1 and they can also reduce scope 2 (market based) emissions by investing in Power Purchase Agreements (PPAs) for example.

Most miners have now pledged to reach net zero in operational emissions. The Standard tests for the presence of a separate commitment here:

Disclosure metric 5.iii.a:

Does the company disclose a target to reduce its operational emissions (scopes 1 & 2) to net zero by 2050 or earlier, including short- and medium-term targets

Operational emissions commitments vary widely. In part this reflects inherent differences in business models but can also reflect differing levels of climate ambition: some imply medium-term cuts consistent with the urgent action implied by a 1.5°C scenario. Separately assessing these targets tests the overall credibility of the company's climate commitments, enabling investors to recognise those leading action and challenge those currently falling short. The Standard separately assesses the net zero alignment of these targets:

Alignment metric 5.iii.b:

[Not operational currently] Is the operational emissions target aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

However, a methodology to assess the net zero alignment of these targets has not yet been fully established. An economy-wide energy consumption intensity benchmark derived from IEA final energy data and applying a cumulative benchmark divergence approach is currently in development. Using this metric could help normalise some of the inherent variations in emissions profile due to business model.

Just as CA100+ Company Benchmark Disclosure Indicator **5.1** tests for disclosure explaining how the company intends to deliver its overall target, the Standard tests for disclosure explaining how the company intends to deliver its operational emissions target.

Disclosure metric 5.iii.c:

Does the company disclose a strategy for reaching net zero operational emissions and interim targets that includes the quantification of major components, the use of neutralising measures (including CCS) and reductions in electricity and methane emissions (see **5.iii.d** and **5.iv**) where relevant

Decarbonisation of emissions from electricity generation needs to happen much faster than from other sectors in a 1.5°C scenario. The IEA's NZE scenario models complete decarbonisation of the electricity sector in developed markets by 2035 and developing markets by 2040. Many of these miners generate a portion of their electricity needs on site (where this relies on fossil fuels this results in scope 1 emissions) but in most cases electricity is purchased from the grid (reported as scope 2). To be consistent with a net zero scenario, miners should target their scope 2 electricity emissions falling to zero in line with the timescales set out above. They can also build their own on-site low carbon capacity or fund PPAs to accelerate the reduction of scope 2 emissions in locations where grid partners are not rapidly decarbonising.

Disclosure metric 5.iii.d:

Does the company disclose separate targets to reduce its operational electricity emissions (scope 2)

The Standard separately assesses the net zero alignment of any electricity emissions target. Targets can be set on an intensity or absolute basis with alignment tested using a CBD approach [1] and TPI electricity generation pathways [48; 49]. These pathways currently differentiate between developed and developing economies, however there are significant challenges to applying these regional pathways to miners who operate in multiple locations. As data availability and methodologies advance, the Standard may be able to perform this net zero alignment test on a regional basis.

Alignment metric 5.iii.e:

Is the electricity emissions target aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

As with metric **5.iii.c** the Standard tests for disclosure indicating a strategy to deliver the target. This disclosure can be included within **5.iii.c**.

Disclosure metric 5.iii.f:

Is the strategy to reduce emissions from electricity use clearly stated and quantified in terms of underlying contributions (at least on a MT horizon)

Sub-indicator 5.iv: Methane

Methane is a potent greenhouse gas and important contributor to global warming, estimated to be responsible for c. 30% of the current temperature rise against pre-industrial levels [50]. As a short-lived climate pollutant, its atmospheric concentration – and thus its warming effect – is determined by current emissions and those over the last decade or so. This stands in contrast to CO_2, for which – as a long-lived gas in the atmosphere – cumulative emissions determine warming [51 p. 28].

An important corollary of these different properties is that emissions reductions have different effects. Reducing methane emissions results in lower methane stocks in the atmosphere and thus reduces the increase in global surface air temperature versus pre-industrial times attributable to methane; a relative cooling [52; 53]. By contrast, reducing CO_2 emissions reduces the rate of warming, but warming does not stop until annual emissions reach net zero, because the gas otherwise continues to accumulate in the atmosphere [51 p. 27; 54]. Therefore, while strong reductions in methane emissions are key in limiting near-term warming and potentially reducing peak warming [55; 56], a focus on methane should not distract from the need to drive down CO_2 emissions, which primarily determine long-term warming [53; 57].

Coal mining is a significant source of methane emissions, contributing c. 12% of total anthropogenic methane and c. 35% of fossil fuel-related methane [58]. Methane is produced during the geological formation of coal and trapped in rocks at depth. It leaks from depressurised rocks in the walls of coal mines, escaping into voids and fractures. Higher grades of coal, and deeper coal mines with higher pressures, typically have higher rates of methane leakage. Emissions occur both during mining and after the mine is abandoned. Due to the significant climate impact of coal mine methane, the Standard sets out a specific sub-indicator testing miners which have coal in their portfolios for methane disclosure.

Accurate measurement and reporting of coal mine methane is a primary consideration, without which it is not possible to set meaningful targets. Satellite measurements indicate that coal mine methane emissions are currently widely underreported [59], however satellite measurements have their own limitations in spatiotemporal coverage and resolution; both top-down and bottom-up monitoring approaches are needed for accurate monitoring [60].

Methane emissions from mines are highly variable both over time at an individual mine and across different mines, with c. 100 times as much methane emitted from the heaviest-emitting mines than the least [58 p. 49]. This variation reinforces the need for dedicated and comprehensive measurement, as absence of data leads to high levels of uncertainty.

The UNEP's International Methane Emissions Observatory is developing the Met coal Methane Partnership (MMP), under which member companies will commit to a coal mine methane reporting framework and pursue 2030 methane intensity reduction targets [61]. The Standard will follow the development of the UNEP MMP and there may be a strong rationale to align metrics in future iterations with the finalised MMP framework.

Mining companies already manage methane in underground mines for safety reasons. However, abating coal mine methane emissions is not straightforward because methane concentrations in mine gases are typically low and fluctuate with time. If concentrations are high enough, methane can be captured from degasification boreholes or ventilation for utilisation as natural gas. Alternatively, it can be destroyed by thermal oxidation; a relatively expensive process but one that is effective even at low concentrations of methane [58]. Methane may also be flared where these techniques are unviable.

The IEA estimates that c. 70% of underground coal mine methane can be abated (primarily through ventilation system abatement), while only 20% of surface coal mine methane can be abated [50]. Of underground mines, the deeper underground mines with the highest methane concentrations tend to be the easiest to tackle, as well as the highest priority in terms of climate impact [58].

A comprehensive methane abatement strategy includes measures taken throughout the mine life cycle [58; 62]. For underground mines, these include:

I. Before mining: draining and capturing methane via degasification boreholes;

II. During mining: using mineshaft ventilation systems to capture or destroy ventilation air methane (VAM) and by using mining techniques that minimise rock disturbance;

III. After mine closure: sealing abandoned mines, installing methane extraction boreholes and flooding (if environmentally appropriate) to reduce seepage.

For surface mines, mitigation is most effective at the pre-mining stage and comprises extensive pre-drainage using boreholes; directional drilling may help capture the most methane depending on mine design [62].

*[The metrics in this section **5.iv.a-5.iv.d** only apply to companies that mine coal]*

The Standard first tests for commitments to improve methane monitoring and reporting, reflecting the foundational importance of these data in the delivery of methane emissions reductions. For an overview of best available techniques in monitoring, reporting and verification, see guidance from the UN Economic Commission for Europe [63].

Disclosure metric 5.iv.a:

Has the company committed to increase the coverage and quality of methane reporting across all coal assets, including after mine closure, using best available techniques and including external verification

The Standard next tests for the presence of methane emission targets. These targets can be set on absolute or intensity basis and include short, medium and long-term components. The Standard states that methane metrics **5.iv.b-d** are contingent on a 'yes' score to **5.iv.a**. This is with the intention to ensure the credibility of targets and to avoid adverse incentives against expanding reporting. Best practice would be to additionally disaggregate the component of this target expected to be delivered by reducing coal production and that resulting from reducing the methane intensity of coal production, however the Standard remains flexible with regard to the format of the target, recognising that the UNEP MPP that will likely establish norms for target disclosures.

Disclosure metric 5.iv.b:

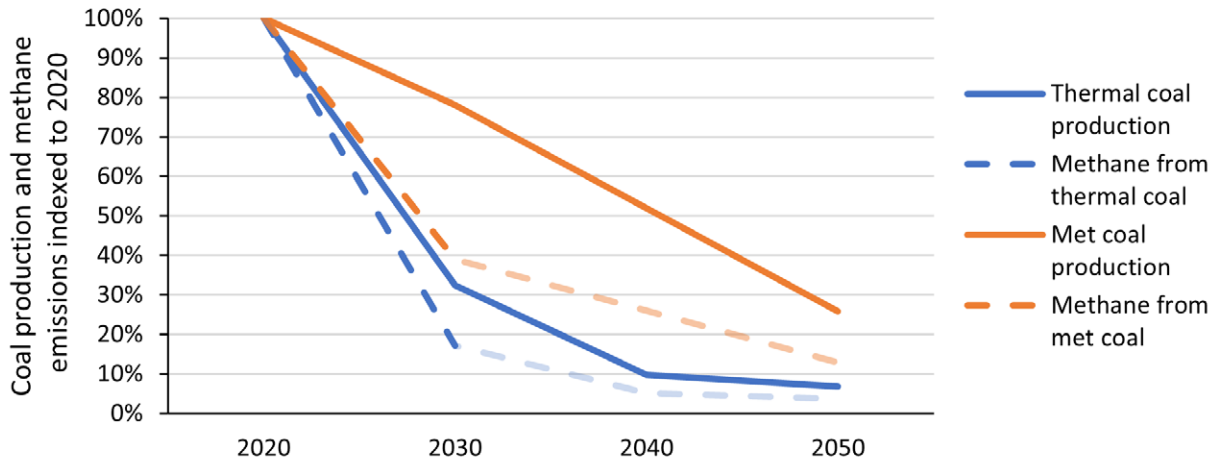
[IF **5.iv.a** = Yes] Does the company disclose targets to reduce methane emissions

The Standard tests the net zero alignment of the emissions pathways implied by these targets. Methane benchmarks for the reduction in a 1.5°C scenario can be constructed from IEA NZE data for the coal sector, splitting out both thermal and metallurgical coal. IEA NZE data [58; 64] implies a 45% intensity (83% absolute) decline in thermal coal methane between 2020 and 2030 and a 50% intensity (61% absolute) metallurgical coal methane decline. The declines are greater on an absolute basis due to the decreasing production of coal (see Exhibit 7).

Alignment metric 5.iv.c:

[Not currently operational] [IF **5.iv.a** = Yes] Is the methane target aligned with a 1.5°C pathway (on either an intensity or absolute basis)

Exhibit 7: Declines in methane emissions (indexed to 2020) based on the IEA's NZE thermal and metallurgical coal pathways



Note: Source: IEA's NZE scenario and Curtailing Methane Emissions from Fossil Fuels report [58; 64]. Only the methane reductions to 2030 are used in the Standard. Methane trajectories beyond 2030 (translucent dashed lines) are inferred based on a constant relationship to coal reductions.

The Standard separately tests for disclosure of a comprehensive mitigation strategy that covers the distinct mine lifecycle phases and prioritises the highest impact mines.

Disclosure metric 5.iv.d:

[IF **5.iv.a** = Yes] Has the company set out a strategy to reduce its methane emissions that addresses methane emissions pre-, during- and post-mining, AND prioritises abatement of highest emitting coal mines

Sub-indicator 5.v: Thermal Coal Production

Reducing coal consumption is arguably the most significant change to the energy system required over the next decade to meet the goals of the Paris Agreement. As the most emission-intensive fossil fuel, its reduction is prioritised in climate modelling with the IEA's NZE requiring a reduction of 50% in thermal coal production by 2030 versus 2021, and 91% by 2050 [22].

Unquestionably delivering this is going to require a significant tightening of policy, particularly in China which consumes 56% of all coal currently [22]. Nevertheless, exposure to rapidly falling coal demand is the biggest transition risk facing the mining sector in general. While many CA100+ companies have chosen to divest their coal activities already, some remain. Given the significant transition risks they pose, the Standard separately assesses the coal activities of mining companies.

The Standard treats thermal and metallurgical coal activities separately based both on feedback from investors and companies and reflecting that they have very different decarbonisation pathways. Thermal coal for electricity generation carries the most significant transition risk. While consumption was boosted by the Ukrainian war in some markets in 2022, in most regions it has been steadily falling long term and is typically more expensive than both gas and renewables as a power source.

*[The metrics in this section **5.v.a-5.v.g** only apply to companies that mine thermal coal]*

For this reason, the Standard tests for disclosure of separate thermal coal emissions targets.

Disclosure metric 5.v.a:

Does the company disclose scope 3 cat. 11 emissions targets specifically for its thermal coal activities that include short, medium and long-term components

The Standard tests the net zero alignment of these emissions targets across the whole pathway using Cumulative Benchmark Divergence (CBD) methodology [1]. This approach is designed to test whether the company's overall plan is aligned with a 1.5°C budget, enabling any short-term overproduction (e.g. due to the effects of the Russia-Ukraine war) to be compensated by steeper reductions in the longer term.

Alignment metric 5.v.b:

Is the thermal coal target aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

The Standard also tests for supporting production disclosure in the years the miner has chosen to set company-wide targets (typically long-term is 2050 and medium-term is 2030). Short-term is again included here due to the importance of near-term action in reducing transition risk and demonstrating commitment to longer-term emissions reductions.

Disclosure metric 5.v.c:

Does the company disclose planned thermal coal production factored into its short, medium and long-term targets (expressed in units [Mt or TJ] and either a % or absolute change from a stated base year value)

The Standard additionally tests this disclosure for alignment with the IEA NZE scenario.

Alignment metric 5.v.d:

Are the LT production plans for thermal coal consistent with the IEA NZE (-91% between 2021 and 2050)

Alignment metric 5.v.e:

Are the MT production plans for thermal coal consistent with the IEA NZE (-50% between 2021-30)

The Standard uses a global benchmark to assess net zero alignment in metrics **5.v.b**, **5.v.e** and **5.v.f** and believes that in general this is the most appropriate way to assess transition risk associated with a global commodity. However it acknowledges a debate in cases where mining activities serve a specific local or regional market that has less ambitious decarbonisation goals. In the event that thermal coal targets are not aligned the Standard additionally encourages companies to disclose a reason why. Companies may want to additionally disclose the regional/national pathways they feel are most relevant.

Disclosure metric 5.v.f:

If any of **5.v.b,d,e** are No, has the company given a reason

Applying carbon capture and storage (CCS) to mitigate thermal coal emissions enables a small proportion of consumption beyond the date by which the power sector needs to achieve net zero. The IEA's NZE scenario suggests thermal coal used with CCS will peak at 10% of 2020's total thermal coal levels in 2040 before falling back to 7% by 2050. It is therefore legitimate for miners, as part of an overall strategy to reduce their transition risk, to focus residual sales on customers intending to deploy this technology. They could choose to encourage their customers to do this via engagement and technology partnerships. The Standard reflects this by encouraging disclosure on the proportion of current output covered by CCS plans.

Disclosure metric 5.v.g:

Does the company disclose the proportion of its thermal coal production going to facilities with publicly disclosed CCS plans

Sub-indicator 5.vi: Metallurgical Coal Production

Metallurgical coal (c. 20% of total coal consumption) is typically a higher-grade coal used in primary steelmaking. Due to the complexity of decarbonising steel production and the longevity of many of the assets, it has a much shallower initial decarbonisation trajectory than thermal coal. The IEA NZE models metallurgical coal consumption falling 30% by 2030 from a 2021 base and 88% by 2050. These reductions pose a significant transition risk to those companies that produce it and therefore the Standard tests for disclosure of separate metallurgical coal emissions targets.

*[The metrics in this section **5.vi.a-5.vi.g** only apply to companies that mine metallurgical coal]*

Disclosure metric 5.vi.a:

Does the company disclose scope 3 cat. 11 emissions targets specifically for its metallurgical coal activities that include short, medium and long-term components

The Standard tests these emissions targets for net zero alignment across the whole pathway using CBD.

Alignment metric 5.vi.b:

Is the metallurgical coal target aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

The Standard also tests for supporting production disclosure in the years it has chosen to set company wide targets (typically long-term is 2050 and medium-term is 2030). Short-term is again included here due to the importance of near-term action in reducing transition risk and demonstrating commitment to longer-term emissions reductions.

Disclosure metric 5.vi.c:

Does the company disclose planned metallurgical coal production factored into its short, medium and long-term targets (expressed in units [Mt or TJ] and either a % or absolute change from a stated base year value)

The Standard additionally tests this disclosure for alignment with the IEA NZE scenario.

Alignment metric 5.vi.d:

Are the LT production plans for metallurgical coal consistent with the IEA NZE (-88% between 2021 and 2050)

Alignment metric 5.vi.e:

Are the MT production plans for metallurgical coal consistent with the IEA NZE (-30% between 2021-30)

As with Sub-indicator **5.v** the Standard uses a global benchmark to assess net zero alignment however it acknowledges a debate in cases where mining activities serve a specific local or regional market that has less ambitious decarbonisation goals. As with thermal coal, in the event that metallurgical coal targets are not aligned, the Standard additionally encourages companies to disclose a reason and companies may want to set out the regional/national pathways they believe are relevant.

Disclosure metric 5.vi.f:

If any of **5.vi.b,d,e** are No, has the company given a reason

Applying carbon capture, and storage (CCS) to mitigate metallurgical coal emissions is expected to play a significant role in decarbonising the steel sector. The IEA's NZE scenario suggests 90% of metallurgical coal will be used in conjunction with CCS by 2050 [64 p. 126]. It is therefore legitimate for miners, as part of an overall strategy to reduce their transition risk, to focus sales on customers intending to deploy this technology. They could also choose to encourage their customers to do this via engagement or technology partnerships. The Standard reflects this by encouraging disclosure on the proportion of current output covered by CCS plans.

Disclosure metric 5.vi.g:

Does the company disclose the proportion of its metallurgical coal production going to facilities with publicly disclosed CCS plans

Sub-indicator 5.vii: Neutralising measures

Investors are keen to understand the quantitative contribution of any "neutralising measures" to overall emissions targets. Neutralising measures address emissions by capturing emissions at point source and sequestering via geological storage, or by "netting off" gross emissions via carbon dioxide removal approaches (also known as "negative emissions").

In order to assess the full role of neutralising measures, investors need to understand the breakdown between different measures and specific details about their intended deployment.

The updated CA100+ Company Benchmark asks all companies to provide details on the offset and negative emissions measures they intend to deploy. The Standard goes further, breaking down neutralising measures into two categories: [1] point-source carbon capture and geological storage, and [2] carbon dioxide removal methods. The rationale for the breakdown is that the former mitigates emissions at source and is applied within the value chain, while the latter involves the removal of carbon dioxide from the atmosphere and has little if any relation to value chain operations (but can be employed by the company to neutralise its own emissions).

The Standard does not currently include offsetting measures that merely avoid emissions: either these are within the value chain, in which case they count within decarbonisation measures, or they are outside of the value chain and therefore do not address the company's own emissions or transition risk. Avoided emissions offsets are not sufficient to achieve net zero and the Oxford Offsetting Principles advises a shift to offsetting through carbon removal [66].

Under the category of point-source carbon capture and geological storage, the Standard recognises uses of both CCS and CCUS in company disclosures (providing the CCUS detailed does indeed imply long-term storage). However, it excludes carbon capture and utilisation (CCU) and enhanced oil recovery (EOR) approaches. Utilised carbon ultimately enters the atmosphere in the overwhelming majority of CCU applications [67]. And while some CO_2 is stored in EOR, the oil it yields when combusted releases CO_2, generally exceeding that stored [68]. Reflecting the fact that CCU is not a net-zero technology except in rare cases, in the IEA's NZE, over 95% of the CO_2 captured in 2030 is geologically stored; less than 5% is utilised [67].

Under the category of carbon dioxide removals, the Standard recognises two broad approaches. First, those involving technologically-mediated storage: bioenergy for carbon capture and storage (BECCS), direct air carbon capture and storage (DACCS), and building with biomass in long-term uses such as cross-laminated timber (which can both sequester carbon and displace demand for high-carbon building materials). Second, nature-based solutions (NbS) that involve the take-up and additional storage of carbon in the biosphere. This is a broad category that includes an array of terrestrial/marine ecosystem and soil carbon restoration approaches [69]. The Standard does not include a third category of carbon removals involving enhanced natural processes of CO_2 drawdown, including both inorganic chemical reactions and primary productivity in the ocean. These measures (often considered geoengineering approaches) are excluded due to the present uncertainty around their efficacy and knock-on effects [69].

Investors are keen to ensure that any neutralising measures employed by corporates have integrity. While comprehensive guidance on this is beyond the scope of this document, it is worth highlighting a few key considerations. Priority should be given to CDR projects that provide durable storage, co-benefits, and can demonstrate clear additionality [66]. NbS and BECCS require significant land use; biodiversity and social factors should be integrated, as well as competing land use demands for food and water resource [70]. For a durable net zero as a whole, scientists argue that carbon extracted from the geosphere (fossil fuels) should be returned to the geosphere in a like-for-like manner, and that geological storage should be prioritised [70; 71]. This reflects the fact that carbon storage in the biosphere is vulnerable to being re-released, for example during wildfires, and cannot expand ad infinitum to accommodate fossil carbon.

While neutralising measures may have an important role to play, IPCC scenario analysis [18 p. 96], reflected in both SBTi guidance [19] and the CA100+ Net-Zero Company Benchmark [2 p. 6], indicates entities should primarily focus on shifting to means of production that do not result in emissions (whether captured or otherwise). For this reason the Standard employs a simple alignment test on the use of neutralising measures as a whole. The selected threshold (50%) will be monitored against latest guidance and may be updated in future iterations.

The Standard first tests for disclosure of the contribution of neutralising measures to long term targets:

Disclosure metric 5.vii.a:

Has the company indicated the contribution (in % or tCO_2) of point-source carbon capture and geological storage (excluding EOR) to its long-term target AND (if relevant) have any contributions of other value chain actors been set out

Disclosure metric 5.vii.b:

Has the company indicated the contribution (in % or tCO_2) of carbon dioxide removal measures (BECCS, DACCS, NbS) to its long-term target that it intends to pay for or operate

It then assesses the role of neutralising measures in medium-term targets:

Disclosure metric 5.vii.c:

Has the company indicated the contribution (in % or tCO_2) of point-source carbon capture and geological storage (excluding EOR) to its medium-term target AND (if relevant) have any contributions of other value chain actors been set out

Disclosure metric 5.vii.d:

Has the company indicated the contribution (in % or tCO_2) of carbon dioxide removal measures (BECCS, DACCS, NbS) to its medium-term target that it intends to pay for or operate

It then applies the same assessment to short-term targets:

Disclosure metric 5.vii.e:

Has the company indicated the contribution (in % or tCO_2) of point-source carbon capture and geological storage (excluding EOR) to its short-term target AND (if relevant) have any contributions of other value chain actors been set out

Disclosure metric 5.vii.f:

Has the company indicated the contribution (in % or tCO_2) of carbon dioxide removal measures (BECCS, DACCS, NbS) to its short-term target that it intends to pay for or operate

The Standard then assesses the net zero alignment of the contribution of neutralising measures:

Alignment metric 5.vii.g:

Is the total contribution of neutralising measures to the emissions reductions implied by the short, medium and long-term targets less than 50% in each case

The Standard then tests for the presence of supporting information that outlines the solution types considered by the company as well as any plans to invest in and deploy that technology.

Disclosure metric 5.vii.h:

Has the company published information setting out the feasibility of neutralising measures it is planning to use to deliver its emissions reduction targets. This should include: information on technical feasibility and integrity AND forward-looking guidance on expected investment AND indicative timelines to each being operational

Sub-indicator 5.viii: Scope 3 Category 10 (processing of sold products)

The section A disaggregated approach to assessing miners' emissions targets sets out the value of evaluating mining companies' climate commitments in a disaggregated manner. Typically scope 3 emissions constitute the vast majority of emissions across the sector (>95%) and for most miners. Scope 3 category 10 is typically the overwhelming majority of these emissions (see Exhibit 2).

For the Diversified Miners assessed by CA100+ and that disclose data, scope 3 category 10 emissions predominantly reflects the processing of iron ore using metallurgical coal by steelmakers. However, the processing of bauxite and alumina can also generate significant emissions. The Standard focuses on these two as they typically dominate category 10 emissions and progress here can (theoretically at least) be compared to climate benchmarks. Other commodities produce processing emissions, but these are typically smaller and harder to benchmark.

Arguably scope 3 category 10 emissions (tonne for tonne) do not create the same level of transition risk as scope 3 category 11 emissions. As previously set out on page 19, the processing of iron ore and bauxite/alumina can use low-carbon forms of energy (and reducing agents where relevant) and therefore the transition need not pose a direct threat to sales.

However, these scope 3 cat. 10 emissions do still carry transition risk. For example, steelmakers continuing to use fossil fuels will be disproportionately impacted by policies such as the EU's Carbon Border Adjustment Mechanism [72] and customers making low carbon purchasing commitments. Miners selling iron ore to steelmakers that are not decarbonising their processes risk losing market share.

It can also be more difficult for miners to address emissions from scope 3 cat. 10 than other categories. A conventional emissions target approach effectively requires miners to set targets which directly rely on actions of their customers to deliver. Particularly where these entities' climate commitments are effectively governed by national policies, this is challenging. In addition, the Standard recognises that, particularly in the aluminium value chain, the majority of scope 3 cat. 10 emissions (which occur during smelting) may be at least one step removed from miners in the value chain. With each step of removal, both accurate emissions data collection and engagement become more challenging. However, these gaps are increasingly being closed.

Recognising these challenges, but seeking to support investor efforts to understand transition risk in this important area, the Standard adds nuance by additionally testing for an engagement approach as an alternative means of target setting for companies reporting scope 3 category 10 emissions from iron ore and bauxite/alumina.

Note that all value chain steps integrated within a company's operations are considered under scopes 1 & 2; for miners that undertake alumina refining and smelting, these emissions are operational and do not fall under scope 3 cat. 10.

*[The metrics in this section **5.viii.a-5.viii.h** only apply to companies that mine iron ore and/or bauxite]*

The Standard initially tests for the presence of target disclosure, segmented where relevant between iron ore and bauxite/alumina. If the commodity in question comprises more than 90% of the scope 3 cat. 10 emissions, a general scope 3 cat. 10 target is accepted.

[This metric only applies to companies that mine iron ore]

Disclosure metric 5.viii.a:

Does the company have a target to reduce its scope 3 cat. 10 emissions from iron ore [IF No AND **5.viii.g** is Yes, this question is "Not Relevant"]

[This metric only applies to companies that mine bauxite/alumina]

Disclosure metric 5.viii.b:

Does the company have a target to reduce its scope 3 cat. 10 emissions from bauxite/alumina [IF No AND **5.viii.g** is Yes, this question is "Not Relevant"]

The Standard tests the net zero alignment of any disclosures given in **5.viii.a & b** by comparing to the steel and aluminium pathways published by the TPI using a CBD approach.

[This metric only applies to companies that mine iron ore]

Alignment metric 5.viii.c:

[Not currently operational] [IF **5.viii.a** = Yes] Is the scope 3 cat. 10 emissions target for iron ore aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

[This metric only applies to companies that mine bauxite/alumina]

Alignment metric 5.viii.d:

[Not currently operational] [IF **5.viii.b** = Yes] Is the scope 3 cat. 10 emissions target for bauxite/alumina aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

To allow investors to assess the transition risk posed by a company's iron ore and/or bauxite/alumina businesses, the Standard tests for disclosure indicating the proportion of customers that have set verified emissions targets consistent with a 1.5°C scenario.

Disclosure metric 5.viii.e:

Does the company disclose the current proportion of direct iron ore AND (separately, where relevant) bauxite/alumina sales to customers with externally verified net zero targets that are consistent with 1.5°C

Recognising that many customers' climate commitments are effectively governed by national policies, the Standard sets out a similar disclosure test to **5.viii.e** but for all net zero commitments on a national level, additionally distinguishing between 2050 commitments potentially consistent with a 1.5°C timeline and all others.

Disclosure metric 5.viii.f:

Does the company disclose the current proportion of direct iron ore AND (separately, where relevant) bauxite/alumina sales to customers based in countries with a national target to reach net zero AND break out the proportion of these that target net zero by 2050

The Standard acknowledges that, reflecting the issues discussed above, some miners may consider setting an emissions target covering scope 3 category 10 (i.e. **5.viii.a/b**) inappropriate. It therefore tests for the presence of an annual engagement target as an alternative. This would capture if a miner had set a target for the number of its customers it would expect to make new net zero commitments in the next financial year and the proportion of its production they might cover.

Disclosure metric 5.viii.g:

In the interests of enhancing the broader adoption of net zero, has the company disclosed a target for the number of customers it has engaged with regarding making net zero commitments and/or would expect to make new net-zero commitments consistent with 1.5°C over the next financial year and the proportion of its production (in Mt) these commitments might cover

In addition to general engagement, some miners are already working closely with their customers through joint technology partnerships designed to accelerate investment in low carbon processes. The Standard tests for disclosure that explains how miners expect to deliver on their scope 3 category 10 emissions targets.

Disclosure metric 5.viii.h:

Does the company state its strategy for delivering the target set out in **5.viii.a/b** or **5.viii.g**

Sub-indicator 5.ix: Shipping emissions

After categories 10 and 11, transportation typically accounts for the next largest share of scope 3 emissions. Often a miner's total transportation emissions (category 4 "upstream" plus category 9 "downstream") are comparable in size to its operational emissions. Typically shipping emissions are a big proportion of this total but they are not always disclosed. Just two of the 11 CA100+ diversified mining companies currently disclose shipping emissions.

Miners are significant buyers of global shipping capacity; in 2022, iron ore, coal and bauxite comprised c. 25% of bn tonne-miles of shipping demand, a large fraction of overall dry bulk cargo [73; 74; 75]. Given this, and, consistent with their stated objectives to play a leading role driving Net Zero, several diversified miners have made commitments to reduce shipping emissions. However, the boundaries chosen for these commitments vary and the level of influence they have over different forms of shipping varies. For chartered shipping capacity, delivering commodities to miners' own customers, mining companies can have more influence over shipping emissions as they have direct responsibility for the shipping in question. Mining companies should also be encouraged to try to influence the shipping emissions of their suppliers (category 4) through engaging with their suppliers to encourage the supplier's commitment to reducing emissions. However, companies arguably have less influence over shipping emissions when customers charter that shipping to collect mined products.

The Standard tests for shipping emissions disclosure (see metric **10.iii.c**) and scope 3 targets covering all shipping emissions. These can be benchmarked against the IEA's NZE scenario using the TPI methodology [76]. Recognition of company commitments on shipping has found support from both investors and companies keen to accelerate the transition to net zero.

Disclosure metric 5.ix.a:

Does the company have a target to reduce its shipping emissions (an element of scope 3 cat. 4 & 9)

Alignment metric 5.ix.b:

Is the shipping emissions target aligned with a 1.5°C pathway (where alignment is determined using cumulative benchmark divergence over 2019-2050)

Disclosure metric 5.ix.c:

Does the company disclose a strategy to bring shipping emissions down in line with its stated targets

Disclosure Indicator 6: Capital Allocation (main)

Net zero requires a comprehensive strategic commitment, and capital investment (capex) plans are an integral part of that commitment. The way in which capital is allocated is a forward-looking indicator that clearly highlights management's priorities and long-term planning assumptions. The CA100+ Company Benchmark already measures companies' capital allocation strategies through Disclosure Indicator 6 focusing on phase out of carbon intensive assets (6a) and investment in climate solutions (6b). In applying these definitions to the mining sector, the CA100+ is likely to classify coal mines as carbon intensive assets and transition materials as climate solutions.

The rationale for the capex metrics associated with transition materials is set out in How the Standard assesses Transition Materials. However, investors are also keen to understand other aspects of miners' capital allocation, particularly around coal and what is needed to support its broader decarbonisation strategy. Due to the inherent variability of capex and its reporting, testing alignment with climate scenarios is challenging. The Standard focusses instead on testing for consistency of capex plans with the company's other climate commitments.

The Standard establishes the context of investment plans by first testing for the presence of groupwide capex disclosure and guidance.

Disclosure metric 6.i.a:

Has the company disclosed total group capex in both the last financial year and a forward-looking budget (minimum 3 years ahead) specifying the number of years included

Sub-indicator 6.ii: Coal Capex

Due to the importance of reducing coal consumption (see Disclosure Indicator 5: Decarbonisation Strategy (main)) for companies with exposure, the Standard specifically tests for disclosure in this area. This is designed to enable investors to assess the consistency between companies' production and investment plans. The IEA states that no new investment in coal capacity (thermal or met) is required in the NZE scenario [64; 22]. The Standard tests for any commitment to end investment in coal.

[This metric only applies to companies that mine coal]

Disclosure metric 6.ii.a:

Has the company made a commitment to not invest in any new coal capacity (including new mines, mine extensions and mine acquisitions)

The Standard also tests for disclosure on current capex allocated for both thermal and metallurgical coal and any forward-looking guidance. Disclosure indicating that spending is going down and the pace of that decline, enhances the credibility of plans to reduce production.

[This metric only applies to companies that mine thermal coal]

Disclosure metric 6.ii.b:

Has the company disclosed thermal coal capex in the last financial year and a forward-looking budget (minimum 3 years ahead)

[This metric only applies to companies that mine met coal]

Disclosure metric 6.ii.c:

Has the company disclosed met coal capex in the last financial year and a forward-looking budget (minimum 3 years ahead)

The Standard additionally tests the level of investment in activities that are not aligned with a 1.5°C trajectory.

*[Metrics **6.ii.d-6.ii.f** only apply to companies that mine coal]*

Disclosure metric 6.ii.d:

If the company has not made a commitment to stop investing in new coal capacity (**6.ii.a**), has the company disclosed capex in new mines in the last financial year and forward-looking guidance

Consistent with a focus on impact (Principle 3), the Standard aims to understand if a company has made a commitment to align its acquisitions and divestment activities (M&A) with the broader net zero goal. It sets out tests that will allow investors to assess whether divestments have the potential to lead to negative environmental and social impacts. The Standard tests for the presence of a policy on M&A that requests any purchaser upholds any rehabilitation obligations and adheres to just transition principles.

Disclosure metric 6.ii.e:

Has the company clearly disclosed, where relevant, the contribution of asset transfer/divestments to both thermal AND met coal production declines

Disclosure metric 6.ii.f:

Has the company established sales conditions that require that purchasers of coal assets have: a) commitment to follow an IEA NZE 1.5°C-aligned production pathway; AND b) financial means to cover decommissioning and rehabilitation; AND c) commitment to adhere to just transition principles

Sub-indicator 6.iii: Emissions reduction

Several miners have announced significant investments in decarbonisation. These are generally welcomed by investors as commitments to net zero, particularly where they give a clear indication of the cost of the strategy.

However, typically capex is just part of the investment required to deliver emissions reductions. Often it just relates to scope 1 & 2 where spending via operating costs is also relevant. As a result, the current disclosure is often too vague to be useful.

Investors are keen to encourage decarbonisation investment disclosure and therefore the Standard tests for the presence of any plans here. However, to make existing disclosure more meaningful, it should specify the years, actions, and emissions reduction the investment pertains to.

Disclosure metric 6.iii.a:

Has the company disclosed committed decarbonisation investment, AND quantitatively detailed components, AND linked this to emissions reductions over a specified period

Disclosure Indicator 7:
Climate Policy Engagement

No additional sector-specific climate policy indicators are added for Disclosure Indicator 7.

Disclosure Indicator 8:
Climate Governance

No additional sector-specific climate governance indicators are added for Disclosure Indicator 8.

Disclosure Indicator 9: Just Transition

A just transition in the CA100+ Net Zero Company Benchmark

Indicator 9 of the Climate Action 100+ Net Zero Company Benchmark (CA100+ Benchmark) calls for companies to recognise the importance of a just transition and to commit to and implement principles relevant to achieving a just transition in all sectors and geographical regions. It encourages companies to:

- Commit to decarbonising in line with defined just transition principles,
- Commit to retain, retrain, redeploy and/or compensate affected workers,
- Commit to develop new projects associated with its decarbonisation efforts in consultation with affected communities and seek their consent,
- Develop a just transition plan for how it will support affected workers and communities,
- Develop the just transition plan in consultation with workers, communities, and other key stakeholders, and
- Disclose the quantified Key Performance Indicators it uses to track progress towards the objectives of its just transition plan.

These key components of a just transition are well established in guidance issued by a broad range of institutions, including the ILO [77], the Multilateral Development Banks (MDB) [78], the Council for Inclusive Capitalism [79], and the World Benchmarking Alliance [80]. The ILO's authoritative definition of a just transition is particularly relevant for this Standard:

"*A just transition means greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind.*" [81]

The Standard provides sector-specific metrics that focus on the unique challenges and opportunities that investors anticipate miners will encounter in the accelerated transition to a net zero global economy. Indicator 9 of this Standard also seeks to build on existing core best practices of responsible mining, which are critical to delivering a comprehensive just transition for mine workers and communities.

A just transition in the global mining sector

The details of just transition policies, planning and implementation differ significantly between countries, communities, and sectors.

Rapidly declining fossil fuel demand and meteoric growth in transition materials (TMs) are central features of all 1.5°C-aligned decarbonisation scenarios. This requires the mining sector to wind down activities like coal mining, which, if not appropriately managed, may remove livelihoods and destabilize regional economies. This is termed the "transition out". The mining sector will also have to scale up mining of TMs to supply low carbon energy generation and storage, creating both opportunities and risks for local communities. This is termed the "transition in".

Mining is a complex sector with large and often highly localised social, economic, and environmental footprints, sitting at the foundation of many global supply chains. Expectations about its role in delivering a just transition will be expressed by a range of stakeholders, including mining companies' direct customers as well as indirect customers further downstream, investors, and regulators.

In addition, the types and intensity of mining impacts vary widely. This is influenced by the social, economic, and environmental contexts, as well as the characteristics of particular mine sites, including extraction methods, environmental sensitivities, regulations, and competing land use activities. As such, a place-based and asset-specific approach to just transition planning is critical.

Considering all these factors, it is essential for miners to engage in transparent and ongoing dialogue with workers, unions, and local community representatives from the earliest stages of project planning. Collaborating with governments and investors to mitigate the potential negative impacts faced by workers in declining industries while increasing social inclusion and economic opportunities in affected regions is key to enabling a socially responsible transition. Publishing comprehensive, regular and company-wide reporting on the tangible actions taken to ensure a just transition across a company's portfolio promotes trust and collaboration among key stakeholders.

Many miners have experience with some of the core best practices of responsible mining required to support a just transition for workers and communities, including observation of labour and human rights, consultation and partnership with Indigenous communities, and environmental rehabilitation of closed sites. Key to Indicator 9 is an acknowledgement that the accelerated nature and magnitude of mining impacts driven by the global transition to a net zero economy will require additional commitments and accessible disclosures from miners to deliver a truly just transition for affected workers and communities.

Assessing mining company disclosures for a just transition

This Standard adds additional criteria to complement the sector-agnostic just transition metrics of the CA100+ Benchmark's Disclosure Indicator 9. By combining data from both, the Standard aims to provide investors with a comprehensive picture of mining companies' commitment and progress towards delivering a just transition.

The sector-specific indicators outlined below acknowledge that the mining sector's progress towards a just transition can leverage an existing foundation of core business practices that respect labour and human rights and manage other social and environmental impacts.

Sub-indicator 9.i: Commitment to a just transition

Sub-indicator 9.i tests for company commitments to a just transition, and disclosure of an annual budget towards implementing just transition plans.

*[Metrics **9.i.a** and **9.i.b** only apply to companies that mine coal or transition materials]*

Disclosure metric 9.i.a.

As relevant, has the company committed to manage both its phaseout of coal mining (the transition out) and/or its efforts to increase transition material mining (the transition in) in line with defined just transition principles

Disclosure metric 9.i.b.

Has the company disclosed an annual budget commitment to implement any just transition plans that it has published

Sub-indicator 9.ii: Planning for mine closures

The Standard sets out two metrics relevant to achieving a just transition relating to mine closures, which will be most immediately relevant for early closures of coal mines. These focus on early preparation and communication with affected stakeholders.

The meaning of "relevant decisions" and "material impact" in Indicator **9.ii.a** should be interpreted broadly. Relevant decisions include early asset closures, sales or decarbonisation plans, and material impacts includes the number of workers employed at a site, the type of work available, and/or the expected life of a coal mine and its associated infrastructure.

*[Metrics **9.ii.a** and **9.ii.b** only apply to companies that mine coal or transition materials]*

Disclosure metric 9.ii.a.

Has the company committed to communicate relevant decisions about the operation of mines or facilities that will have a material impact on workers, contractors, communities, and local authorities as soon as possible

Disclosure metric 9.ii.b.

Does the company publish mine closure and environmental rehabilitation commitments and provisioning as part of its just transition plan for new TM mines and coal mines facing early closure dates

Sub-indicator 9.iii: Aligning with core best practice for the acceleration of TM mining

Mining for TMs can be undertaken in line with a just transition by minimising the impacts of new mines on communities and ensuring that new work opportunities are harnessed in a way that maximises local economic development. In some regions, impacts on communities include disruptions to the traditional livelihoods of Indigenous Peoples. Given local communities' embeddedness within ecosystems, social impacts also include the environmental harms from mines, such as deforestation, air pollution, tailings waste management and water use.

The Standard bases its assessment on established responsible mining frameworks. These include the Initiative for Responsible Mining Assurance [58], Copper Mark [59], the International Council on Mining and Metals (ICMM) Principles [82], and the Global Industry Standard on Tailings Management [83]. The Standard suggests that IRMA be considered the primary independent responsible mining certification when assessing indicator 9.iii.a because of its multistakeholder governance system that specifically allocates equal governing power to each of the represented stakeholders: communities, workers, NGOs, mining companies, companies that purchase mined materials, and investors. Alternatives nominated by companies may be acceptable but only if certification is undertaken by an independent third party. Self-assessments based on these standards are not sufficiently independent.

To improve transparency in relation to TM mining, companies are encouraged to disclose the actions they take to address any alleged human rights abuses. Such abuses are compiled for key companies and commodities by the Business & Human Rights Resource Centre's Transition Minerals Tracker [62]. Beyond its extensive environmental impacts, mining also has economic impacts on local regions and host countries that can either enable or constrain sustainable development, in part depending on corporate decisions about local procurement and contributions to local development. Indigenous co-ownership of mines through equity participation is one potential way to ensure a degree of local economic development. At a minimum, mining companies are encouraged to make an explicit commitment to respect Indigenous rights and obtain free, prior, and informed consent (FPIC) for any resource projects as enshrined in the UN Declaration on the Rights of Indigenous Peoples [84].

*[Metrics **9.iii.a-9.iii.c** only apply to companies that mine transition materials]*

Disclosure metric 9.iii.a.

Has the company committed to achieve independent responsible mining certification for all mines and has disclosed a timeline to do so

Disclosure metric 9.iii.b.

Has the company has committed to address allegations of human and labour rights abuses and to mitigate the risk of future abuses occurring

Disclosure metric 9.iii.c.

Has the company committed to respect the internationally recognised human rights of Indigenous Peoples, including to obtain free, prior, and informed consent before new mines or related facilities are developed

Just transition: the case for policy support

The systemic nature of a just transition requires companies to consider the impact of their own practices as well as their lobbying on policy and regulatory issues that could either positively or negatively impact affected workers and communities. Although this standard does not add additional indicators to assess this alignment, we include this section to inform best practice.

Disclosure Indicator 7 of the CA100+ Benchmark sets out investor expectations on how to conduct broader climate-related lobbying activities in line with the Paris Agreement.

Lobbying in line with a just transition in mining requires companies to support policies that aim to directly regulate and prevent social harms arising during the transition. The exact nature of these policies will differ significantly between regions, though could include measures that provide social protection for affected workers in transitioning regions, raise revenue for communities and workers through transition funds and energy rebates, or mandating the development of just transition plans in dialogue with workers, unions, communities and other relevant stakeholders.

In addition, mining companies are encouraged to support policies that strengthen social and environmental mining regulations, potentially prioritising policy engagement in countries with weaker regulations. Leading companies that voluntarily implement responsible mining practices may benefit from an even playing field of strengthened and consistent mining regulations across jurisdictions.

Alongside the policies outlined above, lobbying for a just transition in the mining industry requires support for broader policies that have indirect social implications. For example, emerging government mineral strategies, including the UK Critical Minerals Refresh [64], the EU's Critical Raw Materials Act [85], and Canada's Critical Minerals Strategy [86], all acknowledge the need for circular economy and recycling policies to effectively manage demand and ensure resilient mineral supply chains. Further policy development in line with the goal to decrease the material intensity of the energy transition could also target public transport and behavioural change away from private car ownership, given recent analysis showing that electric vehicles and batteries are expected to drive approximately half of demand growth for critical minerals [23].

Mining companies, workers, communities, and the transition itself would benefit from this softening of the projected growth in demand for TMs. This is because commodity price fluctuations caused by stark mismatches between supply and demand can lead to labour precarity, weakened implementation of responsible mining practice, and difficulty securing financing and permits. A smoothing of projected demand growth will also lessen the need for an already large number of new mines, arguably benefitting local communities.

Disclosure Indicator 10: TCFD disclosure

The updated CA100+ Company Benchmark Disclosure indicator 10 tests whether a company discloses climate relevant data in a manner consistent with the principles of the TCFD [3; 87]. More specifically it focusses on commitment to and implementation of, the TCFD recommendations and disclosure of climate-scenario assumptions and analysis. This aim is aligned with the ICMM which asks members to disclose "openly and transparently" and "report in alignment with the recommendations of the Task Force on Climate-related Financial Disclosures" [4]. According to the ICMM's Mining Principles [88], all ICMM members must report their material risks and opportunities using the GRI Standards (Performance Expectation 10.4).

The complexity of the mining sector means that investors need additional disclosure to assess transition risks and evaluate progress. To accurately compare companies, they need disclosure on a comprehensive company footprint, one that factors in emissions intensive subsidiaries, or non-operated equity investments, where relevant, and allows investors to compare progress on emissions in those non-operated assets against those which they fully control. The boundary chosen for emissions data should also be internally consistent. Both operational and scope 3 emissions should be on the same footprint and ideally the same as that chosen for financial reporting, production and energy consumption disclosure.

In considering what additional disclosure to test for, the Standard is particularly mindful of Principles 4 and 5 (Making use of existing frameworks and Simplicity respectively). It aims to minimise the reporting burden by focussing on the metrics that it believes are most relevant to investors and those already requested by other frameworks. A comparison between the Standard metrics, current company disclosure and those requested by the GRI and ICMM is given in Exhibit 9. Only one metric is not already disclosed by any companies.

Sub-indicator **10.i** focusses on high-level tests for emissions disclosure. It encourages companies to disclose total scope 1, scope 2 and scope 3 emissions and the impact of any adjustments due to double counting or acquisitions or divestments. It also encourages disclosure of total data on both an equity and operational emissions footprint. This is designed to illuminate any differences between the two boundaries due to the presence of emissions intensive subsidiaries and ensure totals are available on a consistent boundary for all emissions scopes.

Disclosure metric 10.i.a:

Has the company disclosed total scope 1, scope 2 and scope 3 emissions for the last reported financial year

Disclosure metric 10.i.b:

Has the company clearly disclosed (i.e. within the same table) the impact of, AND methodology behind, any adjustments for double counting (between category 10 and 11 for example) on **10.i.a** where relevant

Disclosure metric 10.i.c:

Has the company clearly disclosed the impact of any acquisitions, divestment or other changes in reporting boundary on **10.i.a** (even where the impact is zero)

Disclosure metric 10.i.d:

Has the company disclosed total emissions data (**10.i.a**) on both equity and operational accounting boundaries

To provide reassurance to investors that emissions data is credible it should be externally and independently verified. This is consistent with the commitment of ICMM members "obtain external verification over our performance".

Disclosure metric 10.i.e:

Is the emissions data independently and externally verified

Most miners have set net zero targets for operational emissions (scope 1 & 2). Given the challenges posed by different commodities vary, disclosure that enables investors to understand the emissions intensity of individual products and how it compares to the wider industry is helpful.

Disclosure metric 10.ii.a:

Has the company disclosed operational emissions intensity in the last reported financial year for individual products that in aggregate account for >80% of its total operational emissions

Disclosure metric 10.ii.b:

[IF **10.iia** = Yes] Has the company disclosed how its operational emissions intensity for these products (**10.ii.a**) compares to the industry

Investors also want to scrutinise progress towards these targets using intensity metrics. Some commodities are more intensive to extract and process than others. Using an energy-based denominator allows investors to compare operational emissions between companies.

Disclosure metric 10.ii.c:

Has the company disclosed energy-use related scope 1 emissions intensity using an energy consumed denominator for the last reported financial year (e.g. $MtCO_2e/PJ$)

Disclosure metric 10.ii.d:

Has the company disclosed total scope 2 emissions intensity using an energy consumed denominator for the last reported financial year (e.g. $MtCO_2e/GWh$)

As set out in section: Disclosure indicators 2, 3 and 4: Long, Medium and Short Term (companywide emissions) targets and sub-indicator **5.vii**, investors want to understand the contribution of any use of offsets and credits to emissions disclosure. Concerns about the credibility of renewable energy certificates [89] makes this a particular focus.

Disclosure metric 10.ii.e:

Has the company disclosed any contribution of offsets to net total operational emissions OR stated its emissions disclosure does not reflect the use of offsets

Disclosure metric 10.ii.f:

Has the company disclosed absolute scope 2 using both location-based and market-based methods (excluding any use of renewable energy credits such as RECs or REGOs)

Methane can have a significant influence on operational emissions intensity for coal miners particularly. Investors want to be able to track performance here (**5.iv**).

*[Metrics **10.ii.g** and **10.ii.h** only apply to companies that mine coal]*

Disclosure metric 10.ii.g:

Has the company disclosed total methane emissions on an absolute basis (in metric tonnes) and intensity basis (in tCH_4 per Mt of total coal production)

Disclosure metric 10.ii.h:

Has the company disclosed mine-by-mine methane emissions on an absolute basis (in metric tonnes) and intensity basis (in tCH_4 per Mt of total coal production)

As discussed in the section Sub-indicator 5.viii: Scope 3 Category 10 (processing of sold products), scope 3 typically constitutes the vast majority of miners' overall emissions. As the nature of the transition risk varies substantially by category, miners may set emissions targets by category. Investors want to see additional scope 3 disclosure to help them track progress against these targets.

Disclosure metric 10.iii.a:

Has the company disclosed a breakdown of scope 3 emissions by category

Disclosure metric 10.iii.b:

Has the company disclosed independently and externally verified total shipping emissions

Disclosure metric 10.iii.c:

Has the company disclosed scope 3 cat. 10 emissions, separating out iron ore and aluminium where relevant

Disclosure metric 10.iii.d:

Has the company disclosed scope 3 cat. 11 emissions, separating out oil, gas, thermal and met coal where relevant

Disclosure metric 10.iii.e:

Has the company disclosed scope 3 cat. 15 emissions, with a description of sources if scope 3 cat. 15 is material (>5% of total scope 3)

Tracking commodity production (not just emissions) and their associated financial performance provides investors an alternative lens to assess transition risk and opportunities. Most miners already provide good disclosure on this within existing production reports so in many cases the tests included in the Standard are unlikely prompt additional disclosure however there are specific topics which investors focussing on transition risk are interested in.

To assess miners' carbon intensity against established climate benchmarks such as that developed by the TPI it is necessary to aggregate output into a single denominator. Whilst it has flaws, TPI's Copper Equivalent (CuEq) methodology is open source and applied consistently. Many mining companies (4 out of 10) already publish emission intensity using a variation of CuEq. Further work to standardise the calculation of CuEq reported by companies would be beneficial for both miners and investors.

Disclosure metric 10.iv.a:

Has the company disclosed total CuEq production across all commodities in the last financial year, on a comprehensive boundary aligned with that used for emissions disclosure and using a stated methodology

Investors focused on transition risk are understandably keen to track metallurgical and thermal coal production. Separate financial disclosure allows investors to see the implications of any demand reductions consistent with a 1.5°C pathway.

[This metric only applies to companies that mine thermal coal]

Disclosure metric 10.iv.b:

Has the company disclosed thermal coal production in (Mt) AND sales AND profits in the last financial year

[This metric only applies to companies that mine met coal]

Disclosure metric 10.iv.c:

Has the company disclosed met coal production in (Mt) AND sales AND profits in the last financial year

For investors to understand and accurately compare the carbon intensity of miners with different commodity mixes and track progress over time, it is important for energy consumption data to be disclosed (see metrics **10.ii.d** and **10.ii.e**). Consumption is requested by GRI metrics 302-1,2 and consistent with ICMM's performance expectations 6.5 [88] to improve energy efficiency. Separating into fuel and electricity consumption allows scope 1 and 2 emissions intensity to be calculated.

Disclosure metric 10.v.a:

Has the company disclosed total energy consumption in the last financial year on a footprint consistent with emissions disclosure

Disclosure metric 10.v.b:

Has the company disclosed total electricity consumption in the last financial year on a footprint consistent with emissions disclosure

Exhibit 8: Indicator 10: comparison with other frameworks and disclosure requests

NZS Diversified Mining		GRI (Global Reporting Institute)		ICMM (International Council on Mining and Metals)		Companies**
	Overall Disclosure:			RS7; PE 10.4	Report using GRI Standards	
10.i.a	Total emissions (scope 1, 2 & 3)	305-1,2,3		C9		8/10
10.i.b	Adjustments for double counting	305-2	Can apply GHG Guidance to convey claims and prevent it			1/10
10.i.c	Acquisitions/divestment impacts					5/10
10.i.d	Equity and operational accounting boundaries	305-1,2	Consolidate emissions using equity shares, operational control, etc			1/10
10.i.e	External and independent verification			C9; PE10.4		7/10
	Operational emissions:					
10.ii.a	Intensity for individual products (>80%)					8/10
10.ii.b	Breakdown compared to the industry					1/10
10.ii.c	Scope 1 energy-use related intensity	305-4		C4		8/10
10.ii.d	Scope 2 intensity	305-4				4/10
10.ii.e	Contribution of offsets			RS 8,9; C7	NBS, offsets, advanced sol. No specific ask for disclosure	1/10
10.ii.f	Location AND market based Scope 2	305-2				4/10
10.ii.g	Methane emissions (absolute and intensity)	320	Methane emissions discussed, no asks for disclosure			1/8
10.ii.h	Mine-by-mine methane emissions					0/8
	Scope 3:					
10.iii.a	Reporting scope 3 by category	305-3		C9		8/10
10.iii.b	Independent & externally verified shipping emissions	305-3	No specific asks in upstream and downstream categories	CS	Working with members to improve consistency across all categories of scope 3 measurement and reporting	2/10
10.iii.c	Scope 3 cat. 10 (iron ore and aluminium)					6/10
10.iii.d	Scope 3 cat. 11 (oil, gas, thermal, met coal)					3/9
10.iii.e	Scope 3 cat. 15 (inc. sources if material)					2/9
	Production disclosure:					
10.iv.a	Total CuEq production					1/10
10.iv.b	Thermal coal production, sales, and profits	314	Mentions coal, no ask for disclosure [GRI12]			4/8
10.iv.c	Met coal production, sales, and profits					4/8
	Energy Consumption:					
10.v.a	Total energy consumption	302-1, 2		PE 6.5	Improvement in energy use	10/10
10.v.b	Total electricity consumption					9/10

Partially Aligned Aligned

RS: Recognition Statements [4] C: Commitments [4] PE: Mining Principles [88] CS: Climate Change Statement [90] ** Denominator represents the no. companies reviewed where disclosure against that metric awould be relevant

Disclosure Indicator 11: Historical GHG Emissions Reductions (Beta)

This new beta Disclosure Indicator 11 aims to assess company's historical emissions trajectory in order to gain a perspective on the credibility of its targets. The simple premise is that a company with a track record of reducing emissions consistent with the trajectory implied by its targets is more likely to hit those targets than one where emissions are rising or not on track. To do this it compares the historical trajectory to the one implied by its targets and additionally tests how "sustainable" historical reductions have been (the extent to which they have been driven by the use of offsets, M&A or other one-off factors).

The Standard initially proposed similar, separate tests for combined scope 1 and 2 and scope 3. Since these are now largely incorporated into the sector neutral framework, it no longer intends to add separate metrics here.

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Climate Action 100+

Global Investors Driving Business Transition