



COP27 and COP15: The climate and nature crises

The MSCI Net-Zero Tracker

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



Introduction

'From summits to solutions'

There are two conferences in the latter half of 2022 that are set to impact how global stakeholders tackle climate change.

The first, in Sharm el-Sheikh, Egypt this November, will convene countries for the COP27 climate change conference, which aims to speed efforts to reduce global greenhouse gas emissions and unlock investment to help developing countries meet their energy needs and withstand the impacts of climate change.¹ Nations will meet again three weeks later in Montreal, Canada for the U.N. Biodiversity Conference, where they hope to hammer out a framework to protect and conserve nature.²

COP27 will mark a critical moment for assessing action by owners and managers of trillions of dollars of assets who have pledged to align their portfolios with the goal of an economy that removes as much greenhouse gas as it puts in. Achieving it means reducing their financed emissions in line with a series of increasingly ambitious targets.³ Investors look to companies to reduce emissions all along their value chain and transform their businesses for a net-zero world.

The MSCI Net-Zero Tracker indicates the collective progress of the world's listed companies toward keeping global temperature rise this century within 1.5 degrees Celsius (1.5°C) of preindustrial levels, the threshold for preventing the worst effects of a warming climate.⁴ It shows the companies with the largest carbon footprints, shines a light on corporate leaders and laggards in climate disclosure, and highlights companies whose climate targets are notable for their alignment with global goals to reduce emissions.

¹ COP27, Sharm el-Sheikh, Egypt 2022, "Vision & Mission." While this report does not address investor financing for the low-carbon transition in developing countries, we refer readers to MSCI ESG Research's 2022 ESG Trends to Watch, which discusses the need for creative conduits to close current funding gaps. See "2022 ESG Trends to Watch," MSCI ESG Research, December 2021.

² "U.N. Biodiversity Conference (COP15)," U.N. Environment Programme

³ For an example of targets, see "Target Setting Protocol, Second edition," U.N.-convened Net-Zero Asset Owner Alliance, January 2022. Financed emissions refers to investors' own Scope 3 emissions from their investments.

⁴ Represented by the MSCI All Country World Investable Market Index (ACWI IMI), which includes large-, mid- and small-cap listed companies across 23 developed market and 27 emerging market countries. With 9,248 constituents, the index covers approximately 99% of the global equity investment opportunity set, as of Sept. 30, 2022.

The climate and biodiversity crises demand decisive action

This edition of the MSCI Net-Zero Tracker also highlights the interrelationship between climate change and biodiversity. Since many of the largest companies are counting on carbon-absorbing forests to offset future emissions, the report looks at how the loss of forest cover – including from wildfires and deforestation – undermines both the permanence of those carbon offsets and the commitments they support.⁵

The perils of climate change and loss of biodiversity share both drivers and solutions. Climate change and deforestation threaten ecosystems and species. Nature and natural ecosystems remove carbon from the atmosphere and shield countries and communities from the physical impacts of climate change.⁶ There can be no resolution of either crisis without a joint confrontation of both.

COP27 will arrive 11 months into a year that makes apparent the urgency of climate action. Evidence of the effects of warmer temperatures – from record heat waves to flooding and drought – surrounds us.⁷ Russia's war in Ukraine has caused energy prices to skyrocket and forced Europe to rely more on coal and liquified natural gas.⁸ Greenhouse gas emissions must peak by 2025 if we are to minimize catastrophic warming.⁹ The costs of inaction dwarf the costs of lowering emissions now.¹⁰

But tailwinds have formed too. The energy crisis has spurred the European Union and the U.K. to hasten the pivot of their economies to sustainably produced energy.¹¹ The U.S. has passed a landmark climate law that could drive trillions of dollars of investment in clean energy.¹² Though coal remains part of the global energy picture, renewables made up about 85% of all new electrical capacity globally last year.¹³ Financial regulators in at least 10 large economies are introducing climate-related disclosure rules for listed companies and other market participants.¹⁴

Egypt's foreign minister has said that COP27 needs to move the world from "summits to solutions."¹⁵ The Net-Zero Tracker, by examining the collective carbon footprint and emissions trajectory of listed companies, connects the decarbonization of investment portfolios to the decarbonization of the global economy. It reports on action.

5 Irfan, Umar. "Can you really negate your carbon emissions? Carbon offsets, explained," Vox, Feb. 27, 2020.

6 "Sixth Assessment Report, Impacts, Adaptation and Vulnerability," Intergovernmental Panel on Climate Change, Feb. 27, 2022.

7 See, for example, "High temperatures exacerbated by climate change made 2022 Northern Hemisphere droughts more likely," World Weather Attribution, Oct. 5, 2022. See also, "Climate change likely increased extreme monsoon rainfall, flooding highly vulnerable communities in Pakistan," World Weather Attribution, Sept. 14, 2022, and "Climate Change made India and Pakistan's 2022 early heatwave '30 times more likely,'" Carbon Brief, May 23, 2022.

8 Romei, Valentina and Arnold, Martin. "Germany Turns to Coal for a Third of its Electricity," Financial Times, Sept. 7, 2022. See also, Koc, Cagan and Shiryaevskaya, Anna. "New Gas Terminals Arrive to Ease Putin's Grip on Europe," Bloomberg, Sept. 8, 2022.

9 "Climate Change 2022: Mitigation of Climate Change," Intergovernmental Panel on Climate Change, April 4, 2022.

10 See "What the War in Ukraine Could Mean for Net-Zero Investing," MSCI ESG Research, May 16, 2022. See also, "Further Delaying Climate Policies Will Hurt Economic Growth," International Monetary Fund, Oct. 5, 2022.

11 "REPowerEU: affordable, secure and sustainable energy for Europe," European Commission, May 18, 2022. See also, "British energy security strategy," Department for Business, Energy & Industrial Strategy and Prime Minister's Office, 10 Downing Street," April 7, 2022.

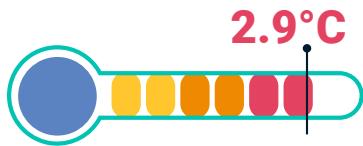
12 Princeton University Zero Lab. "Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022," August 2022.

13 "Power Transition Trends 2022," Bloomberg NEF, Sept. 21, 2022.

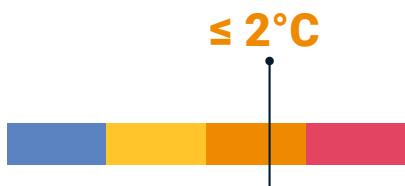
14 Uddin, Zohir and Wu, Emma. "As TCFD Comes of Age, Regulators Take a Varied Approach," MSCI ESG Research, April 21, 2022.

15 Murphy, Katharine, "COP27 summit must focus on how world will adapt to climate change, says UN envoy." The Guardian, July 13, 2022.

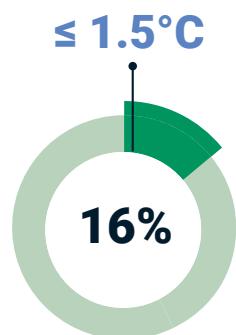
Key findings



Listed companies are on track to cause average global temperatures to rise by 2.9°C above preindustrial levels.



Nearly half (49%) of listed companies align with future warming of 2°C, putting them at the high end of the Paris Agreement goal of keeping warming well below 2°C, preferably to no more than 1.5°C, above preindustrial levels.



Sixteen 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.

Action needed on warming

Listed companies are on track to warm the planet 2.9° Celsius by the end of the century, the same as we projected in June 2022.¹⁶

- » Sixteen percent of listed companies align with keeping global warming at or below 1.5°C — the threshold above which scientists say the effects of climate change become much more extreme.¹⁷
- » One-third of listed companies align with keeping global warming at or below 2°C, putting them at the high end of the Paris Agreement goal of keeping warming well below 2°C, preferably to no more than 1.5°C, above preindustrial levels.¹⁸
- » The remainder (51%) of listed companies align with future warming of greater than 2°C.
- » Every region has listed companies that are misaligned with global climate goals.

1.5°C waits for no one

Listed companies are on track to put 10.9 gigatons (billion tons) of direct Scope 1 greenhouse gas emissions into the atmosphere this year, up about one percent from 2021 but down 4.4% from their pre-pandemic high.¹⁹

The time remaining for listed companies to limit warming to 1.5°C shrank by two months since June.²⁰ We estimate that listed companies will use up their share of the global carbon budget for keeping temperature rise below 1.5°C by Dec. 31, 2026.²¹

Targets at risk

Companies that together represent nearly two-thirds (64%) of global greenhouse emissions rely on carbon offsets to achieve their net-zero goals.²² While offsets that rely on the conservation or planting of forests are among the most common, the forests that generate those offsets are at risk of being destroyed by deforestation and wildfires that are themselves made worse by climate change.

16 Data as of Aug. 31, 2022. For universe of listed companies, see footnote 4, above. See also "The MSCI Net-Zero Tracker," MSCI ESG Research, June 2022.

17 See "Global Warming of 1.5°C," Intergovernmental Panel on Climate Change, Oct. 8, 2018

18 U.N. Climate Change. "What is the Paris Agreement?" See also, IPCC. "Global Warming of 1.5°C." Oct. 6, 2018.

19 MSCI estimate, based on company emissions data where available. Where such data is unavailable, MSCI estimates MSCI ACWI IMI emissions based on Carbon Monitor data (www.carbonmonitor.org).

20 "The MSCI Net-Zero Tracker," MSCI ESG Research, June 2022

21 The calculation reflects listed companies' share of the global budget for limiting the rise in average temperatures to 1.5°C, as of Aug. 31, 2022.

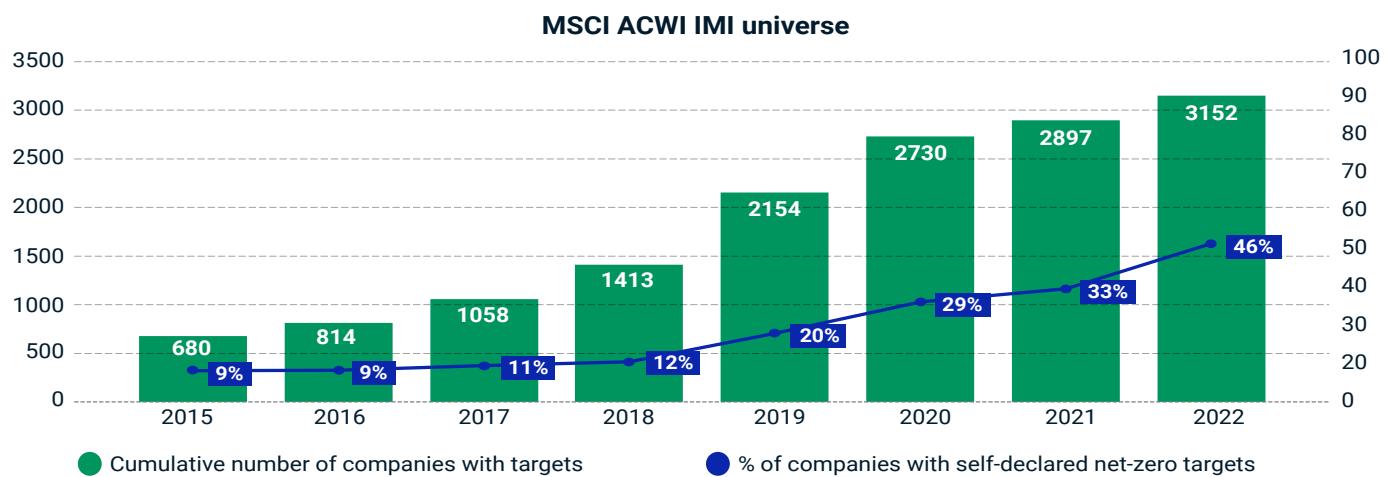
22 Arnold, Jack and Toledano, Perrine. "Corporate Net-Zero Pledges: The Bad and the Ugly," Columbia Center on Sustainable Investment, Dec. 1, 2022

Not all net-zero targets are created equal

Investors who align their strategies with a 1.5°C decarbonization pathway increasingly expect companies to target net-zero emissions by 2050 before they will consider investing.²³ While (36%) of listed companies have set a decarbonization target, less than half (46%) of them have declared some type of net-zero target, data from MSCI ESG Research shows.

Self-declared corporate net-zero targets vary broadly. Some aim to balance carbon emissions with carbon removal. Others plan to reduce direct emissions but not those from the company's suppliers or customers. Some intend to simply boost the company's use of energy from renewable sources. Fewer listed companies still have a net-zero target approved by the Science Based Targets initiative (SBTi), which calls for reporting total value chain emissions from Scope 1, 2 and 3 categories, reducing emissions to zero or residual levels by 2050, and offsetting residual emissions. Only 41 constituents of the MSCI ACWI IMI Index have set an SBTi-approved net-zero target, while 577 companies (6.3% of index constituents) have committed to set one in the future, as of Aug. 31, 2022.²⁴

Cumulative number of listed companies with some type of net-zero target



Source: MSCI ESG Research. Data on companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022. When target announcement dates were not disclosed, we assumed the targets were set in 2021.

While MSCI has developed a Target Scorecard to help evaluate corporate decarbonization targets consistently, investors continue to need consistent, comparable, and timely information on progress by companies toward achieving them.²⁵ Less than half (44%) of listed companies have disclosed any of their carbon emissions, as of Aug. 31.²⁶ Fewer still – about 30% – disclosed any of emissions from their value chain, or Scope 3, the largest source of emissions for all but a handful of industries. Ninety-two percent of financial institutions, companies and other stakeholders surveyed recently by the Glasgow Financial Alliance for Net Zero ranked limited disclosure of companies' Scope 3 emissions as their top climate-related data challenge.²⁷

²³ See, for example, "Proposed Rule: The Enhancement and Standardization of Climate-Related Disclosures for Investors," Securities and Exchange Commission, March 21, 2022, page 267

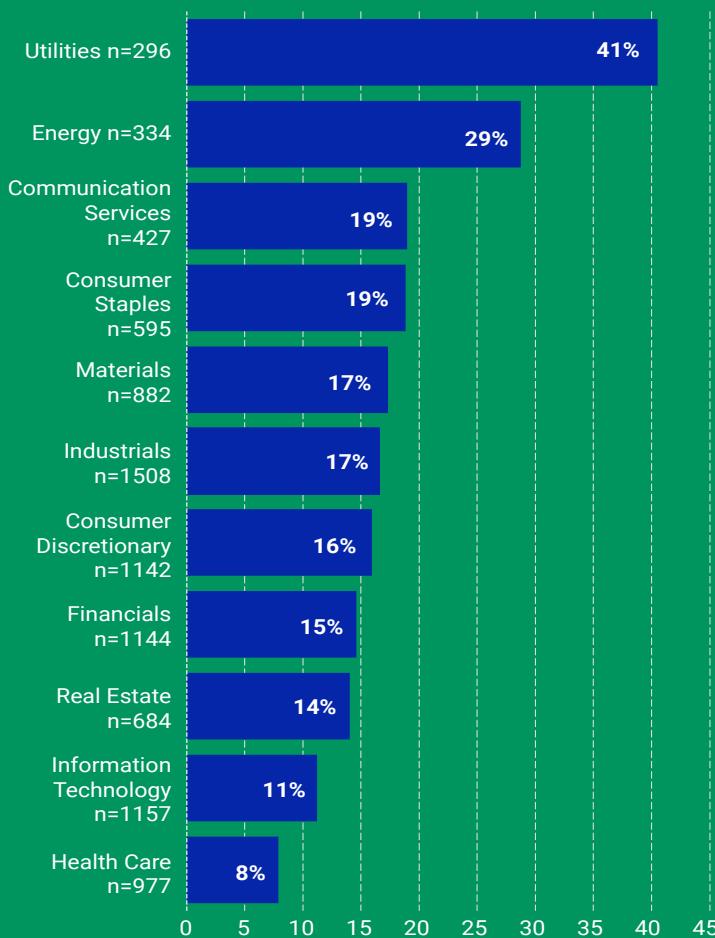
²⁴ MSCI analysis, based on the data published by SBTi, as of August 2022

²⁵ "Breaking Down Corporate Net-Zero Climate Targets," MSCI ESG Research, May 24, 2021

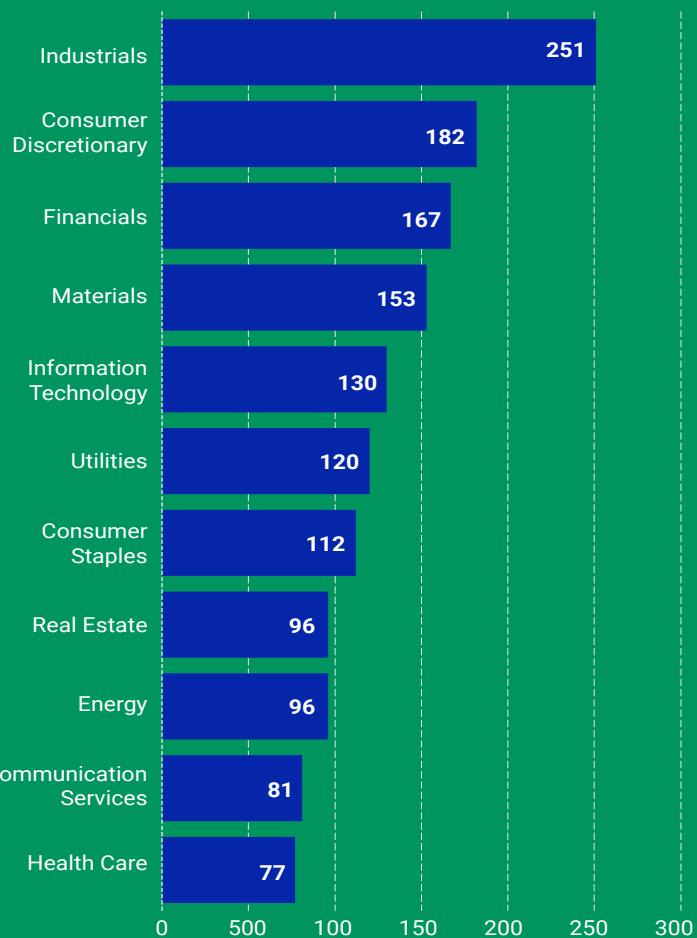
²⁶ MSCI ESG Research, data as of Aug. 31, 2022

²⁷ "Development of the Net-Zero Data Public Utility," Climate Data Steering Committee, Glasgow Financial Alliance for Net Zero, September 2022

Percentage of companies with self-declared net-zero targets by GICS® sector



Number of companies with self-declared net-zero targets by GICS® sector

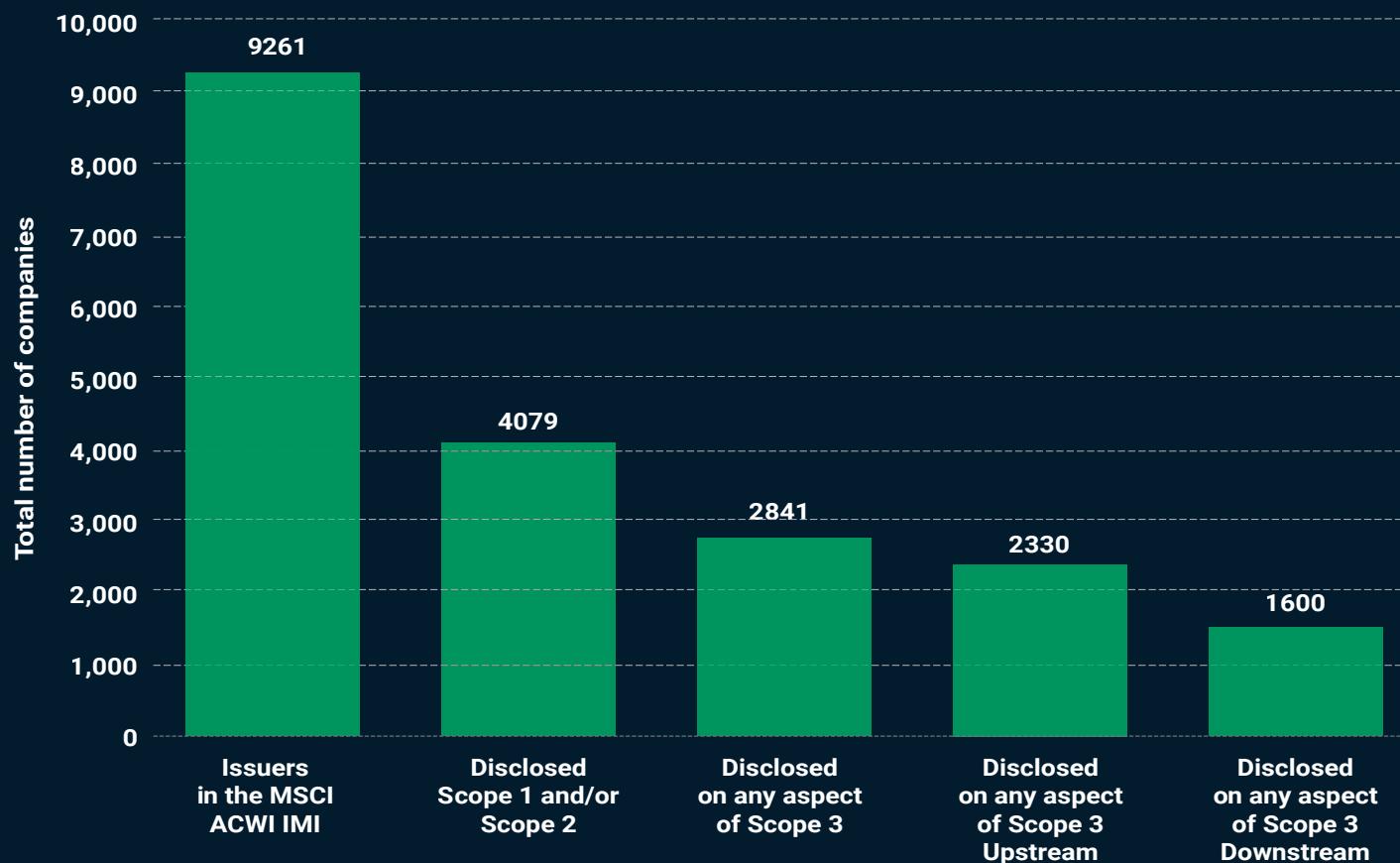


Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022. Sectors from the Global Industry Classification Standard (GICS®) is a global industry classification standard jointly developed by MSCI Inc. and S&P Global Market Intelligence. The GICS® structure comprises 11 sectors, 24 industry groups, 69 industries and 158 sub-industries.

Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022

Clients can log in to MSCI Climate Lab to view the latest alignment of listed companies with global temperature targets together with corporate emissions profiles in detail. To learn more about Climate Lab, contact your MSCI representative or reach out via msci.com/contact-us.

Scope 3 emissions remain a black box



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

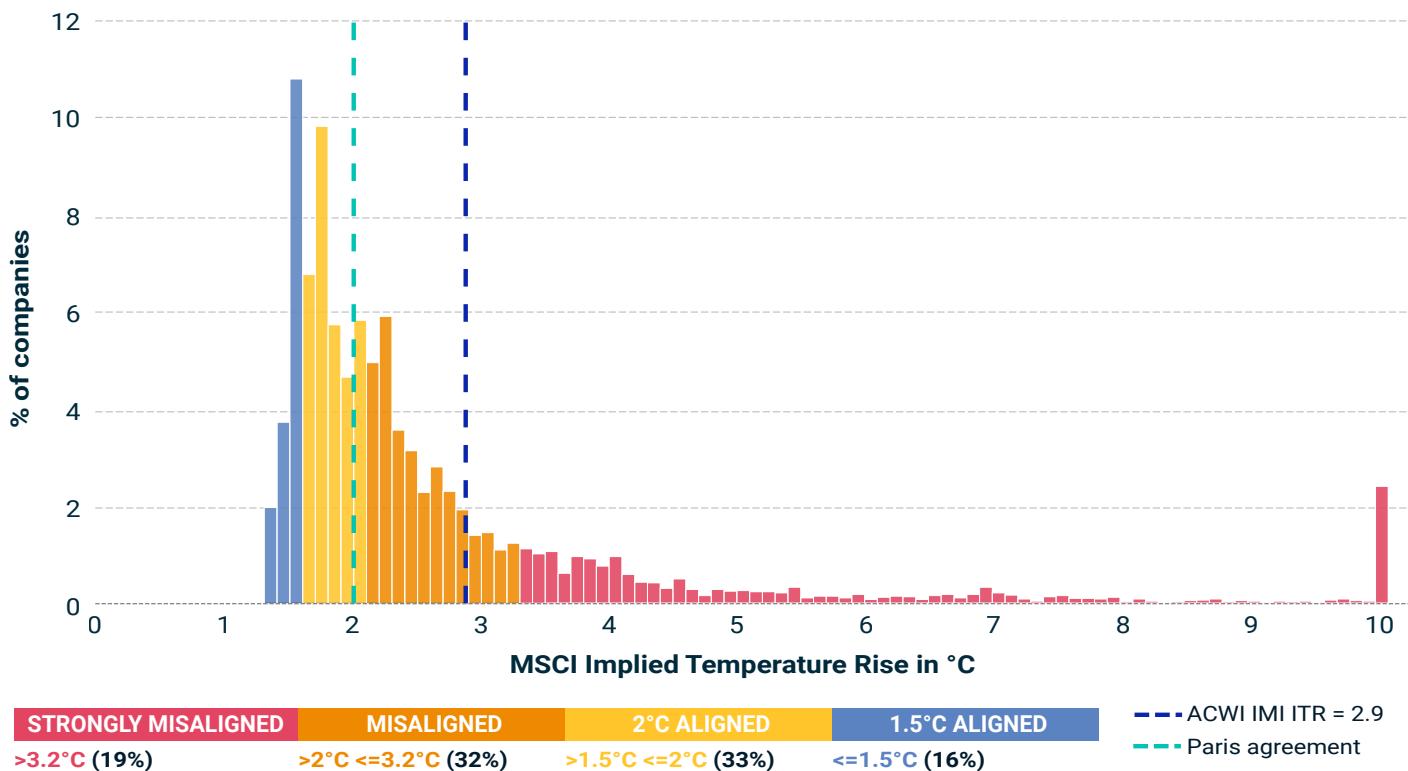


The need for action

Listed companies are putting greenhouse gases into the atmosphere at a rate that would make the planet 2.9°C warmer, unchanged from their contribution to future warming we projected in June 2022.²⁸ Nearly half (49%) of listed companies are on track to keep warming below 2°C, while 16% align with a 1.5°C temperature rise, about the same as in June.²⁹

Companies need to raise their climate ambition. To appreciate by how much, consider the range of decarbonization recommended by the U.N.-convened Net-Zero Asset Owner Alliance, which calls for members to target a reduction in financed emissions for listed equity and debt, real estate and physical infrastructure, of 22% to 32% by 2025 and 49% to 65% by 2030, followed by further decreases to net-zero by 2050 in line with a 1.5°C pathway.³⁰

Listed companies are on track to make the world 2.9°C warmer



Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022

²⁸ The estimate metric reflects companies' collective implied temperature rise, which estimates what the increase in average temperatures this century would be were the economy to over- or undershoot the global carbon budget by the same amount as the company in question. See "Implied Temperature Rise Methodology," MSCI ESG Research, September 2021.

²⁹ Though we reported in June 2022 that 11% of listed companies aligned with a 1.5°C temperature rise, we have since included within this set of companies those that align with an implied temperature rise between 1.50°C and 1.55°C. Had we rounded similarly to calculate the corresponding set of companies for the June edition of the Net-Zero Tracker, that report would have showed that 17% of companies aligned with future warming of 1.5°C. See, "The MSCI Net-Zero Tracker," MSCI ESG Research, June 2022.

³⁰ "Target Setting Protocol, Second Edition." UN-convened Net-Zero Asset Owner Alliance, January 2022. The Net Zero Asset Managers Initiative also requires its members to target net-zero five years at a time and to transition their portfolios to net-zero by 2050 in line with efforts to limit warming to 1.5°C. See "The Net Zero Asset Managers Commitment," Net Zero Asset Managers Initiative.

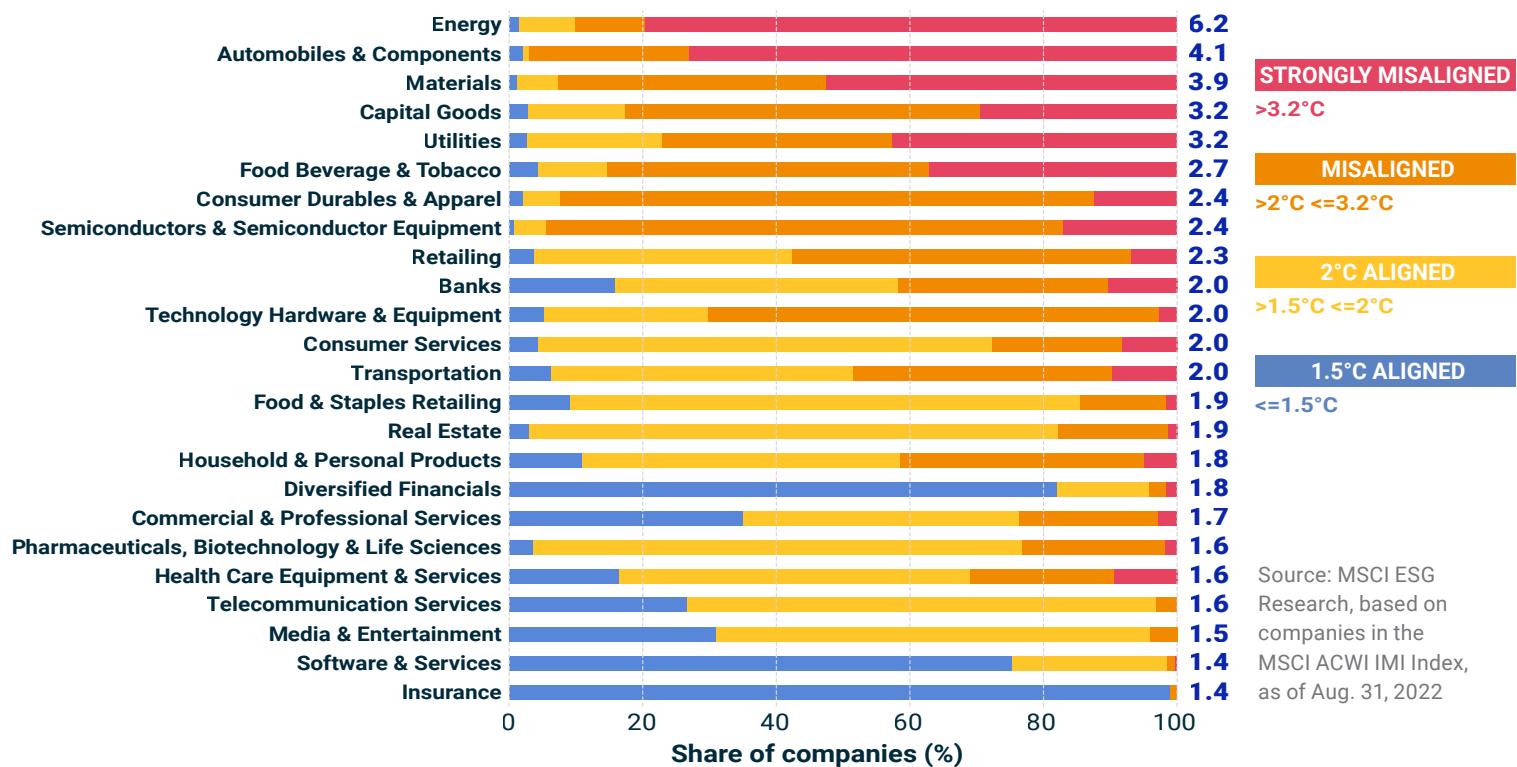
Going where the emissions are

Only three of 24 industry groups align with keeping future warming at or below 1.5°C, according to our calculation of implied temperature rise, which uses companies' current emissions, reported emissions-reduction targets and other data to project their absolute scope 1, 2 and 3 emissions over the next five decades.³¹ Misaligned industries range from the biggest emitters of greenhouse gases, such as energy and utilities, that put carbon into the atmosphere directly from their operations to those with large value-chain related emissions such as retailing and real estate. While the implied temperature rise for four of the five highest-emitting industries has ticked down since June

2022, the drop reflects an increase in their revenue-aligned carbon budgets because of higher revenues from soaring energy prices rather than a change in their absolute emissions.³²

To achieve net-zero in the global economy, investors will need to identify and support companies in every industry that are decarbonizing. That means investing in companies based on their projected emissions pathway rather than their current carbon footprint. For the economy to reach net-zero by 2050, every company on track to exceed globally agreed thresholds will have to decarbonize.

Implied temperature rise by GICS® industry group



Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022

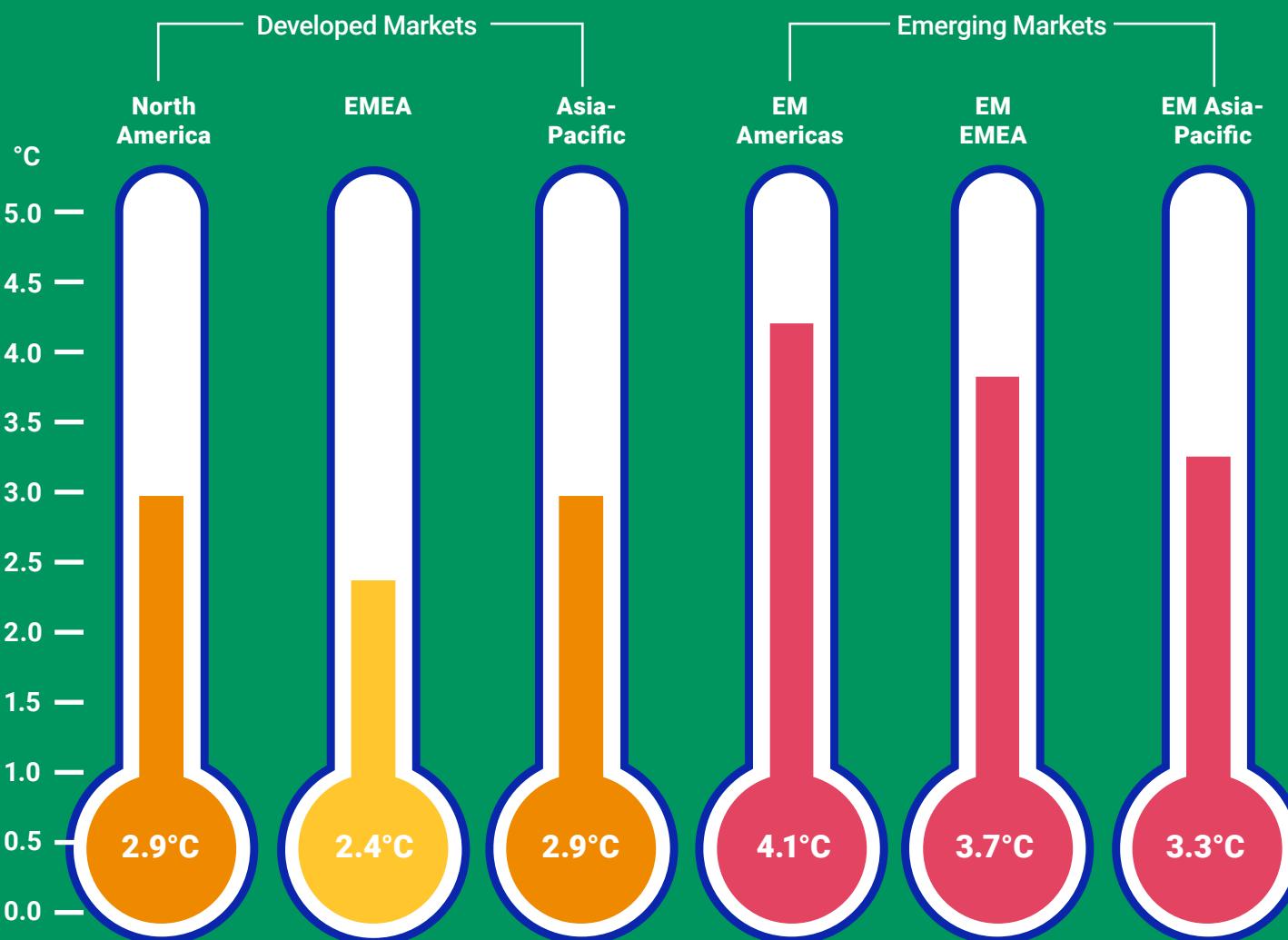
³¹ See "Implied Temperature Rise Methodology," MSCI ESG Research, September 2021. The implied temperature rise of banks, diversified financials and insurance industry groups covers carbon emissions from portfolio investments and commercial loans with known use of proceeds, as directed by the Greenhouse Gas Protocol, which requires that companies account for the proportional emissions of such investments. Our methodology does not currently cover emissions of investments made by insurance companies via separate accounts.

³² MSCI's Implied Temperature Rise methodology uses revenue as a proxy for size. We allocate an annual carbon budget to companies based on their reported Scope 1 and 2 emissions and their estimated Scope 3 emissions and revenue, in line with guidance issued by the Portfolio Alignment Team for the Task Force on Climate-related Financial Disclosures. The change in carbon budget allocated to the energy industry, for example, caused the implied temperature of that sector to fall to 6.2°C, as of Aug. 31, from 6.8°C, as of May 31. See MSCI ESG Research, "The MSCI Net-Zero Tracker," June 2022.

Companies in every region need to decarbonize

There are listed companies in every region putting greenhouse gases into the atmosphere at a rate that will breach 1.5°C.³³ While every ton of carbon warms the planet to the same extent wherever it is produced, there is a difference in the carbon budgets allocated to each region and the region's associated total emissions. The implied temperature rise of listed companies therefore varies by region.

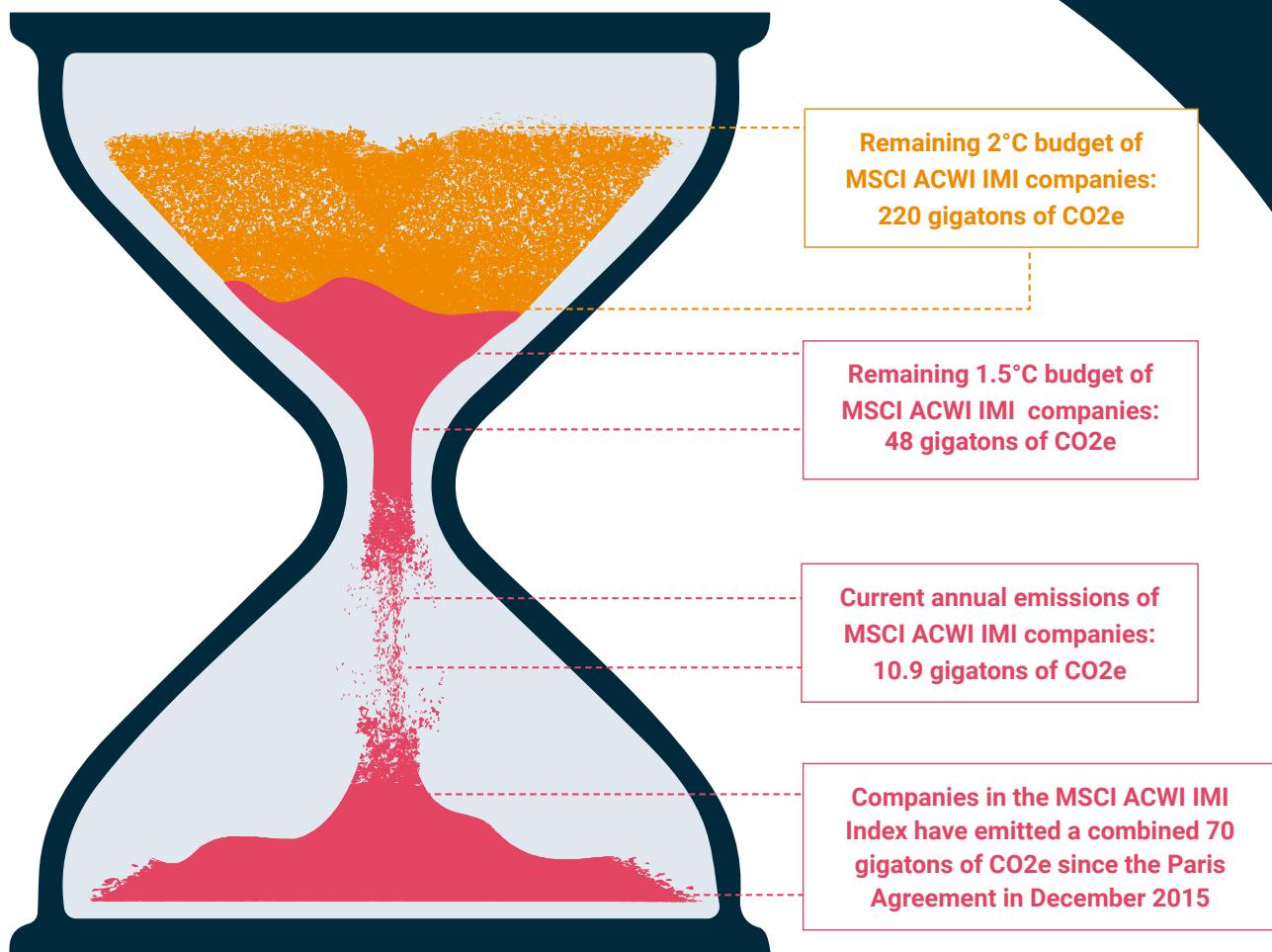
Implied temperature rise



Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022

³³ For the definition of developed- and emerging-market regions, see "MSCI Market Classification Framework," June 2022

Time to avoid the worst effects of climate change is slipping away



As of Aug 31, 2022

The hourglass above and countdown clocks below 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 Aug. 31, 2022. Emissions for 2021 that companies haven't yet reported and 2022 figures 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 Aug. 31, 2022.



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

As of Aug 31, 2022

Listed companies would deplete their share of the global emissions budget for limiting temperature rise to 1.5°C by Dec. 31, 2026, based on their emissions as of Aug. 31, 2022. That is two months sooner than we estimated in June, when we reported that companies would use up their share of the global carbon budget within 57 months.³⁴ Every passing month means the goal is less likely to be met.

- » To limit warming to 1.5°C, listed companies would need to collectively cap future Scope 1 emissions at 48 gigatons of CO₂e by 2050. Without any change to their current emissions of nearly 11 gigatons a year, listed companies would deplete their remaining emissions budget in 4 years, 4 months.
- » To limit warming to 2°C, listed companies would need to collectively cap future Scope 1 emissions at 220 gigatons of CO₂e by 2050. Without any change to their current emissions of nearly 11 gigatons a year, listed companies would deplete their remaining emissions budget in 20 years, 1 month.

³⁴ The June edition of the Net-Zero Tracker reflected listed companies' greenhouse gas emissions as of May 31. The time remaining before companies use up their share of the global carbon budget shrank by five months between May 31 and Aug. 31, a period of only three months, hence our reporting here that companies could deplete their current share of the budget two months sooner than we reported in June.

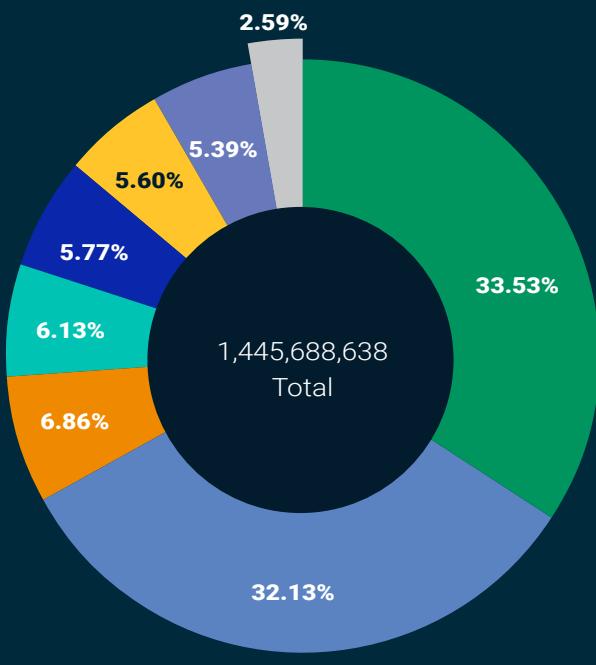


Climate targets in jeopardy

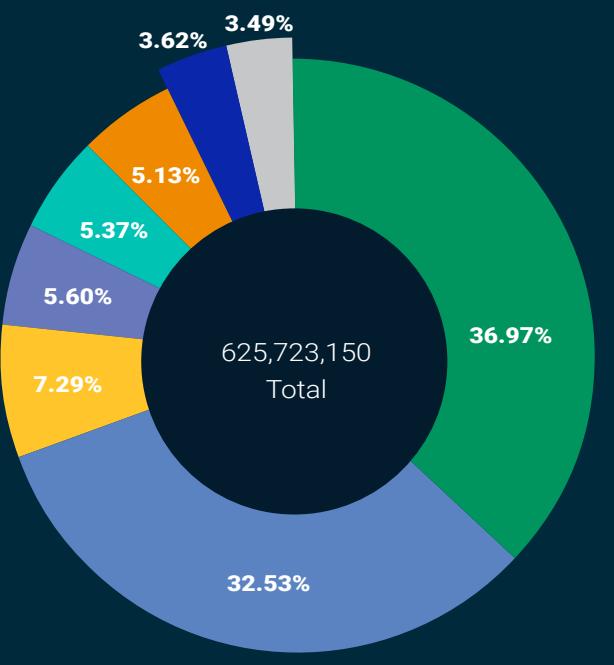
Climate change is threatening to undermine corporate decarbonization targets that are themselves designed to limit future warming. As many as two-thirds of such targets set by companies in industries that collectively represent 64% of direct global greenhouse gas emissions are premised on the use of carbon offsets, an analysis by researchers at Columbia University finds.³⁵

Nearly one-third (32%) of carbon offsets issued to date are tied to planting or preserving forests, according to data from the global offsets rating agency BeZero Carbon.³⁶ Among the 10 listed companies with the largest carbon footprints that have declared some type of net-zero target, at least two – Saudi Aramco and Shell – are making forest-based offsets part of their net-zero strategies, while a third, BP, is investing in forest-based offsets that it can use or sell to customers.³⁷

Carbon offsets issued, by sector



Carbon offsets outstanding, by sector



Source: BeZero Carbon, data as of Sept. 16, 2022. Data indicates offsets since 1995 stored in registries maintained by Verra, The Gold Standard, Climate Action Reserve and the American Carbon Registry. Offsets issued refers to the total number of offsets. Offsets outstanding refers to the number of offsets that have yet to be retired.

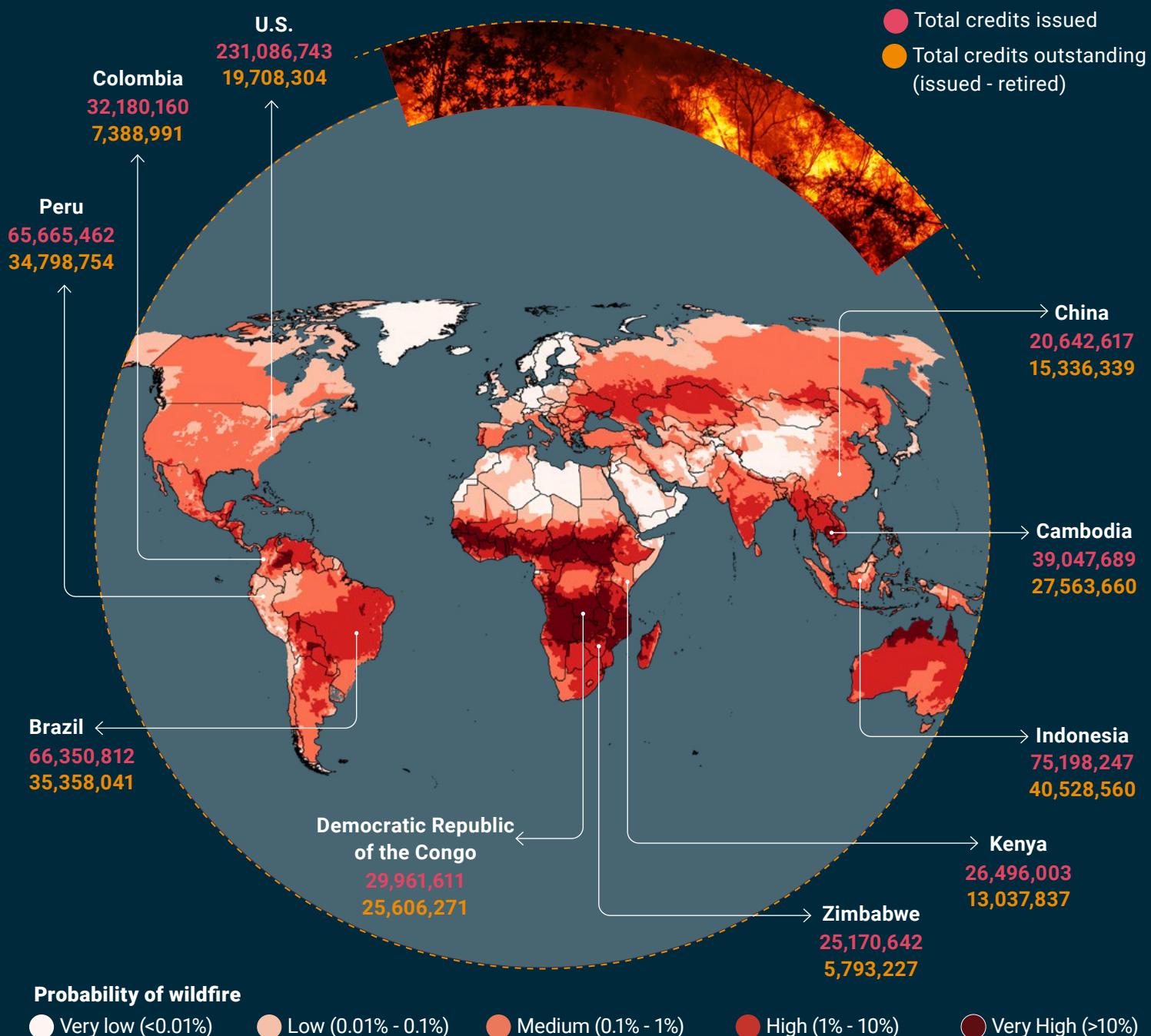
³⁵ Arnold and Toledano. "Corporate Net-Zero Pledges."

³⁶ Activity covered by the offsets includes establishing forests on land not previously forested, protecting forests that would otherwise be cut down, improving forest management, preserving grasslands and peatlands, and providing developing countries with a financial incentive to preserve forestland.

³⁷ "Saudi Aramco Sustainability Report 2021." Saudi Aramco, 2021; "Nature-based solutions." Shell, available at shell.com; "Sustainability Report 2021." BP, 2021.

Though the integrity of forest-based offsets depends in part on their permanence, the growing risk of wildfires, itself a consequence of climate change-induced heat and drought, threatens to destroy the natural carbon reservoirs that such offsets are designed to provide.³⁸ Fires, which also result from manmade burning to convert forests to farmland, mean the loss of crucial carbon sinks; the world's forests absorb an estimated 7.6 billion tons of carbon annually, or about one-and-a-half times the annual emissions of the U.S.³⁹ As the map below shows, significant numbers of nature-based offsets are located in areas that are at medium to high risk of wildfires.

Forest-based offsets in the path of wildfires, based on wildfire probability, 2050



Source: Offsets data from BeZero Carbon, as of Sept. 16, 2022. Wildfire data from MSCI ESG Research, as of Aug. 31, 2022.

38 "Core Carbon Principles Assessment Framework and Assessment Procedure." The Integrity Council for the Voluntary Carbon Market. July 2022.

39 "NASA Satellites Help Quantify Forests' Impact on Global Carbon Budget." NASA, Feb. 3, 2021. See also, McGrath, Matt. "Climate Change: Spike in Amazon Emissions Linked to Law Enforcement." BBC News, Sept. 23, 2022.

Sponsors of forest-based offsets typically set aside some of them in reserve to guard against fire damage, but evidence suggests the set-asides themselves may be heavily encumbered. Wildfires have depleted 95% of set-aside forest offsets in California's emissions cap-and-trade program, for example.⁴⁰ Because protected forests that burn no longer absorb CO₂ emissions, the risks raise the question whether companies that purchase offsets will be able to use them in their carbon accounting.⁴¹

While wildfires and forestry are the main cause of tree loss in northern and temperate forests, tropical forests are destroyed primarily by deforestation, including clearing for agriculture and logging.⁴² Nearly 30 listed companies in the materials, energy, utilities and consumer staples sectors have as many as 7,000 assets in areas that are being deforested, data from MSCI ESG Research shows.⁴³



⁴⁰ Badgley, Grayson et. al. "California's Forest Carbon Offset Buffer Pool is Severely Undercapitalized." Aug. 5, 2022.

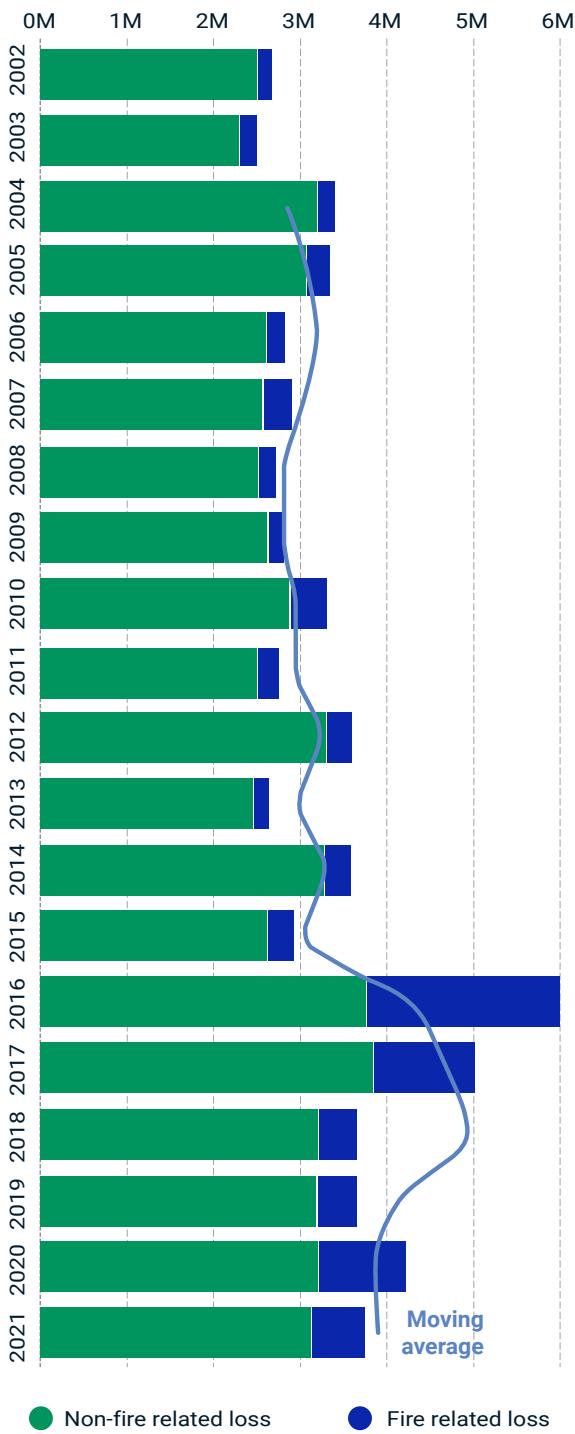
⁴¹ As the Securities and Exchange Commission noted in its proposed rule on climate-change disclosures, "the value of an offset may decrease substantially and suddenly if, for example, the offset represents protected forest land that burns in a wildfire and no longer represents a reduction in [greenhouse gas] emissions." See, "Proposed Rule: The Enhancement and Standardization of Climate-Related Disclosures for Investors." Securities and Exchange Commission, March 21, 2022, page 79.

⁴² World Resources Institute | Global Forest Review. "Forest Pulse: The Latest on the World's Forests."

⁴³ Data reflects companies in the MSCI ACWI IMI Index, as of Aug. 31, 2022.

Tropical primary forest loss , 2002-2021

Primary forest loss (hectares)



Source: World Resources Institute | Global Forest Watch

Nature-related risks and warming

Deforestation also has disastrous impacts on biodiversity. Forests shelter 80% of land-based species and safeguard the health of ecosystems by preventing erosion and, together with terrestrial ecosystems, enhance biodiversity and help regulate the climate.⁴⁴ Among the items on the agenda at COP27 will be a push by delegates to speed action to protect forests between now and 2030.⁴⁵ The effort follows a pledge by more than 140 countries at COP26 in Glasgow to work together to protect and restore forests, including by aligning financial flows with the global goal of reversing their loss and degradation.⁴⁶

More broadly, half of global economic output depends on nature, which is threatened by changes in land use that link to deforestation, overharvesting of resources, climate change, pollution and invasive alien species.⁴⁷ Biodiversity loss and climate change go hand in hand, both from a perspective of drivers of impact and solutions. Oceans, for example, absorb roughly 30% of the carbon dioxide released into the atmosphere.⁴⁸ But as the buildup of CO₂ in the atmosphere dissolves into oceans, they become more acidic, impacting marine life. More than three-quarters of food crops rely on pollination, which is weakened by climate change and deforestation.⁴⁹

Unless society limits warming to 1.5°C, “climate change is likely to become the dominant cause of biodiversity loss in the coming decades,” the World Wild Fund for Nature and the Zoological Society of London write in their latest Living Planet Report.⁵⁰ Failure to reduce or adapt to nature-related risks creates risk for financial institutions and financial stability.⁵¹ Companies and investors increasingly need to understand both their dependencies and impacts on nature to have a meaningful understanding of their risks and opportunities.⁵²

Make nature part of risk management

Investors can estimate the vulnerability of their investments to wildfire using MSCI’s Climate Value-at-Risk, which delivers a forward-looking assessment designed to help investors understand the possible financial impact of climate-related risks on the value of listed equities, corporate bonds and commercial real estate. MSCI is also introducing a tool designed to help investors screen their investments for exposure to companies whose activities contribute to deforestation and damage to nature, and to map their dependencies accordingly.

See our Climate and Net-Zero Solutions at msci.com.

⁴⁴ See “Life on Land,” U.N. Sustainable Development Goals. See also “Forests and Terrestrial Ecosystems (Landscapes).” The World Bank, June 23, 2022.

⁴⁵ “Leaders Will Build on Glasgow Legacy to Establish Forests & Climate Leaders’ Partnership at COP27.” U.K. Government, Sept. 21, 2022

⁴⁶ “Glasgow Leaders’ Declaration on Forests and Land Use,” UN Climate Change Conference 2021, Nov. 2, 2021

⁴⁷ “Becoming #GenerationRestoration: Ecosystem Restoration for People, Nature and Climate.” U.N. Environment Programme, June 3, 2021. See also, See also, “Global Assessment Report on Biodiversity and Ecosystem Services.” Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, May 5, 2019.

⁴⁸ “Ocean Acidification.” National Oceanic and Atmospheric Administration, April 1, 2020.

⁴⁹ See also, “Pollinators and Climate Change.” National Park Service, Dec. 2, 2021.

⁵⁰ “Living Planet Report 2022 Building a Nature-Positive Society,” World Wild Fund for Nature in collaboration with the Zoological Society of London, Oct. 13, 2022

⁵¹ “Statement on Nature-Related Financial Risks.” Network for Greening the Financial System, March 24, 2022.

⁵² The Task Force on Nature-related Financial Disclosures is developing a voluntary framework for reporting nature-related risks and opportunities designed to help investors and other financial-market participants consider how they may be interacting with ecosystems that present high biodiversity risk. See, “The TNFD Nature-Related Risk and Opportunity Management and Disclosure Framework Beta v0.2,” June 2022.

Global and listed company Scope 1 emissions



The measure that matters is whether global greenhouse gas emissions are going up or down. Though the steady increase in emissions has slowed as the global economy continues to recover from the pandemic, their trajectory has yet to suggest the pandemic-induced drop was anything more than a one-off. We estimate that direct (Scope 1) emissions of the world's listed companies will edge up about 1% this year after climbing 6.9% in 2021. Listed company Scope 1 emissions are forecast to account for nearly one-fifth (18%) of this year's total projected global GHG emissions of 60.4 gigatons.

The table below shows total MSCI ACWI IMI Scope 1 greenhouse gas emissions (sum for all constituents without index weighting) and total global emissions, as of Aug. 31, 2022.

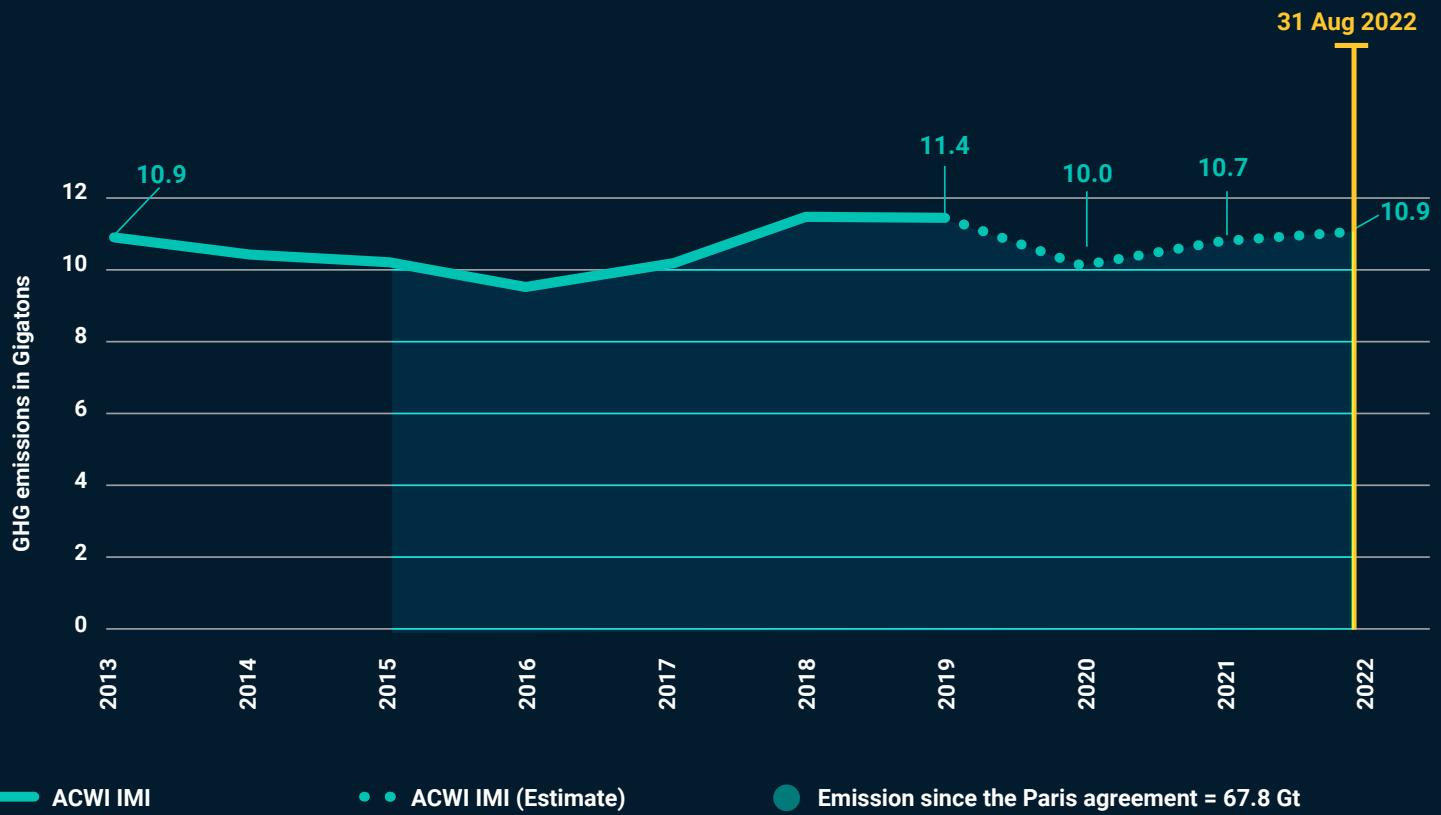
Historical greenhouse gas emissions [Gt CO ₂ e]	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Global greenhouse gas emissions*	51.2	51.7	51.8	51.9	53.5	55.3	59.1	55.8	59.6	60.4
ACWI IMI Scope 1**	10.9	10.4	10.2	9.6	10.2	11.4	11.4	10.1	10.8	10.9

* Global emissions through the end of 2021 are based on annual UN Environment Programme reports. The estimate for 2022 reflects changes in emissions as reported by Carbon Monitor. Data reflects cumulative GHG emissions.

** MSCI ACWI IMI emissions for 2020 as reported by companies or estimated by MSCI where not reported. Emissions for 2021 and 2022 are estimated from changes in emissions as reported by Carbon Monitor.

Scope 1 greenhouse gas emissions of listed companies

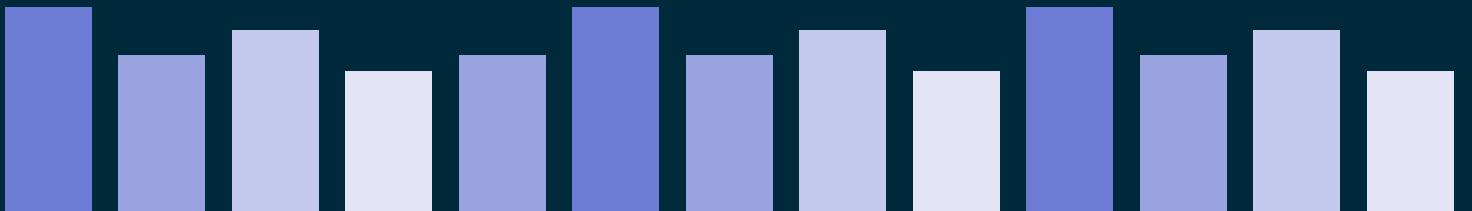
Listed companies' direct emissions continue to climb but have come down from levels that preceded the pandemic. Emissions must fall further and faster if society is to limit the rise in average global temperatures to 1.5°C.



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



The 10 listed companies with the largest carbon footprints



Ten listed companies are responsible for 5.5% of all listed-company direct (Scope 1) emissions. The table below shows the 10 listed companies with the highest total GHG emissions in the 12 months that ended Aug. 31, 2022. It also shows the contribution of each of those companies' emissions to the total emissions of listed companies, as well as differences in transparency.

Issuer	Country	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]	Total carbon emissions [million 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	74.9	6.4	2044.8	Not Available	2126.2	Estimated only***	3.1%	Y
Coal India Ltd	India	16.7	1.5	997.7	Not Available	1015.9	Estimated only***	1.5%	Y
Exxon Mobil Corporation	U.S.	105.0	7.0	747.8	540.0	859.8	76%	1.3%	
PetroChina Company Limited	China	121.4	38.2	664.7	Not Available	824.3	19%	1.2%	
Shell PLC	U.K.	63.0	9.0	656.6	1339.6	728.6	194%	1.1%	Y

Issuer	Country	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]	Total carbon emissions [million 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)
Rio Tinto PLC	U.K.	22.7	8.4	658.9	553.5	690.0	85%	1.0%	Y
BHP Group Limited	Australia	10.0	6.2	670.8	402.5	687.0	61%	1.0%	
China Shenhua Energy Company Limited	China	126.7	8.2	530.3	Not Available	665.2	20%	1.0%	
BP P.L.C.	U.K.	36.5	2.6	619.2	303.6	658.3	52%	1.0%	Y
Rio Tinto Limited	Australia	22.7	8.4	619.4	553.5	650.5	90%	1.0%	Y

* 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 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 emissions.

**** Because companies share their value chain with multiple other companies, double counting is unavoidable when estimating Scopes 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 it produces, including oil, natural gas, liquified 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.

Shining a light on disclosure: leaders and laggards



Investors need companies to report their carbon footprint across all emissions scopes and categories to assess the contribution of every company to climate change.⁵³ Disclosure enables investors to measure the carbon intensity of companies, model climate-related financial risk and its possible impact on the performance of portfolios, and allocate capital accordingly.

Listed companies with improved emissions reporting

The table below shows a sample of 10 of the nearly 80 companies in the MSCI ACWI IMI that reported additional scopes or categories of greenhouse gas emissions in the 12 months that ended Aug. 31, 2022, and that are now reporting substantially all their emissions across all emissions scopes. Clients can view the complete list in MSCI Climate Lab.

Issuer	Country	Total reported emissions [million tons of CO ₂ e]	Total estimated emissions [million tons of CO ₂ e]	Total reported emissions as a percentage of MSCI estimated total emissions*
ACC limited	India	18.5	17.7	104%
Rumo SA	Brazil	1.5	1.4	104%
Central Pattana Public Company Limited	Thailand	0.5	0.5	104%
Telecom Plus PLC	U.K.	1.7	1.7	104%
Kurita Water Industries Ltd.	Japan	2.2	2.1	104%
Mitsubishi Materials Corporation	Japan	21.6	20.8	104%
Nissin Foods Holdings Co., Ltd.	Japan	4.1	3.9	104%
California Resources Corporation	U.S.	23.0	22.2	103%
America Movil, S.A.B. de C.V.	Mexico	9.2	8.9	103%
The Southern Company	U.S.	111.9	108.4	103%

* 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.

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

The largest emitters that have not disclosed their greenhouse gas emissions



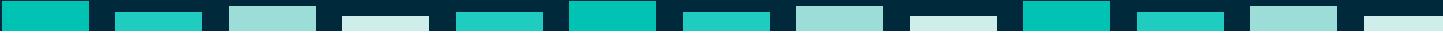
The table below shows the 10 largest emitters based on MSCI ESG Research's estimates of emissions across all emissions scopes that had not reported any of their greenhouse gas emissions as of Aug. 31, 2022.⁵⁴

Issuer	Country	Emissions reference year	GICS® sector	Total estimated emissions [million tons CO2e]
Shaanxi Coal Industry Company Limited	China	2020	Energy	199.2
Berkshire Hathaway Inc.*	U.S.	2020	Financials	146.8
China State Construction Engineering Corporation Limited	China	2020	Industrials	93.6
Shanxi Coking Coal Energy Group Co., Ltd.	China	2019	Energy	82.5
PBF Energy Inc.	U.S.	2020	Energy	75.3
Shanxi Lu'an Environmental Energy Dev. Co., Ltd.	China	2020	Energy	73.8
China Aviation Oil (Singapore) Corporation Ltd.	China	2020	Energy	64.1
Dongfang Electric Corporation Limited	China	2020	Industrials	57.5
Huayu Automotive Systems Company Limited	China	2020	Cons. Discretionary	53.2
Mastec, Inc.	U.S.	2020	Industrials	41.0

* Berkshire Hathaway Inc., a holding company, has not reported carbon emissions as of May 31, 2022. At least three of its subsidiaries — Berkshire Hathaway Energy, MidAmerican Energy Company, and Burlington Northern Santa Fe (BNSF) — have reported emissions separately. The holding company, however, has not reported its emissions in the aggregate

⁵⁴ The table remains unchanged from the June 2022 edition of the Net-Zero Tracker, which reported data as of May 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-thorough emissions-reduction targets



Not all decarbonization targets are up to the task. While corporate climate leaders aim to achieve net-zero emissions across their entire carbon footprint, some companies start with targets that address only a fraction.

The table below shows the 10 companies in the MSCI ACWI IMI that have published the most thorough corporate decarbonization targets in the 12 months that ended Aug. 31, 2022.

We assessed thoroughness 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.⁵⁵

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)
Equinor Asa	Norway	2021	317.7	261.1	-3.1%	100.0%	1.7
Apple Inc.	U.S.	2021	166.1	23.2	-6.6%	100.0%	1.4
Holcim Ag	Switzerland	2021	155.5	156.0	-3.2%	100.0%	1.8
CLP Holdings Limited	Hong Kong	2021	58.5	65.0	-3.2%	100.0%	1.6
American Electric Power Company, Inc.	U.S.	2020	58.1	90.1	-3.2%	100.0%	2
The Kansai Electric Power Company, Incorporated	Japan	2021	48.7	0.0	-3.2%	100.0%	1.4
Iberdrola, S.A.	Spain	2021	43.9	69.3	-2.0%	100.0%	1.7
Faurecia SE	France	2020	43.6	25.0	-9.1%	100.0%	1.5
Toyota Tsusho Corporation	Japan	2020	43.5	0.9	-9.1%	100.0%	1.3
General Dynamics Corporation	U.S.	2021	34.9	0.0	-6.6%	100.0%	1.4

* 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 Scopes 1 and 2 emissions, if reported, together with MSCI's estimate of the company's Scope 3 emissions. See note on page 14 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 (Scope 1 and 2 reported, Scope 3 estimated) covered by its latest climate target.

⁵⁵ MSCI ESG Research measures comprehensiveness as the percentage of Scopes 1, 2 and 3 emissions covered by the company's targets. MSCI ESG Research standardizes companies' projected emissions to show them as the amount to be reduced annually.

Net-zero is about now

At their current emissions, companies will use up their remaining share of the global carbon budget for limiting warming this century to 1.5°C in 52 months, or by the end of 2026. Listed companies are on a pathway that would cause average global temperatures to rise by nearly twice that amount.

For companies and investors, getting to net-zero is about action today. That means setting and acting on a series of increasingly ambitious decarbonization targets five years at a time. The falling cost of renewables, an energy crisis, and policy action in the U.S., the EU and elsewhere, all could speed the transition to clean energy.

Climate change and loss of biodiversity go hand in hand. A warming world and degradation of the environment threaten communities and the economy alike. Climate change compounds destruction of biodiversity and ecosystems, weakening society's ability to withstand and adapt to the effects of a changing climate. Wildfires worsened by climate change emit carbon into the air while destroying forests that store carbon naturally, adding to the fragility of many of the offsets that companies are counting on to reach net-zero.

Trillions of dollars in investment will be needed for a low-carbon transition. Reducing emissions and preserving ecosystems lowers both investment risk and the cost of transitioning to a net-zero future . COP27 and the U.N. Biodiversity Conference can accelerate action to address both crises. Immediate action is an imperative if society is to thrive.



For prior editions of the MSCI Net-Zero Tracker, visit
[https://www.msci.com/research-and-insights/
net-zero-tracker](https://www.msci.com/research-and-insights/net-zero-tracker)

Glossary

Biodiversity: Variability among living organisms and the ecological complexes of which they are part. This includes diversity within and among species and ecosystems.

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

Carbon dioxide equivalent (CO₂e): Greenhouse gas emissions with the same global warming potential as 1 metric ton of carbon.

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

Emissions intensity: Greenhouse gas emissions in CO₂e tons per USD millions of company sales.

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. For the methodology that MSCI uses to calculate implied temperature rise, see "Implied Temperature Rise Methodology," MSCI ESG Research, September 2021.

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

Nature-based solutions: Practices that combine natural processes with the built environment to counter climate change and its effects.

Nature-related financial risk: Risks that damage to ecosystems and the loss of biodiversity pose to companies and investors.

GICS®: The global industry classification standard jointly developed by MSCI Inc. and S&P Global Market Intelligence.

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

MSCI ACWI Investable Market Index (IMI): Captures listed large-, mid- and small-capitalization companies across 23 developed markets and 24 emerging-market countries. With 9,248 constituents, the index covers approximately 99% of the global equity investment opportunity set, as of Sept. 30, 2022.

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: An arbiter of corporate climate targets established by CDP, the U.N. Global Compact, the World Resources Institute, the U.N. and the World Wildlife Foundation.

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

Scope 2 emissions: Listed companies' greenhouse gas emissions from electricity use in tons of CO₂e.

Scope 3 emissions: Listed companies' indirect greenhouse gas emissions in tons of CO₂e from their upstream supply chain, emissions inherent in products and services or emissions from portfolio companies. Scope 3 covers 15 categories of upstream and downstream emissions, as defined by the Greenhouse Gas Protocol.



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