MSCI

May 2023

Spotlight on unlisted assets

The MSCI Net-Zero Tracker

A periodic report on progress by the world's listed companies toward curbing climate risk

Introduction

One year ago, demand for fossil fuels boomed amid a scramble by countries to shore up their energy supplies after Russia's invasion of Ukraine and the sanctions and embargoes targeting Russia that ensued.

The year that followed produced windfall profits for oil and gas companies and sent energy-related carbon emissions to a new high, yet it also catalyzed governments, investors and industry to accelerate moves toward an energy future ultimately built on a foundation of global security and sustainability.[1]

Signs of that momentum and shift abound. The U.S., the European Union and other major economies are racing to provide incentives for and attract clean-technology businesses via varying mixes of subsidies and spending. Climate disclosure frameworks are set to become legal obligations for thousands of companies worldwide in the coming years. The biggest utilities in the U.S. and Europe are channeling the lion's share of their capital spending toward investments in renewables, which are expected to supply more than one-third of the world's energy (and nearly all the growth in demand for electricity) by 2025, provided the capacity can be deployed.[2]

The climate transition shows every sign of expanding, yet global carbon emissions would need to fall further and faster, including by nearly half from 2019 levels this decade, to prevent the costliest effects of climate change.[3] Investment in reducing greenhouse gas emissions and adapting to the effects of a warming world would need to increase between three- and six-fold.[4]

1 "Global CO2 emissions rose less than initially feared in 2022 as clean energy growth offset much of the impact of greater coal and oil use." International Energy Agency, March 2, 2023.

2 "ESG and Climate Trends to Watch for 2023." MSCI ESG Research LLC, Dec. 6, 2022. See also, "Electricity Market Report 2023." International Energy Agency, Feb. 8, 2023, and "NREL Study Identifies the Opportunities and Challenges of Achieving the U.S. Transformational Goal of 100% Clean Electricity by 2035," Office of Energy Efficiency & Renewable Energy, U.S. Dept. of Energy, Aug. 30, 2022.

3 The IPCC found has found, for example, that as global temperatures increase, so do sea level rise, the frequency of extreme heatwaves and drought, and risks to species. Natural carbon sinks, meanwhile, become less able to absorb emissions. See "Synthesis Report of the IPCC Sixth Assessment Report (AR6), Summary for Policymakers." Intergovernmental Panel on Climate Change (IPCC), March 19, 2023.

4 Ibid.

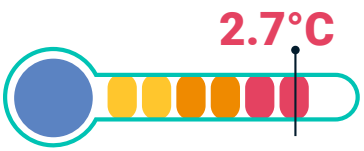
The MSCI Net-Zero Tracker monitors alignment of the world's listed companies with the critical threshold of limiting the rise in average global temperatures to 1.5 degrees Celsius (1.5°C) above preindustrial levels and counts down the time until the collective carbon budget for world's listed companies is estimated to be depleted.[5]

The report also highlights companies that have the largest estimated carbon footprints, shines a light on corporate leaders and laggards in climate disclosure and places a spotlight on companies that have disclosed notably thorough and comprehensive climate targets.

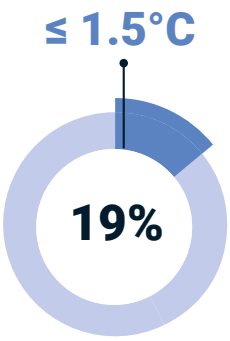
This edition of the MSCI Net-Zero Tracker also looks at listed companies across industries that are addressing economic opportunities associated with the climate transition, as well as the alignment of unlisted assets with global climate goals. The focus on climate opportunities highlights the critical need for clean-energy technologies, as well as the opportunity to scale up climate investments, and how revenue data can help investors identify and monitor companies in every industry that are truly decarbonizing. The spotlight on unlisted assets reflects their growing share of institutional investments (and hence the greenhouse gas emissions associated with them) as well as the importance of measuring emissions across asset classes.

5 Represented by the MSCI ACWI Investable Market Index (ACWI IMI), which includes large-, mid- and small-cap listed companies across 23 developed market and 27 emerging market countries. With 9,144 constituents, the index covers approximately 99% of the global equity investment opportunity set, as of March 31, 2023.

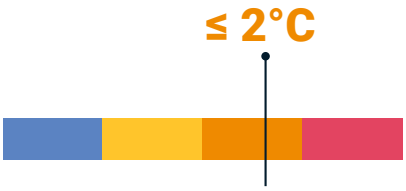
Key findings



Listed companies are on a path to warm the planet by 2.7° above preindustrial levels this century.



Nineteen percent of listed companies align with a 1.5°C temperature rise — the threshold above which scientists say the risk of catastrophic climate hazards increases significantly.



Just over half (51%) of listed companies align with warming less than or equal to 2°C, placing them at the high end of the Paris Agreement's uppermost temperature threshold.

Progress on corporate climate disclosure

» 35% of listed companies have disclosed at least some of their Scope 3 emissions, up 4 percentage points from seven months earlier (as of March 31, 2023).

» 44% of listed companies have set a decarbonization target, up 8 percentage points from seven months earlier (as of March 31, 2023).

- 17% of listed companies have published a climate target that, if achieved, would align carbon emissions across the company's total value chain with the ambitious 1.5°C goal of the Paris Agreement, up 10 percentage points over the same period.

Leaning into a low-carbon future

» **Companies in the emissions-intensive utilities, real estate, capital goods and automotive industries** have the highest revenue exposure to sustainably produced power and clean technologies, suggesting that investors who invest in emissions-intensive industries in the short term may help drive down global carbon emissions over the long term.

Investors are counting on companies to close an ambition gap

» **Listed companies are on a path to warm the planet by 2.7°** above preindustrial levels this century, based on an analysis of their future emissions pathways and current climate commitments.[6]

- **19% of listed companies align with a 1.5°C pathway**, the threshold above which the effects of global warming become more extreme.[7]
- **Just over half (51%) of listed companies align with warming equal to or below 2°C**, placing them at the high end of the Paris Agreement's uppermost temperature threshold.[8]

6 Data as of March 31, 2023. The estimate reflects listed companies' Implied Temperature Rise (ITR), which estimates the increase in average temperatures this century, were the economy to over- or undershoot the global carbon budget by the same amount as the companies in question. See "Understanding MSCI's Climate Metrics." MSCI ESG Research, January 2023.

7 "Global Warming of 1.5°C." IPCC, Oct. 8, 2018.

8 The Paris Agreement aims to limit the increase in global average temperature to well below 2°C above preindustrial levels while pursuing efforts to limit the temperature increase to 1.5°C. "Paris Agreement." United Nations, 2015.

Companies are still emitting a record amount of carbon

- **Listed companies are projected to put 11.2 Gt of carbon dioxide equivalent (CO2e) emissions** into the atmosphere this year, unchanged from 2022.[9]
- **We estimate that listed companies will use up their share of the global carbon budget** for keeping temperature rise below 1.5°C within 43 months (by Oct. 31, 2026), two months sooner than we projected in the October 2022 edition of this report.[10]

Looking beyond listed companies

- **Unlisted companies in four of the five most emissions-intensive industry groups were less carbon-intensive than their listed counterparts on aggregate**, based on an analysis of data from MSCI ESG Research and Burgiss, a global provider of data and research for alternative investments, as of Sept. 30, 2022.
- **Real-assets funds held the most emissions-intensive industries per dollar of financing**, followed by mezzanine- and distressed-debt funds, as of Sept. 30, 2022.
    - The carbon intensity of all three fund types was more than triple the carbon intensity of buyout funds, reflecting private equity's exposure to a greater diversity of sectors.
- **Private-asset managers in North America held the largest portfolios by market value**, but their portfolios are less carbon-intensive than those of their counterparts in Europe and Asia.
    - The difference reflects in part the comparatively larger share of technology investing by U.S. managers compared with managers from other regions.

9 MSCI estimate, based on company emissions data, where available. Where such data is unavailable, MSCI estimates MSCI ACWI IMI emissions based on data from Carbon Monitor.

10 The calculation reflects listed companies' share of the global budget for limiting the rise in average temperatures to 1.5°C, as of March 31, 2023. The October edition of this report estimated that listed companies would use up their 1.5°C budget by Dec. 31, 2026, based on data as of Aug. 31, 2022. Hence, the budget shrank by nine months within the span of seven months.

More listed companies set climate targets, **Scope 3 reporting on the rise**

The number of listed companies that set decarbonization targets and publish their carbon footprints is edging higher.

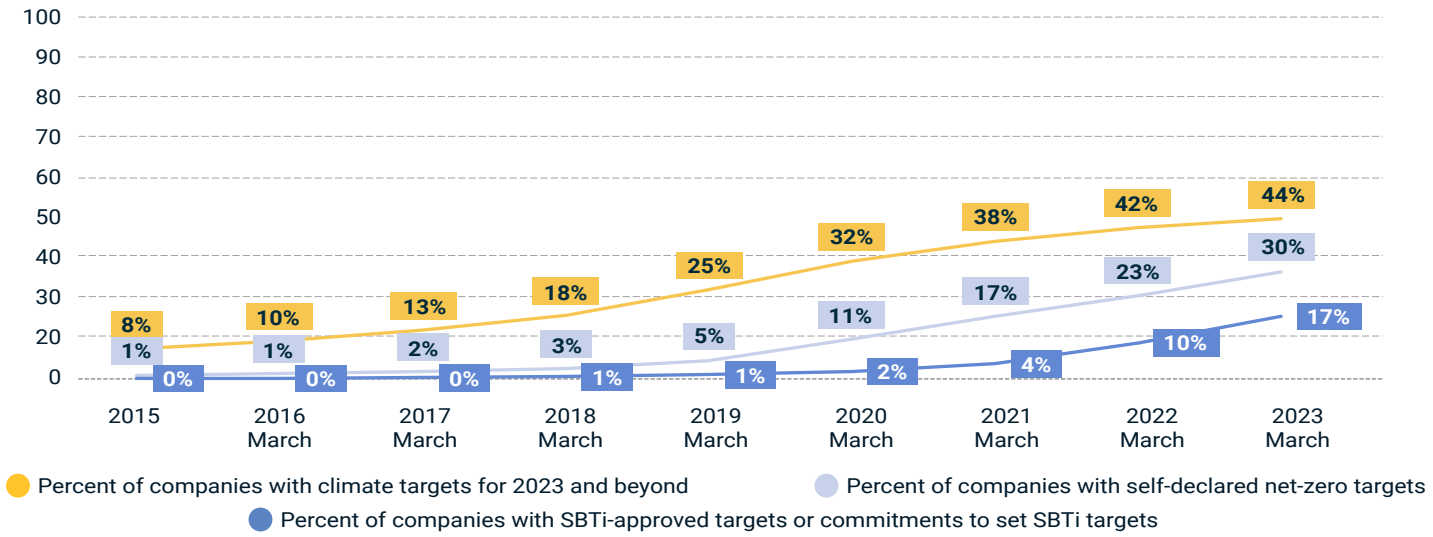
About 44% of listed companies had published a climate target, as of March 31, 2023, up 8 percentage points from seven months earlier (Exhibit 1). Thirty percent of those targets aimed to reach net-zero, as of March 31, 2023.

The rise in target setting may reflect a variety of factors, including a series of both voluntary and mandatory corporate climate disclosure standards slated to take effect in coming years.[11]

At the same time, self-declared net-zero targets vary in terms of their comprehensiveness and ambition. Some aim to balance carbon emissions with carbon removal, while others do not cover companies' complete carbon footprint or rely on carbon offsets that lack third-party validation.

About 17% of listed companies have committed to align their decarbonization target with the standard set by the Science Based Targets initiative (SBTi), which requires companies to set long-term targets that would reduce their residual emissions to net-zero by 2050 while aligning their reductions with a 1.5°C pathway over the near term.[12] A United Nations high-level expert group on net-zero commitments by the private sector recommended at COP27 that investors have their targets verified by a third party such as SBTi.[13]

Exhibit 1: More listed companies are setting climate targets, though ambition varies (% of MSCI ACWI IMI)



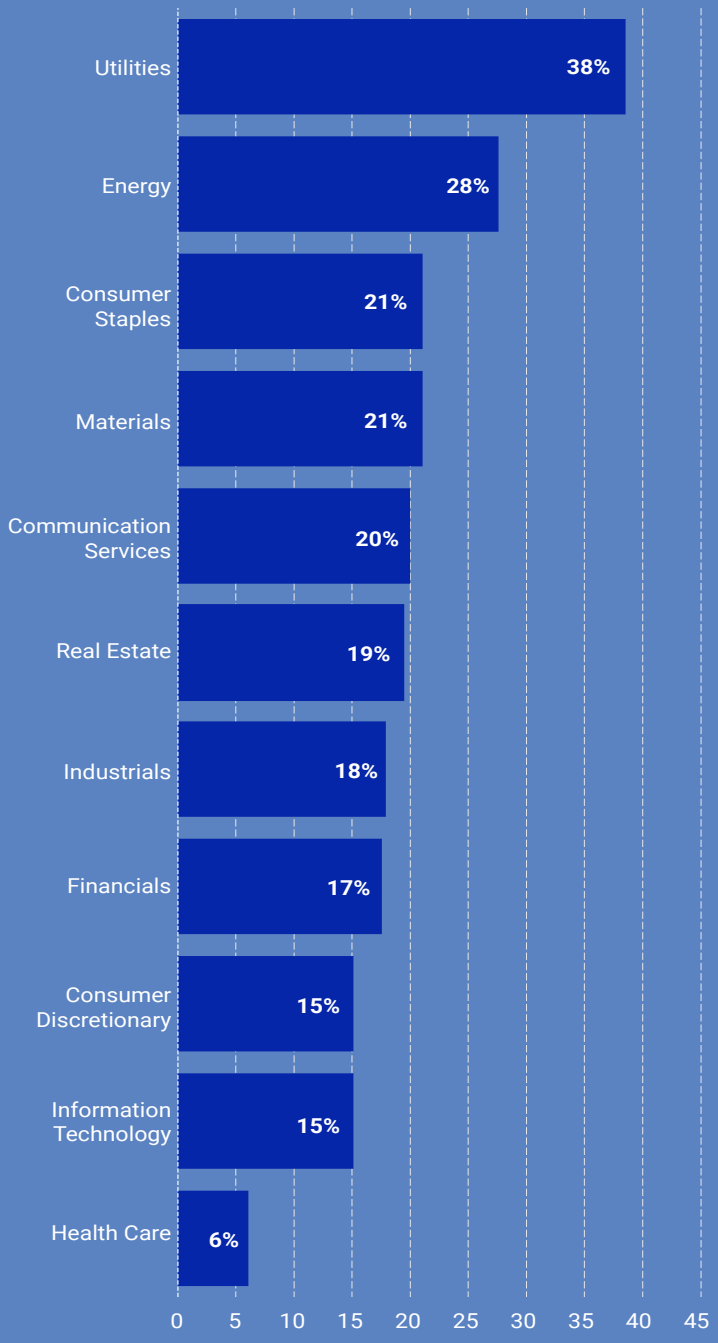
Source: MSCI ESG Research and CDP, data as of March 31, 2023

11 They include the standard from the International Sustainability Standards Board, European Sustainability Reporting Standards in the European Union, and climate disclosure rules proposed by the U.S. Securities and Exchange Commission. See "ESG and Climate Trends to Watch for 2023." MSCI ESG Research, Dec. 6, 2022.

12 "SBTi Corporate Net-Zero Standard, Version 10." Science Based Targets initiative, October 2021. Data as of March 31, 2023.

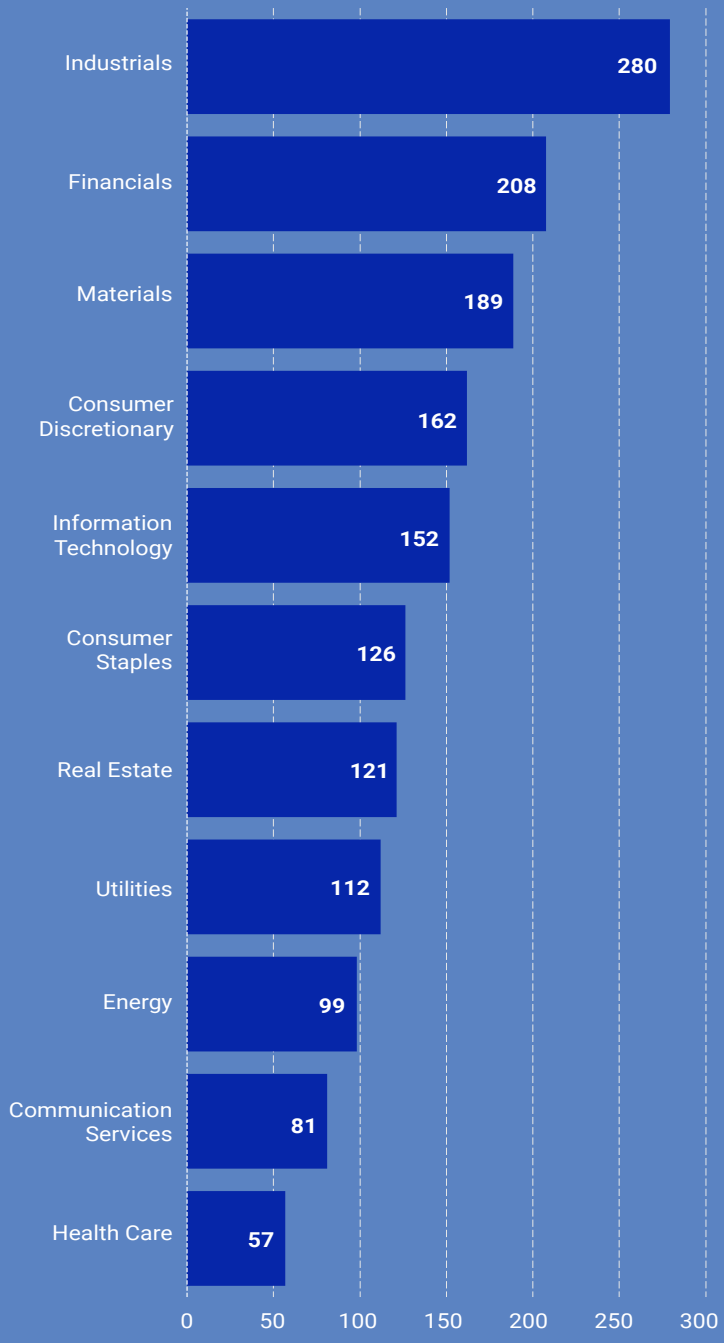
13 "Integrity Matters: Net Zero Commitments by Businesses, Financial Institutions, Cities and Regions." Report from the United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities, Nov. 8, 2022.

Exhibit 2A: Percentage of companies with self-declared net-zero targets by GICS® sector



Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI, data as of March 31, 2023. Sectors from the Global Industry Classification Standard (GICS®) jointly developed by MSCI Inc. and S&P Global Market Intelligence. The GICS® structure comprises 11 sectors, 24 industry groups, 69 industries and 158 sub-industries.

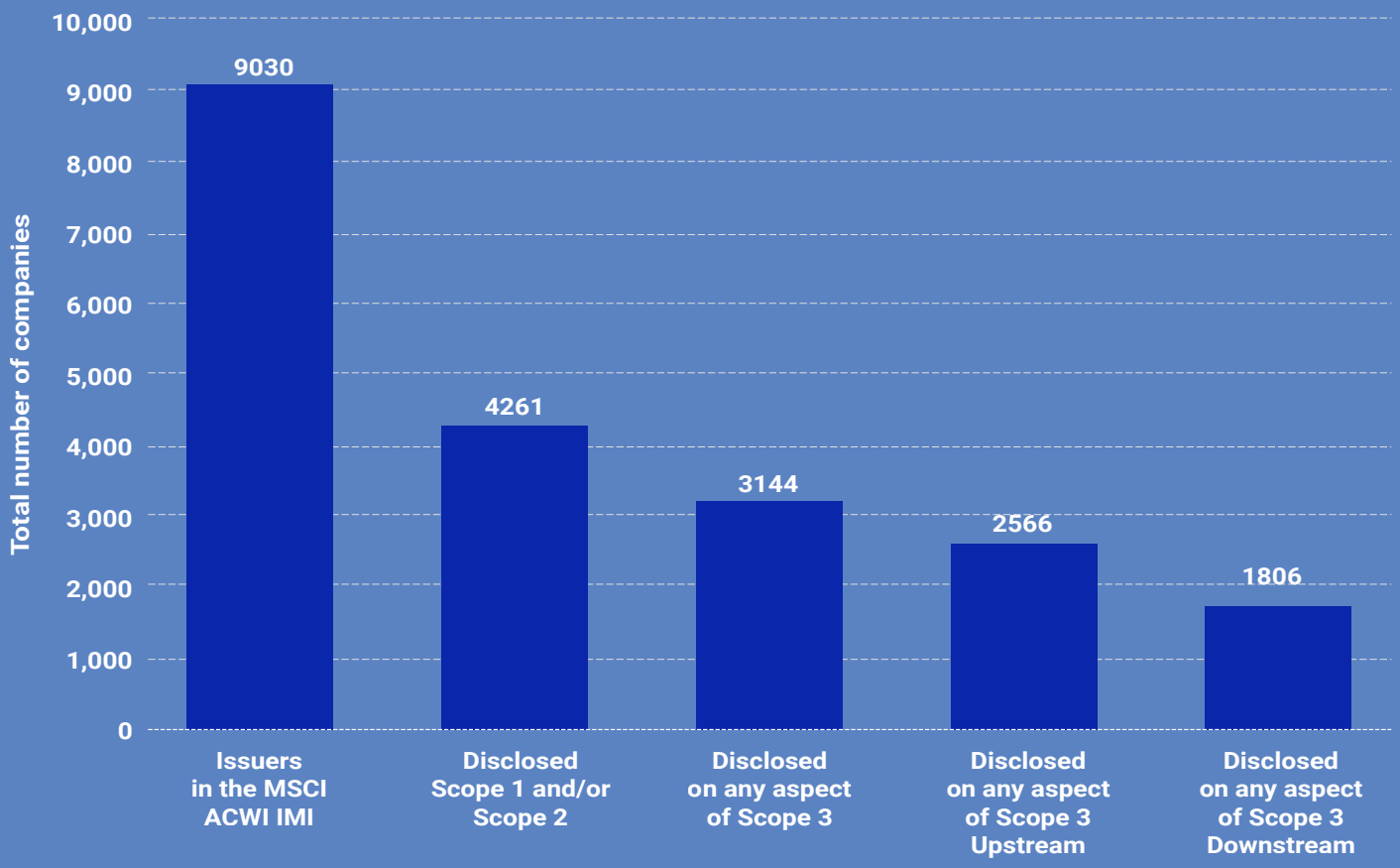
Exhibit 2B: Number of companies with self-declared net-zero targets by GICS® sector



Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI, data as of March 31, 2023

More companies are reporting Scope 3 carbon emissions. About 35% of listed companies disclosed at least some of their Scope 3 emissions as of March 31, 2023, up four percentage points from seven months earlier (Exhibit 3). The improvement matters because Scope 3 emissions, which arise from the company's suppliers or use of its products by customers, represent the largest source of emissions for all but a handful of industries.[14] Though taking inventory of Scope 3 emissions is getting easier as carbon accounting improves, reporting them can still be a challenge because it requires companies to tally emissions from each of their suppliers.[15]

Exhibit 3: Listed companies are reporting more of their carbon emissions



Source: MSCI ESG Research, data as of March 31, 2023. The difference between the number of MSCI ACWI IMI issuers shown here and the number of index constituents as of March 31, 2023 reflects differences between index rebalancing and emissions reporting.

14 "Scope 3 Carbon Emissions: Seeing the Full Picture." MSCI Research, Sept. 17, 2020.

15 Clients can find MSCI ESG Research's latest Scope 3 emissions methodology in MSCI ESG Manager.

Leaning into **climate opportunities**

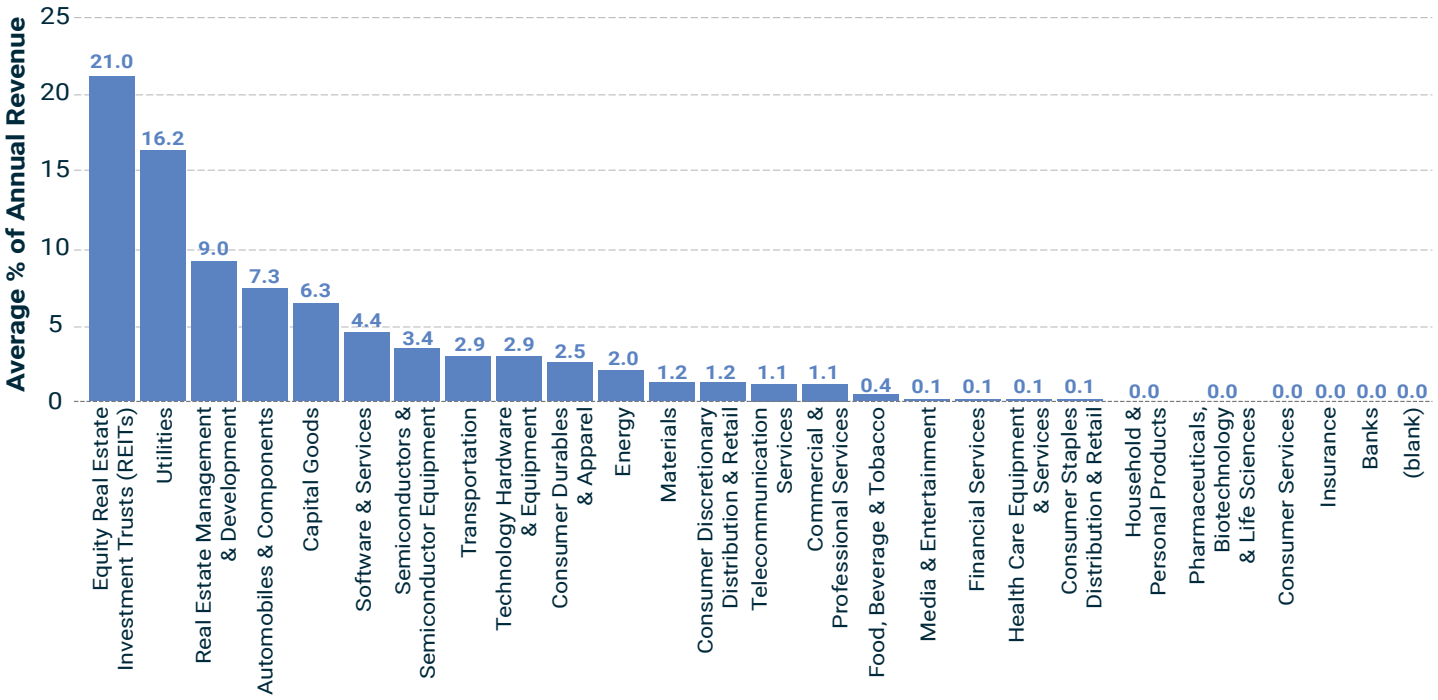
Reducing greenhouse gas emissions alone won't get society to net-zero without a massive scaling-up and deployment of renewable energy and green technologies, including electrifying nearly everything that currently runs on fossil fuels. Achieving net-zero electricity in the U.S. alone by 2035 would require annual deployment of solar and wind, for example, to more than quadruple current levels.[16]

In assessing companies' transition plans, investors may wish to compare, for applicable industries, the share of revenue a company earns from clean technology with the revenue that it earns from fossil fuels, as well as whether (and how) the company prioritizes sustainable growth in its spending on innovation.

Exhibit 4 shows revenue exposure to alternative energy, energy efficiency and green buildings among listed companies in 24 GICS® industry groups.[17] Some of the largest shares of sustainable impact revenue show up in utilities and other carbon-intensive industries. For investors, this suggests that financing the climate transition may entail a willingness to tolerate more portfolio emissions in the near term – particularly in industries that are hard to decarbonize – to drive down emissions in the real economy by 2050.

The Appendix spotlights the five companies with the largest share of sustainable impact revenue in each industry group in the 12 months that ended March 31, 2023.

Exhibit 4



Source: MSCI ESG Research, data as of March 31, 2023

16 "Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035." National Renewable Energy Laboratory, 2022.

17 Based on MSCI's Sustainable Impact Metrics, which measure revenue exposure to solutions that align with the U.N. Sustainable Development Goals. Industry from the Global Industry Classification Standard (GICS®) is a global industry classification standard jointly developed by MSCI Inc. and S&P Global Market Intelligence. The GICS® structure comprises 11 sectors, 24 industry groups, 69 industries and 158 sub-industries.

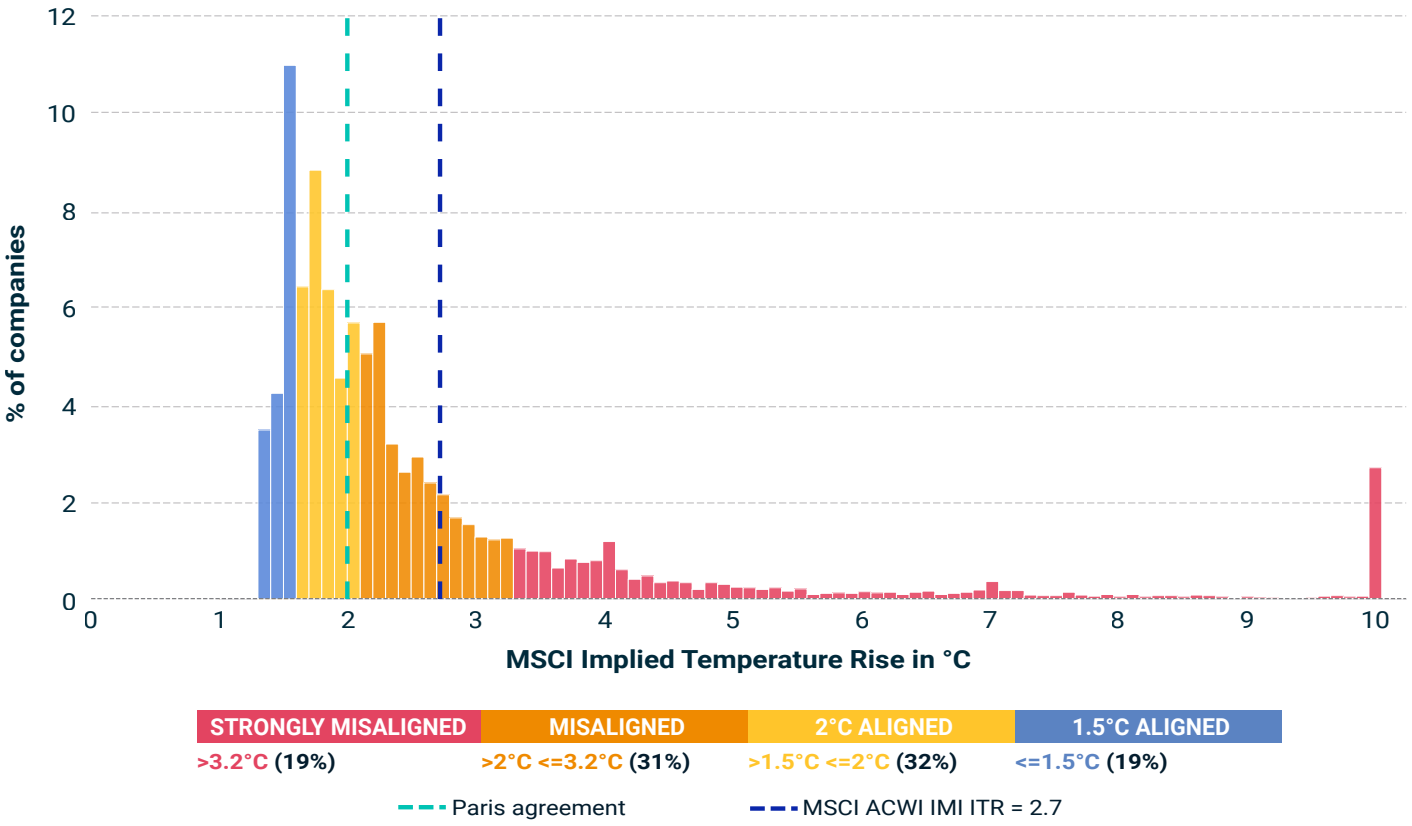
An ambition **gap remains**

Listed companies would need to reduce their carbon emissions further and faster to avoid the worst effects of a warming planet, based on our latest analysis. Companies' greenhouse gas emissions and projected emissions trajectories indicate that warming would exceed 1.5°C this century if the whole economy had the same carbon budget overshoot or undershoot as the companies in question.[18]

Just over half (51%) of listed companies are on track to keep warming below 2°C, while 19% align with a 1.5°C temperature rise (Exhibit 5). All pathways that limit warming to either 1.5°C or 2°C this century, however, assume "rapid and deep and, in most cases, immediate greenhouse gas reductions in all sectors this decade," the IPCC affirmed in March.[19]

Investors and other capital-markets participants have a critical role to play in narrowing that gap by using the strategic levers at their disposal to spur companies to reduce emissions in line with the Paris Agreement.[20] Investors also may wish to monitor whether their allocation of capital to companies that are decarbonizing shows the desired effect in greening, not only for their own portfolios but also for the global economy.

Exhibit 5: Listed companies align with warming of 2°C



Source: MSCI ESG Research. Estimation indicates the aggregate Implied Temperature Rise of companies in the MSCI ACWI IMI, as of March 31, 2023.

18 Estimate is based on MSCI's Implied Temperature Rise model, which indicates the estimated warming potential of a company or portfolio in degrees Celsius based on its current carbon emissions and projected emissions trajectory.

19 Synthesis Report of the IPCC Sixth Assessment Report (AR6), Summary for Policymakers." Intergovernmental Panel on Climate Change (IPCC), March 19, 2023.

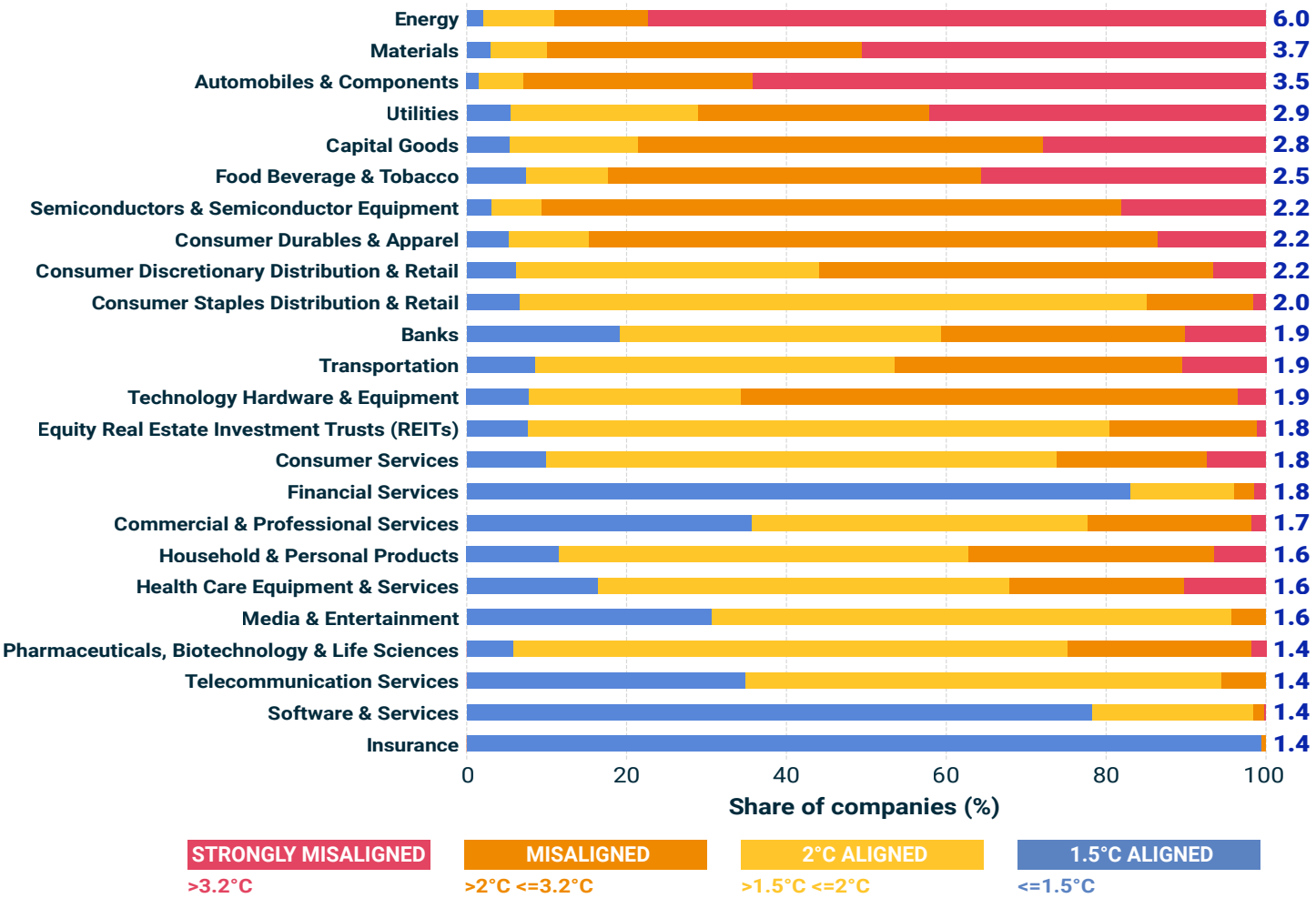
20 For more on strategic levers, see "Net-Zero Alignment Series: Examining the path to net-zero," MSCI ESG Research.

Going where the emissions are

Four of 24 industry groups align with keeping future warming at or below 1.5°C, while 15 industry groups align with a 2°C pathway, as of March 31, 2023 (Exhibit 6).[21] Misaligned industry groups range from the biggest emitters of greenhouse gases, such as energy and materials, to those with large value-chain-related emissions, such as automobile makers.

Investors may wish to identify companies in every industry that are decarbonizing, such as investing in companies based on their projected emissions pathway, rather than their current carbon footprint. That is why we use Implied Temperature Rise, a forward-looking measure, to track the progress of listed companies toward curbing climate risk, rather than carbon footprinting, which is backward-looking. For the economy to reach net-zero by 2050, every company on track to exceed globally agreed thresholds will have to decarbonize more quickly.

Exhibit 6: Implied Temperature Rise by GICS® industry group



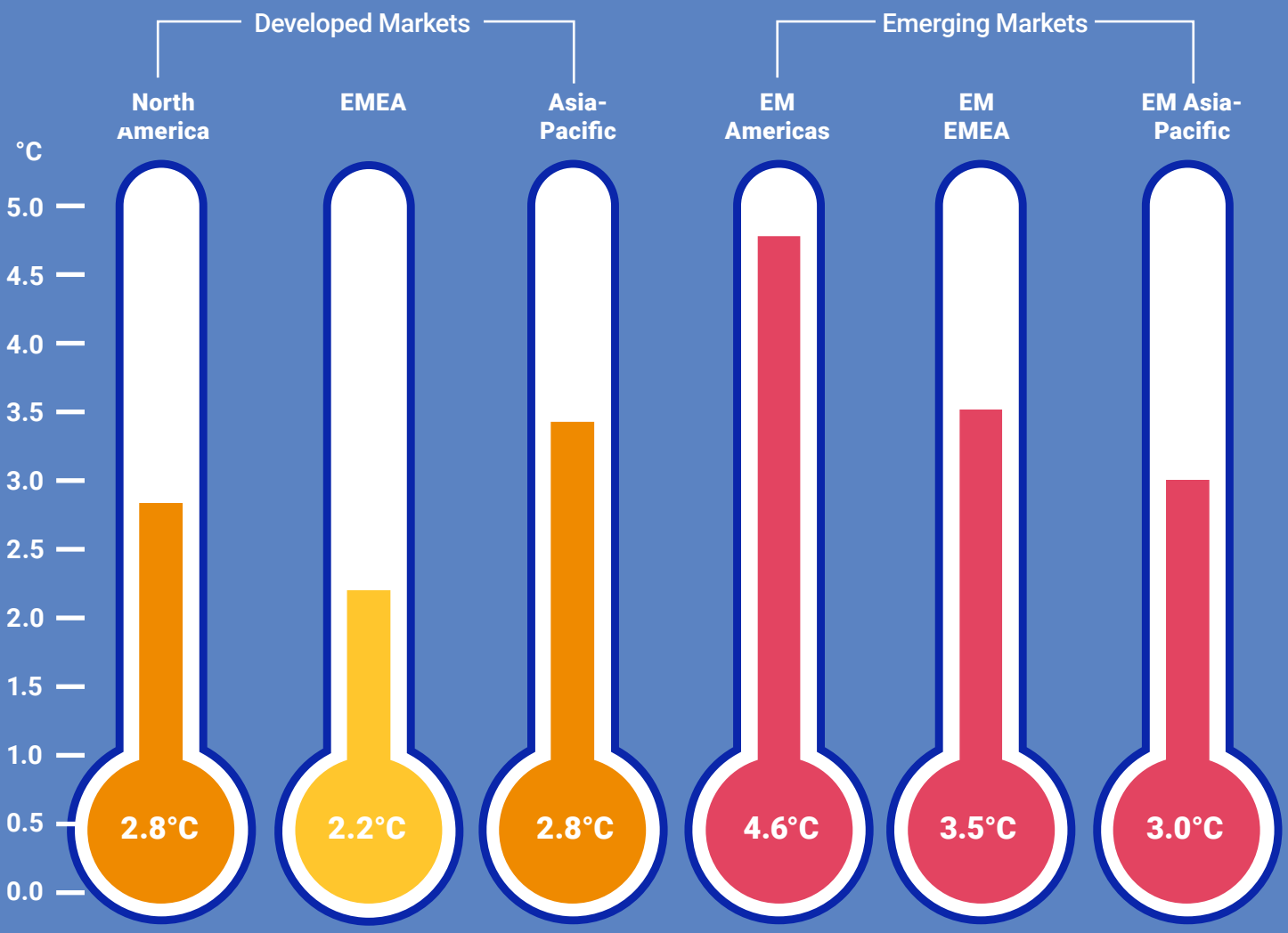
Source: MSCI ESG Research, data as of March 31, 2023

21 The Implied Temperature Rise of banks, diversified financials and insurance industry groups covers carbon emissions from portfolio investments and commercial loans with known use of proceeds, as directed by the Greenhouse Gas Protocol, which requires that companies account for the proportional emissions of such investments. Our methodology does not currently cover emissions of investments that insurance companies hold in their general accounts, which are unavailable to investors.

Companies in every region would **breach key climate thresholds**

The carbon emissions of listed companies in every region make it likely that the world would exceed critical climate goals, based on our analysis of indexes comprising six developed and emerging-market regions.[22] While every ton of carbon warms the planet to the same extent wherever it is produced, we allocate a share of the global carbon budget to listed companies based in part on their sector and region.

Exhibit 7: Implied Temperature Rise

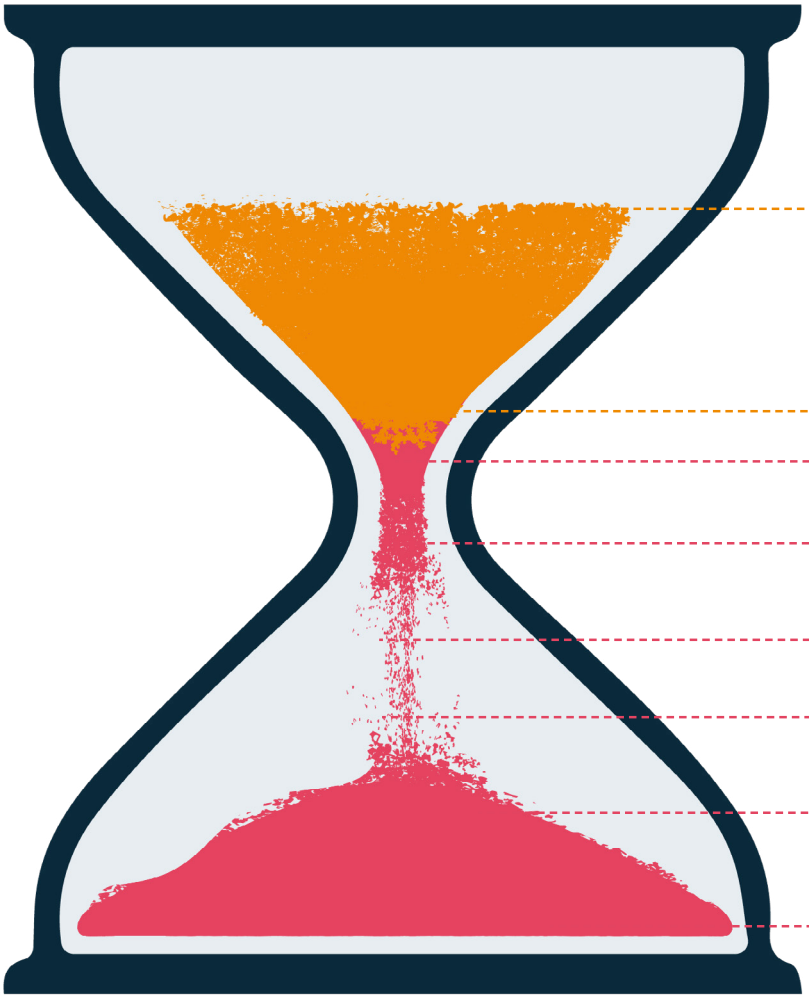


Source: MSCI ESG Research, data as of March 31, 2023, based on data in the following regional indexes: MSCI North America Investable Market Index, the MSCI Europe and Middle East Index, the MSCI Pacific Investable Market Index, the MSCI Emerging Markets Latin America Index, the MSCI Emerging Markets EMEA Investable Market Index, and the MSCI Emerging Markets Asia Index

22 For the classification of developed- and emerging-market regions, see "MSCI Market Classification Framework," June 2022.

Losing the **1.5°C budget**

Exhibit 8



Remaining 2°C budget of MSCI ACWI IMI companies: 213 Gt of CO2e

Remaining 1.5°C budget of MSCI ACWI IMI companies: 41 Gt of CO2e

Projected annual emissions of MSCI ACWI IMI companies in 2023: 11.2 Gt of CO2e

Companies in the MSCI ACWI IMI have emitted a combined 78 Gt of CO2e since the Paris Agreement in December 2015

Source: MSCI ESG Research, data as of March 31, 2023

The hourglass and countdown clock show annual total Scope 1 emissions of MSCI ACWI IMI constituents (not index-weighted) based on listed companies' reported emissions data and MSCI estimates as of March 31, 2023. Emissions for 2022 that companies haven't yet reported are based solely on MSCI estimates, given a lag in company reporting. The remaining future emissions budget to achieve a 1.5°C and 2°C warming scenario are calculated based on bottom-up estimates (sum of remaining emissions budget of all MSCI ACWI IMI constituents) as of March 31, 2023.

Exhibit 9

Months left to limit warming to 1.5°C

Time remaining until listed companies deplete the emissions budget for limiting global temperature rise this century to 1.5°C above preindustrial levels

Months left to keep warming well below 2°C

Time remaining until listed companies deplete the emissions budget for keeping global temperature rise this century well below 2°C above preindustrial levels

Source: MSCI ESG Research, data as of March 31, 2023

Listed companies would deplete their share of the global carbon emissions budget for limiting temperature rise to 1.5°C by Oct. 31, 2026, based on their emissions as of March 31, 2023. That is two months sooner than we estimated last October, when we reported that companies would use up their share of the global carbon budget within 52 months.[23] A 1.5°C-aligned pathway for listed companies remains possible, yet it looks increasingly unlikely that listed companies will achieve this without exceeding the threshold first.

- To limit warming to 1.5°C, listed companies would need to collectively cap future Scope 1 emissions at 41 Gt of CO2e by 2050. Without any change to their current emissions of 11.2 Gt a year, listed companies would deplete their remaining emissions budget in 3 years, 7 months.
- To limit warming to 2°C, listed companies would need to collectively cap future Scope 1 emissions at 213 Gt of CO2e by 2050. Without any change to their current emissions of 11.2 Gt a year, listed companies would deplete their remaining emissions budget in 18 years, 11 months.

23 The October 2022 edition of the Net-Zero Tracker reflected listed companies' carbon emissions as of Aug. 31, 2022. The time remaining before listed companies use up their share of the global carbon budget shrank by nine months between Aug. 31 and March 31, a period of seven months, hence our reporting here that listed companies could deplete their current share of the budget two months sooner than we reported in October 2022.

Looking at private assets

Institutional investors are sharpening their focus on the climate-related impact of unlisted assets, which have grown to more than one-quarter (26%) of pension portfolios, up from 7% roughly 20 years ago and, consequently, emit an increasing share of the greenhouse gases associated with them.[24]

Investors may find addressing climate risk particularly challenging with private assets because of the opacity that can characterize them. Unlike listed companies, which face growing pressure from regulators and other stakeholders to publish their emissions and other climate-related financial information, unlisted companies may face less pressure to disclose such information.[25] While some unlisted companies and private-asset managers disclose their carbon emissions voluntarily, investors rely heavily on estimates of the size and shape of the emissions profile of the private-asset universe to bridge the transparency gap.[26]

The analysis below draws on data from the private-capital universe developed by Burgiss, a global provider of data and research for alternative investments. The charts and tables that follow measure carbon intensity as tons of carbon dioxide equivalent (CO2e) emissions per USD 1 million of enterprise value including cash (EVIC). Financed emissions, in contrast, indicate the emissions attributed to investors based on company-level data within the Burgiss universe.

» **Though conventional wisdom holds that carbon intensities may be higher in private markets than in listed markets, our estimates suggest otherwise.** Unlisted companies in four of the five most emissions-intensive industry groups are less carbon-intensive than their listed counterparts, data from MSCI ESG Research and Burgiss suggests (Exhibit 10).

Exhibit 10: Comparing the carbon emissions intensity of listed and unlisted companies in five emissions-intensive industry groups

Listed companies	
Industry group	**Estimated carbon intensity, Scope 1 and 2 emissions (tons of CO2e)**
Utilities	728.0
Materials	581.7
Transportation	361.3
Energy	189.5
Food, Beverages and Tobacco	145.8
Unlisted companies	
Industry group	**Estimated carbon intensity, Scope 1 and 2 emissions (tons of CO2e)**
Utilities	316.5
Materials	274.1
Transportation	249.3
Energy	214.2
Food, Beverages and Tobacco	87.2

Source: MSCI ESG Research and Burgiss, data as of Sept. 30, 2022

24 "Global Pension Assets Study | 2022." Thinking Ahead Institute, Willis Towers Watson, 2022.

25 U.S.-listed private equity general partners, for example, would fall within the scope of climate disclosure rules proposed by the Securities and Exchange Commission, while unlisted companies would not. See "The Enhancement and Standardization of Climate-Related Disclosures for Investors." Securities and Exchange Commission, March 21, 2022.

26 "Private Assets Can't Hide from SEC's Proposed Climate Rule." MSCI ESG Research, Aug. 8, 2022.

- The difference partly reflects differences within industry groups between public and private assets. Within the energy sector, for example, private companies in the three most carbon-intensive sub-industries accounted for 42% of the sector's financed emissions, but only 26% of the holdings' valuation in the sector, as of Sept. 30, 2022 (Exhibit 11). Whereas in the public market, the three most carbon-intensive energy sector sub-industries accounted for 85% of the sector's market capitalization.

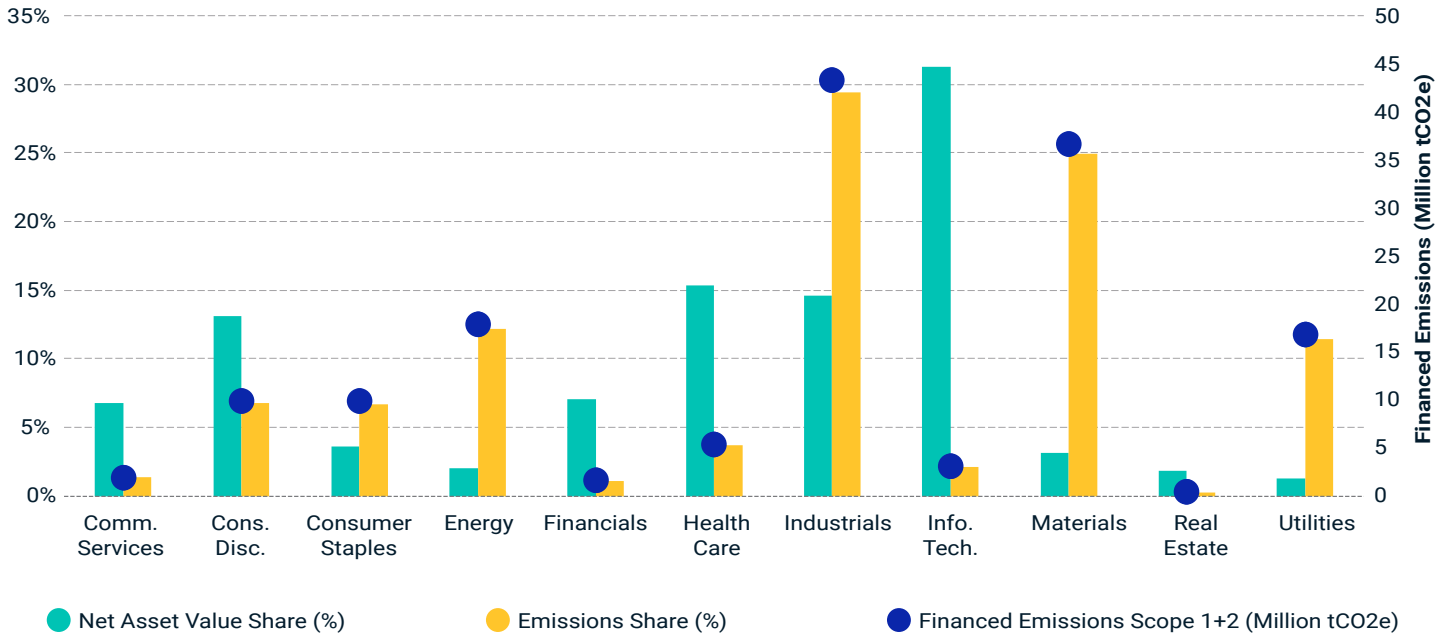
Exhibit 11: Comparing carbon intensity in the energy sector

Most carbon-intensive energy sub-industries	Private holdings in unlisted energy companies, share of sector valuation	Listed energy companies, share of sector market cap
Oil and Gas Refining and Marketing	7%	10%
Integrated Oil Gas	1%	54%
Oil and Gas Exploration and Production	18%	21%

Source: MSCI ESG Research and Burgiss, data as of Sept. 30, 2022

» **Privately held companies skew toward industries such as information technology and health care that are generally less carbon-intensive.** That means that in aggregate, unlisted-company emissions constitute a smaller share of carbon emissions attributed to institutional portfolios (Exhibit 12). Together, the information technology and health-care sectors account for nearly half (47%) of the aggregate market value of institutional private holdings but constitute just 6% of institutionally financed emissions. The energy, materials and utilities sectors, in contrast, represent only 6% of the total market value of private companies but account for nearly half of estimated financed emissions.

Exhibit 12: Unlisted-company universe, sector valuations vs. emissions



Source: MSCI ESG Research and Burgiss, data Sept. 30, 2022. The analysis reflects estimated emissions of companies only and does not include buildings.

» **Institutional investors finance almost 150 million tons of CO2e emissions in their private equity, debt and real-asset portfolios**, data from Burgiss shows, as of Sept. 30, 2022. Note that our estimate of private-asset emissions does not include the complete carbon footprint of all unlisted assets, whose ownership extends beyond institutional investors to other public and private companies as well as to governments. Our estimate, for example, does not cover the emissions of buildings or those of state-owned factories or infrastructure. While more work is needed to widen investors' view into the climate-related impact of private assets, the data presented here may start to illuminate the carbon footprint of an asset class that investors have struggled to see into clearly.

Comparing the carbon emissions of private assets by type and region

» **Private equity buyout funds held the largest share of unlisted financed emissions**, data from MSCI ESG Research and Burgiss as of Sept. 30, 2022 shows (Exhibit 13). The asset class contributed 48% of total emissions (70.8 million tons of CO2e) in Burgiss' model of the private-asset investment universe. Buyout funds accounted for 45% of the aggregate valuation of private holdings, or nearly USD 2 trillion, a factor that contributed significantly to their financed emissions share. That was followed by real-assets funds (24% or 33.3 million tons of CO2e) and mezzanine-debt funds (6% or 9 million tons of CO2e).

» **Real-assets funds held the most emissions-intensive industries per dollar of financing**, followed by mezzanine- and distressed-debt funds, as of Sept. 30, 2022. The carbon intensity of all three fund types was about triple the carbon intensity of buyout funds, reflecting the different sector composition and exposure to carbon-intensive assets within each asset class.

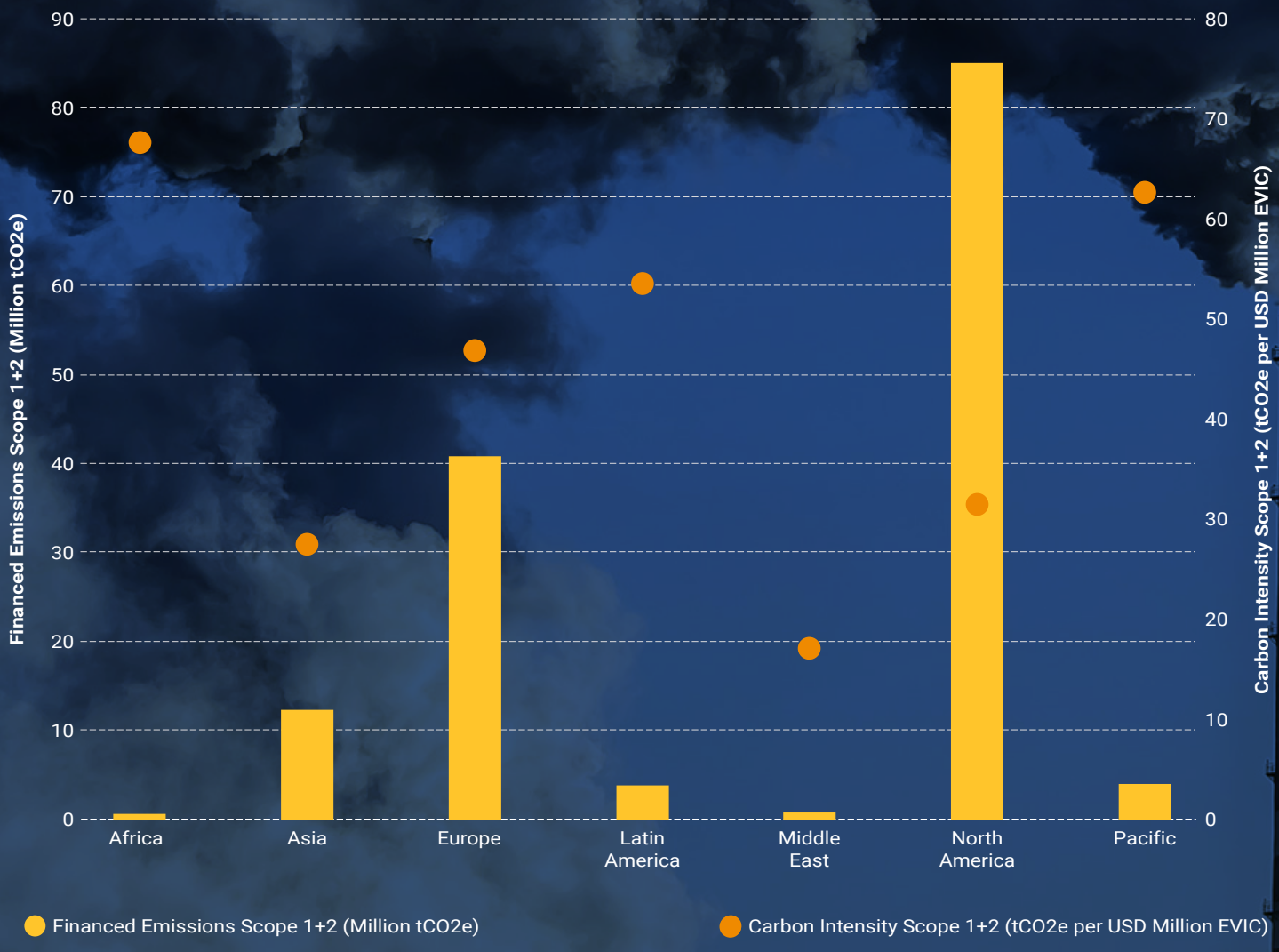
Exhibit 13: Comparing the emissions of private assets by type

Asset Class	Type	Carbon Intensity (tCO2e per USD Million EVIC)	Financed Emissions (Million tCO2e)	Valuation (USD Billion)	Share of Valuation (%)	Share of Emissions
Debt	Distressed	101.6	6.5	64.4	1.6%	4.7%
	Mezzanine	108.1	9.0	83.4	2.1%	6.4%
	Senior	33.6	2.2	66.0	1.6%	1.6%
	Generalist	31.0	2.5	79.3	2.0%	1.8%
	Other	27.5	0.5	17.2	0.4%	0.3%
Equity	Buyout	37.3	70.8	1900.7	46.8%	50.5%
	Expansion Capital	15.4	0.8	54.4	1.3%	0.6%
	Venture Capital	6.3	6.1	970.5	23.9%	4.4%
	Generalist	14.3	7.3	509.9	12.5%	5.2%
	Other	38.5	1.1	28.0	0.7%	0.8%
Real Assets	Companies	115.4	33.3	289.0	7.1%	23.8%

Source: MSCI ESG Research and Burgiss, data as of Sept. 30, 2022. For definitions of fund types, see Burgiss: Private Capital Classification System. "Other" refers to investments that don't fit neatly into defined fund types.

- **Investments in unlisted companies in Africa, the Pacific and Latin America were the most carbon-intensive worldwide**, as of Sept. 30, 2022, while those in North America, Europe and Asia emitted the most CO2 into the atmosphere on an absolute basis (Exhibit 14). Unlisted companies in North America appeared to be less carbon-intensive than those in Europe, on a per-dollar invested basis. The opposite can be seen in Africa and the Pacific, where financed emissions are low but emissions intensities are high. The differences may inform decision-making by investors, depending on whether they aim to assess carbon risk (intensity) or impact (financed emissions).
- **Private-asset managers in the U.S. held the largest portfolios by market value, yet their portfolios are less carbon-intensive than those of their counterparts in Europe and Asia.** The difference partly reflects the comparatively larger share of technology investing by U.S. managers compared with managers from other regions. Since 2018, about 30% of U.S. private asset managers' investments have been in information technology, surpassing asset managers in both Europe (26%) and Asia and the Pacific (about 16%).

Exhibit 14: Comparing the estimated emissions of private assets by region



Source: MSCI ESG Research and Burgiss, data as of Sept. 30, 2022. The analysis reflects estimated emissions of companies only and does not include buildings.

Global and listed-company Scope 1 emissions

Whether global greenhouse gas emissions are going down – and how quickly – is the measure that matters for assessing progress toward net-zero. To avoid double counting, we focus here on listed companies' direct (Scope 1) emissions (Exhibit 15).

We estimate that direct (Scope 1) emissions of the world's listed companies will represent 18.6% of global emissions this year, roughly the same as they did in 2022, when emissions reached an all-time high. Despite calls for reorienting the global economy around sustainability following both the global financial crisis of 2007-2009 and the coronavirus pandemic, the trajectory of both global and corporate carbon emissions shows that neither crisis drove carbon emissions down for good.

Exhibit 15 shows total MSCI ACWI IMI Scope 1 greenhouse gas emissions (sum for all index constituents without index weighting) and total estimated global carbon emissions, as of March 31, 2023.

Exhibit 15

Historical greenhouse gas emissions [Gt C02e]	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 (estimated)
Global greenhouse gas emissions*	51.2	51.7	51.8	51.9	53.5	55.3	59.1	55.8	59.6	60.4	60.2
ACWI IMI Scope 1**	10.9	10.4	10.2	9.6	10.2	11.4	11.4	10.4	11	11.2	11.2

Source: MSCI ESG Research. Estimation indicates the aggregate Implied Temperature Rise of companies in the MSCI ACWI IMI, as of March 31, 2023.

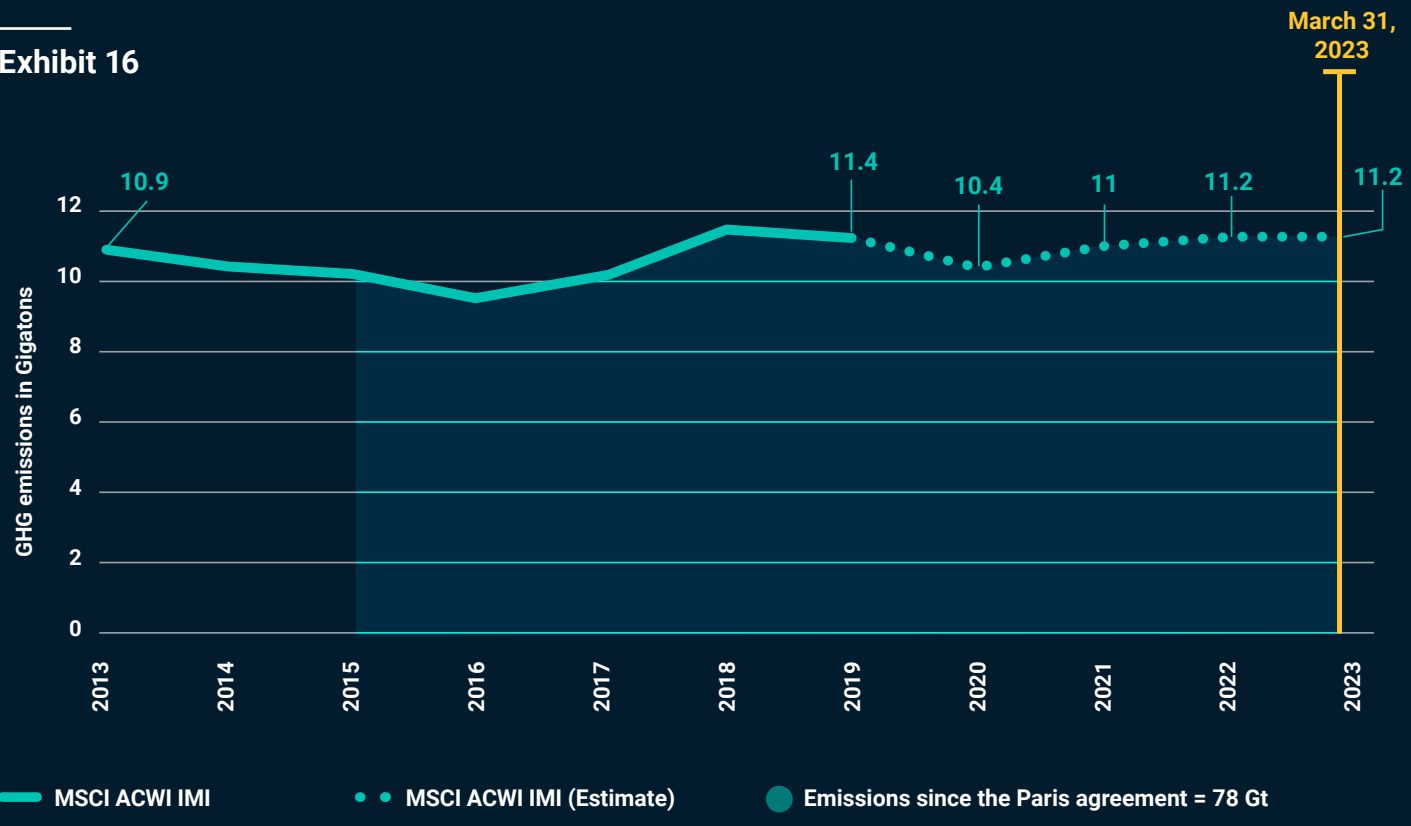
* Global emissions through the end of 2022 are based on annual UN Environment Programme reports. The estimate for 2023 reflects changes in emissions as reported by Carbon Monitor. Data reflects cumulative GHG emissions.

** MSCI ACWI IMI emissions for 2022 as reported by companies or estimated by MSCI, where not reported. Emissions for 2023 are estimated from changes in emissions as reported by Carbon Monitor.

Scope 1 greenhouse gas emissions of listed companies

Listed companies' direct emissions continue to climb but have come down from levels that preceded the pandemic (Exhibit 16). Emissions would need to fall further and faster if society is to limit the rise in average global temperatures to 1.5°C.

Exhibit 16



Emissions reflect the addition of China to the MSCI ACWI IMI starting in 2018

Source: MSCI ESG Research, data as of March 31, 2023

Shining a light on disclosure: Leaders and laggards

There is growing momentum among investors for companies to report their carbon footprint across all emissions scopes and categories.[28] Disclosure by companies of their complete carbon emissions enables investors to compare and standardize evaluation of companies based on their alignment with a 1.5°C pathway, model climate-related financial risk and allocate capital accordingly with investment objectives.

The 10 listed companies with the largest carbon footprints

Ten listed companies were responsible for 5.2% of all listed-company direct (Scope 1) emissions in the 12 months that ended Dec. 31, 2022. Exhibit 17 shows the contribution of each of those companies to the total emissions of listed companies, together with differences in their levels of transparency.

Exhibit 17

Issuer	Country	Total carbon emissions [million tons of CO2e]*	Scope 1 emissions [million tons of CO2e]	Scope 2 emissions [million tons of CO2e]	Scope 3 emissions [million tons of CO2e]	Carbon emission scope 3 reported [millions of tons of CO2e]	Reported emissions (sum) as a percentage of MSCI estimated total emissions**	Ratio of total company emissions (reported/ estimated) vs MSCI ACWI IMI total emissions****	Does the company have a self-declared net-zero target? (Y/N)
Saudi Arabian Oil Company	Saudi Arabia	2167.7	74.9	6.42	2086.4	Not Available	Estimated only***	2.1%	Y
Coal India Ltd.	India	1121.7	19.1	1.81	1100.8	Not Available	Estimated only***	1.1%	Y
PetroChina Company Limited	China	873.8	121.4	38.15	714.3	Not Available	18%	0.8%	N
Exxon Mobil Corporation	U.S.	834.5	110	7	717.5	530	78%	0.8%	Y
BHP Group Limited	Australia	787.7	9.2	3.1	775.5	328.5	43%	0.8%	Y

28 See generally, "The GHG Protocol Corporate Accounting and Reporting Standard," Greenhouse Gas Protocol.

Issuer	Country	Total carbon emissions [million tons of CO2e]*	Scope 1 emissions [million tons of CO2e]	Scope 2 emissions [million tons of CO2e]	Scope 3 emissions [million tons of CO2e]	Carbon emission scope 3 reported [millions of tons of CO2e]	Reported emissions (sum) as a percentage of MSCI estimated total emissions**	Ratio of total company emissions (reported/ estimated) vs MSCI ACWI IMI total emissions****	Does the company have a self-declared net-zero target? (Y/N)
SAIC Motor Corporation Limited	China	731.5	1.8	3.38	726.4	Not Available	Estimated only***	0.7%	N
Vale S.A.	Brazil	725.8	9.6	1	715.2	481.9	68%	0.7%	Y
China Shenhua Energy Company Limited	China	717.4	126.7	8.22	582.6	Not Available	19%	0.7%	N
Shell PLC*****	U.K.	701.5	91	9	601.5	1299	199%	0.7%	Y
Rio Tinto PLC	U.K.	675.4	22.7	8.4	644.3	553.5	87%	0.7%	Y

Source: MSCI ESG Research, data as of Dec. 31, 2022

* Sum of reported or estimated Scope 1 and 2 emissions plus Scope 3 emissions estimates.

** If a company does not report its Scope 1 and 2 carbon emissions data, MSCI ESG Research estimates each scope separately based on either the company's previously reported emissions data or, if none, the carbon emissions intensity of the company's production or industry segments. We estimate Scope 3 emissions for all companies in our coverage based on company-specific information that considers both the revenue intensity of emissions and production data, in line with the Greenhouse Gas Protocol framework. For more information, please see: "MSCI Climate Change Metrics Methodology and Definition" and "Scope 3 Carbon Emissions Estimation Methodology", MSCI ESG Research.

*** Comparison between reported and estimated emissions does not apply because the company reports only some of its Scope 1 emissions. Hence, MSCI uses estimates alone to calculate the company's total carbon emissions.

**** Because companies share their value chain with multiple other companies, double counting is unavoidable when estimating Scope 2 and 3 emissions. The comparison here, on average, cancels this double counting by comparing each listed company's share of total emissions with MSCI ACWI IMI total emissions.

***** Because Shell reports Scope 3 emissions from the sale of products that it produces, including oil, natural gas, liquefied natural gas, gas-to-liquids and biofuels, and the emissions of products it sells on behalf of third parties, the company's reported emissions exceed by nearly two times MSCI's estimate, which calculates the company's Scope 3 emissions based on products the company itself produces. See, "Greenhouse Gas Emissions," at shell.com.

Listed companies with **improved emissions reporting**

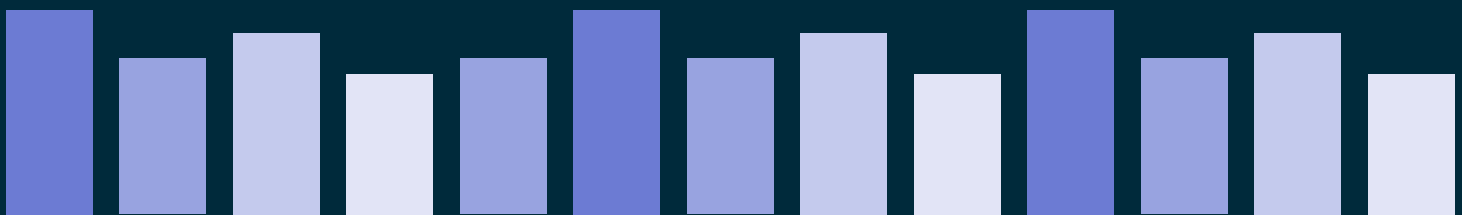


Exhibit 18 shows 10 of the nearly 80 companies in the MSCI ACWI IMI Index that reported additional scopes or categories of greenhouse gas emissions in the 12 months that ended Dec. 31, 2022, and that are now reporting substantially all their emissions across all scopes.[29] Note that reported emissions can exceed estimated emissions in instances where estimates do not capture emissions from all business segments or companies report sales of products on behalf of third parties.

Exhibit 18

Issuer	Country	Total estimated emissions [million tons of CO2e]	Total reported emissions [million tons of CO2e]	Total reported emissions as a percentage of MSCI-estimated total emissions*
Holcim AG	Switzerland	155.5	156	100%
Heidelberg Cement AG	Germany	96.2	94.6	98%
A.P. Moeller-Maersk A/S	Denmark	62.9	60.9	97%
Santos Limited	Australia	40.2	38.9	97%
Neste Oyj	Finland	38.8	37.7	97%
EDP – Energias de Portugal, S.A.	Portugal	21.3	20.9	98%
Heineken N.V.	Netherlands	18.8	18.9	100%
Titan Cement International S.A.	Belgium	13.3	12.8	96%
SSE PLC	U.K.	10.0	9.9	99%
Mytilineos S.A.	Greece	9.5	9.7	101%

Source: MSCI ESG Research, data as of Dec. 31, 2022

* If a company does not report its Scope 1 and 2 carbon emissions data, MSCI ESG Research estimates each scope separately based on either the company's previously reported emissions data or, if none, the carbon emissions intensity of the company's production or industry segments. We estimate Scope 3 emissions for all companies in our coverage based on company-specific information that considers both the revenue intensity of emissions and production data, in line with the Greenhouse Gas Protocol framework. For more information, please see: "MSCI Climate Change Metrics Methodology and Definitions" and "Scope 3 Carbon Emissions Estimation Methodology," MSCI ESG Research.

29 Clients can view the complete list in MSCI One.

The largest emitters that have not disclosed their greenhouse gas emissions

Exhibit 19 shows the 10 largest emitters based on MSCI ESG Research estimates of emissions (across all emissions scopes) that had not reported greenhouse gas emissions, as of Dec. 31, 2022.[30]

Exhibit 19

Issuer	Country	Emissions reference year	GICS® sector	Total estimated emissions [million tons CO2e]
Shaanxi Coal Industry Company Limited	China	2021	Energy	260.2
Berkshire Hathaway Inc.	U.S.	2021	Financials	164.0
China State Construction Engineering Corporation Limited	China	2021	Industrials	139.0
Shanxi Lu'an Environmental Energy Dev. Co., Ltd.	China	2021	Energy	104.1
Pbf Energy Inc.	U.S.	2020	Energy	96.1
Huayu Automotive Systems Company Limited	China	2021	Cons. Discretionary	56.8
Dongfang Electric Corporation Limited	China	2021	Industrials	56.4
China Aviation Oil (Singapore) Corporation Ltd.	China	2021	Energy	49.0
Shanxi Coking Coal energy Group Co., Ltd.	China	2021	Energy	36.1
Mastec, Inc.	U.S.	2021	Industrials	34.2

Source: MSCI ESG Research, data as of Dec. 31, 2022

30 The table remains unchanged from the October 2022 edition of the Net-Zero Tracker, which reported data as of Aug. 31, 2022. Both Shanxi Lu-an Environmental Energy Dev. Co. and Mastec, Inc. have said they plan to disclose carbon emissions but have not said when those disclosures might be made.

Listed companies with the most comprehensive emissions-reduction targets

Not all decarbonization targets are fit for the purpose. Corporate climate leaders aim to achieve net-zero emissions across their entire carbon footprint, yet some companies start with carbon-reduction targets that address only a fraction of net-zero emissions targets.

Exhibit 20 shows 10 of the nearly 350 companies in the MSCI ACWI IMI that have published the most-thorough corporate decarbonization targets in the 12 months that ended Dec. 31, 2022.[31] MSCI ESG Research assesses the thoroughness of decarbonization targets according to three criteria: comprehensiveness (the table below comprises targets that address a company's total emissions), the change in emissions (% of tons of CO2e) targeted each year and the Implied Temperature Rise that would result.[32]

Exhibit 20

Issuer	Country	Carbon emissions (most recent available year)*	Total carbon emission by issuer (estimated)**	Total carbon emission by issuer (reported)	Target summary annual change (annualized target)***	Comprehensiveness ****	Implied temperature rise (°C)
SK Innovation Co., Ltd.	South Korea	2021	53.91	129.56	-3.45%	100.00%	1.7
Iberdrola, S.A.	Spain	2021	43.84	65.9	-3.45%	100.00%	1.4
Titan Cemeten Internatinoal S.A.	Belgium	2021	13.28	12.8	-3.45%	100.00%	1.7
Schneider Electric SE	France	2021	13.16	69.2	-3.45%	100.00%	1.4
Nordea Bank Abp	Finland	2021	11.13	0.02	-3.45%	100.00%	1.5

31 Clients can view the complete list in MSCI One.

32 MSCI ESG Research measures comprehensiveness as the percentage of Scope 1, 2 and 3 emissions covered by the company's targets. We standardize companies' projected emissions to show them as the amount to be reduced annually.

Issuer	Country	Carbon emissions (most recent available year)*	Total carbon emission by issuer (estimated)**	Total carbon emission by issuer (reported)	Target summary annual change (annualized target)***	Comprehensiveness ****	Implied temperature rise (°C)
Danske Bank A/S	Denmark	2021	7.55	0.01	-49.91%	100.00%	1.3
Air Canada	Canada	2021	6.26	5.49	-3.45%	100.00%	1.7
Lululemon Athletica Inc.	Canada	2021	3.89	1.37	-3.45%	100.00%	1.5
Telefonica Brasil S.A.	Brazil	2021	1.56	0.99	-3.45%	100.00%	1.3
Brambles Limited	Australia	2022	1.08	1.6	-5.56%	100.00%	1.3

Source: MSCI ESG Research, data as of Dec. 31, 2022

* Carbon emissions (most recent available year) shows the latest year for which the company has reported its emissions and may differ from the date of the company's latest climate target.

** Total carbon emissions (estimated) shows the sum of the company's reported Scope 1 and 2 emissions, if reported, together with MSCI ESG Research's estimate of the company's Scope 3 emissions. See note on page 24 above.

*** Targeted change in emissions shows the projected normalized annual change in absolute emissions across all emissions scopes (Scope 1 and 2 reported, Scope 3 estimated).

****Comprehensiveness of target (%) refers to the percentage of a company's emissions (Scopes 1 and 2 reported, Scope 3 estimated) covered by its latest climate target.

Conclusion

Listed companies are making progress toward net-zero. That includes mapping out and committing to decarbonization targets, and publishing greenhouse gas emissions across their value chains.

A significant gap remains, however, between companies' collective climate ambition and the amount of greenhouse gases that they are continuing to emit into the atmosphere. The window to limit global temperature rise to 1.5°C is "rapidly narrowing," as the IPCC noted in March. The emissions of listed companies, meanwhile, are on a trajectory to warm the planet by 2.7°C this century.

Many investors are expected to continue to allocate capital in line with science-based net-zero targets and to use all the strategic levers at their disposal – from asset allocation to engagement and investment in climate solutions – to help place companies in each industry on a net-zero path.

If the shift to a net-zero economy is to succeed, investors may want to determine the greenhouse gas emissions associated with their investments across every asset type, including unlisted assets. Investors may also wish to look beyond emissions, to differentiate companies based on their investment in green opportunities and a net-zero future.

The climate transition is gaining traction but is nowhere near where it needs to be if society is to avoid the most disruptive warming. Carbon emissions hover near all-time highs, and the end of this critical decade for cutting emissions is approaching. The clock is ticking.

Glossary

Carbon budget: The amount of carbon that society can release into the atmosphere before breaching key temperature thresholds.

Carbon dioxide equivalent (C02e): Greenhouse gas emissions with the same global warming potential as 1 metric ton of carbon.

Carbon emissions EVIC intensity: Greenhouse gas emissions in metric tons of CO2e tons per USD 1 million of financing of a company.

Carbon emissions revenue intensity: Greenhouse gas emissions in metric tons of CO2e a company emits to generate every USD 1 million of revenue.

Comprehensiveness: Percentage of listed companies' Scopes 1, 2 and 3 emissions covered by emissions reporting or target setting.

Financed emissions: Greenhouse gas emissions associated with investments, loans and insurance.

GICS®: The global industry classification standard jointly developed by MSCI Inc. and S&P Global Market Intelligence. The GICS® structure comprises 11 sectors, 24 industry groups, 69 industries and 158 sub-industries.

Gigaton [Gt]: 1 billion tons (of emissions).

Implied Temperature Rise: A measure that estimates the increase in average temperatures this century that would occur if the economy were to overshoot or undershoot the global carbon budget by the same amount as the company in question.

Megaton [Mt]: 1 million tons (of emissions).

MSCI ACWI Investable Market Index (IMI): Captures large-, mid- and small-cap listed companies across 23 developed markets and 27 emerging market countries. With 9,144 constituents, the index covers approximately 99% of the global equity investment opportunity set, as of March 31, 2023.

Remaining emissions budget: A company's future emissions budget, in tons of CO2e, for limiting warming this century to 1.5°C or 2°C above preindustrial levels.

Science Based Targets initiative: A nonprofit organization established by CDP, the U.N. Global Compact, the World Resources Institute, the U.N. and the World Wildlife Foundation to assess corporate climate targets.

Scope 1 emissions: Companies' direct greenhouse gas emissions in tons of CO2e.

Scope 2 emissions: Companies' greenhouse gas emissions from electricity use in tons of C02e.

Scope 3 emissions: Companies' greenhouse gas emissions from across their value chain in tons of CO2e.

Appendix

The five listed companies with the largest revenue exposure to alternative energy, energy efficiency or green building in each GICS® industry group	Average of Total Impact Revenue
Capital Goods	**100.0**
Alfen NV	100.0
Blink Charging Co.	100.0
Hyliion Holdings Corp	100.0
Hyzon Motors Inc	100.0
Kempower Oyj	100.0
Plug Power Inc.	100.0
Utilities	**99.5**
CECEP Wind-Power Corporation	99.5
China Datang Corporation Renewable Power Co., Ltd.	99.5
Energix – Renewable Energies, Ltd.	100.0
Montauk Renewables Inc	99.2
Neoen S.A.	99.5
Equity Real Estate Investment Trusts (REITs)	**99.1**
Digital Realty Trust, Inc.	96.5
Klepierre S.A.	100.0
Lar Espana Real Estate SOCIMI, S.A.	100.0
Mapletree Pan Asia Commercial Trust	100.0
Mercialys S.A.	98.9
Automobiles & Components	**98.4**
Li Auto Inc.	97.4
Lucid Group, Inc	100.0
Rivian Automotive, Inc.	100.0
Tesla, Inc.	97.4
XPENG, Inc.	97.0
Software & Services	**84.4**
8X8, Inc.	55.9
Chindata Group Holdings Limited	96.9
CM.com N.V.	82.7
Kingsoft Cloud Holdings Limited	100.0
Tuya Inc.	86.5
Semiconductors & Semiconductor Equipment	**84.3**
Duk San Neolux Co., Ltd.	100.0
Enphase Energy, Inc.	75.0
Everlight Electronics Co., Ltd.	65.2
Shanghai Aiko Solar Energy Co., Ltd.	99.0
SMA Solar Technology AG	82.3

Energy	**83.8**
Enviva Inc.	95.9
Mitsuuroko Group Holdings Co., Ltd.	45.0
REX American Resources Corp.	79.2
VERBIO Vereinigte BioEnergie AG	99.3
Waga Energy S.A.	99.7
Real Estate Management & Development	**82.7**
Atrium Ljungberg AB	71.4
Deutsche EuroShop AG	95.9
Platzer Fastigheter Holding AB (public)	89.0
SOHO China Limited	82.2
Swire Properties Limited	75.2
Consumer Durables & Apparel	**79.3**
Crest Nicholson Holdings PLC	69.0
Installed Building Products, Inc.	64.1
KB Home	99.2
Meritage Homes Corporation	95.8
Neinor Homes S.A.	68.4
Transportation	**75.6**
BTS Group Holdings Public Company Limited	66.9
Central Japan Railway Company	68.3
FirstGroup PLC	61.0
MTR Corporation Limited	85.4
Taiwan High Speed Rail Corporation	96.2
Materials	**60.8**
Aspen Aerogels, Inc.	59.8
FutureFuel Corp.	79.0
Livent Corporation	57.0
Vulcan Energy Resources Ltd	64.4
Yunnan Energy New Material Co., Ltd.	43.7
Consumer Discretionary Distribution & Retail	**52.5**
Carasso Motors Ltd.	13.9
EVgo Inc.	64.3
Fastned BV	99.2
Hotai Motor Co., Ltd.	21.0
Isetan Mitsukoshi Holdings Ltd.	64.1
Technology Hardware & Equipment	**50.1**
Azbil Corporation	40.0
China Railway Signal & Communication Corporation Limited	53.0
L&F Co., Ltd,	56.3
Samsung SDI Co., Ltd.	56.3
Wiwynn Corporation	44.9
Commercial & Professional Services	**33.8**
Dynagreen Environmental Protection Group Co., Ltd.	51.8
Orizon Valorizacao de Residuos SA	20.3
Smart Metering Systems PLC	59.6
SungEel HiTech Co., Ltd.	10.9
TRE Holdings Corporation	26.2

Food, Beverage & Tobacco	**21.7**
Darling Ingredients Inc.	9.1
Jalles Machado S.A.	42.2
Khon Kaen Sugar Industry Public Company Limited	21.8
Sao Martinho S.A.	21.5
Suedzucker AG	13.9
Telecommunication Services	**12.0**
ARTERIA Networks Corporation	8.0
Bandwidth Inc.	15.7
CITIC Telecom International Holdings Limited	12.1
Tata Communications Limited	8.9
TIME dotCom Bhd.	15.3
Financial Services	**8.5**
Brookfield Corporation	16.8
Element Fleet Management Corp.	10.3
Orix Corporation	4.1
Ratos AB	6.7
WEX Inc.	4.7
Media & Entertainment	**6.1**
Baidu, Inc.	6.1
NHN Corporation	5.1
PubMatic, Inc.	3.6
Soft-World International Corporation	5.4
Tencent Holdings Limited	10.3
Consumer Staples Distribution & Retail	**1.6**
Health Care Equipment & Services	**0.1**
Household & Personal Products	**0.0**
Pharmaceuticals, Biotechnology & Life Sciences	**0.0**
Consumer Services	**0.0**
Insurance	**0.0**
Banks	**0.0**

Source: MSCI ESG Research, data as of March 31, 2023. Includes recent-year revenue from products, services or infrastructure projects that support development or delivery of renewable energy and alternative fuels, biomass or other alternative sources of energy; design, construction, redevelopment retrofitting or acquisition of green-certifiied properties; zero-emissions or hybrid vehicles, including essential components; or generation of renewable energy. Industry groups shown with exceedingly low or zero total impact revenue have insignificant revenue exposure to those categories.

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