

The MSCI Net-Zero Tracker

A guide to progress by listed companies toward
global climate goals



Foreword

As we stand on the precipice of COP28 in Dubai, it is my privilege to introduce the MSCI Sustainability Institute's Net-Zero Tracker. This publication arrives at a pivotal moment in our collective fight against climate change, a fight that is increasingly defining our era.

The urgency of addressing climate change cannot be overstated. The world has borne witness to a relentless barrage of extreme weather events, with each year potentially breaking records for soaring temperatures. The consequences of inaction have been vividly demonstrated by the tragic toll of death, devastation and misery inflicted on communities across the globe.

This report coincides with a crucial juncture on our path to achieving the goals set forth in the Paris Agreement. In Dubai, governments will embark on the first Global Stocktake, a vital moment of reckoning where we assess how far we have come in our pursuit of a more sustainable future. This report from the MSCI Sustainability Institute is poised to make an invaluable contribution to this assessment, alongside the numerous studies and findings that have come to light.

The MSCI Net-Zero Tracker brings a unique perspective to the table by examining the efforts of listed companies. Companies have become indispensable actors in the collective endeavor to combat climate change. Their actions and commitments have far-reaching consequences, shaping our path toward a more sustainable and resilient world. By analyzing their progress and contributions to global climate goals, this publication provides us with essential insights.

It is apparent from this analysis that companies have taken commendable steps toward addressing climate change. Yet, it is equally clear that we have not yet mustered the level of ambition and action necessary to confront the magnitude of the crisis before us. The Paris Agreement sets a clear path – a path that demands a 43% reduction in emissions by 2030 and a commitment to achieving net-zero emissions by 2050. Regrettably, current commitments from governments, as articulated in their Nationally Determined Contributions, fall woefully short of this imperative.

In this light, the MSCI Net-Zero Tracker report reinforces a truth that has become increasingly evident – we are short of action, and we are short of ambition. The insights within these pages serve as a stark reminder of the immense rift that exists between our present trajectory and the path required to avert the most catastrophic impacts of climate change.

It is within this worrying rift that our opportunity lies. COP28 in Dubai is our chance

to affect a dramatic course correction. Informed by the comprehensive assessment provided by the MSCI Net-Zero Tracker and other sources, we can recalibrate our efforts. We can scale up our initiatives across all sectors. We can, and must, increase ambition as we prepare for the next round of Nationally Determined Contributions, due in 2025. This decade is critical, and our actions now and in the next few years will either redefine our course or deepen our peril.

We must chart the key steps and milestones required to decarbonize our economies, all while safeguarding sustainable development and just transitions. This undertaking necessitates massive investments and a transformative shift in financial flows. Yet, if these endeavors align with low emissions and climate-resilient development pathways, they can unlock trillions of dollars and redirect investments toward climate action on an unprecedented scale.

Crucially, the private sector plays a fundamental role in setting us on the course toward greater climate action. Companies across all sectors possess the power to be game-changers – leading on action and directing investment toward more sustainable and resilient economic activity. Consider the prospects in the energy sector – at COP28, we have the potential to triple renewable capacity and double energy efficiencies by 2030. Achieving these targets requires the willingness of the private sector to accelerate corporate action and to drive the mobilization of trillions of dollars of investment required into the energy transition.

The private sector has demonstrated an ability to move with greater rapidity than the sometimes ponderous wheels of global political processes. In recent years, we have witnessed an increase in climate related financing, but nowhere near the scale required. We are however, witnessing that solar panels, wind power turbines, electric vehicles, heat pumps, and emerging technologies such as hydrogen are becoming targets for investment by the private sector, even if not at the needed pace.

It is undeniable that the private sector holds a vital role in propelling this transition forward. The transformation we seek is not the burden of any one stakeholder; it requires a concerted, collaborative effort. Governments, businesses, financial institutions, civil society, scientists, and the communities on the front lines – all must unite in this endeavor.

In this context, the MSCI Sustainability Institute's commitment to fostering collaboration is both commendable and essential – insights from this report also clearly confirm this. Only by working together can we hope to drive the transition to a cleaner, greener, more prosperous and equitable future. The MSCI Net-Zero Tracker serves as a beacon of illumination in these challenging times, guiding us toward a path of greater ambition, action, and accountability.

I extend my heartfelt appreciation to the MSCI Sustainability Institute for their invaluable contribution to our shared mission. Together, we shall strive for a world that is resilient in the face of climate change, just in its transitions, and prosperous in its commitment to a sustainable future.

Thank you.

James Grabert, Director, Mitigation

United Nations Framework Convention on Climate Change*

Introduction

This month, delegates from nearly 200 countries, policymakers, and leaders from finance, business and civil society will gather in Dubai for the COP28 climate conference with the goal of fast-tracking the transition to a low-carbon economy.

The gathering will assess progress toward the goal of the Paris Agreement to limit the rise in average global temperatures to 1.5°C (2.7°F) above preindustrial levels.¹ “Much more action is needed now, on all fronts and by all actors, if the long-term goals of the Paris Agreement are to be met,” an assessment published in September by the United Nations Framework Convention on Climate Change (UNFCCC) concluded.²

Progress by the private sector in reducing greenhouse gas (GHG) emissions will weigh on the global stocktake, as the assessment is known. Nearly one-fifth of the estimated 61 billion tons of GHGs that society is likely to put into the atmosphere this year will come from the world’s listed companies.³ COP28 participants will assess the credibility and ambition of their climate commitments as well as those by financial institutions and other so-called nonstate entities.

This edition of the MSCI Net-Zero Tracker assesses progress toward a low-carbon future by listed companies and governments in 16 Group of 20 (G20) nations.⁴ The report:

- » Assesses decarbonization in each of those countries and listed companies based in them
- » Examines climate progress by the world’s listed companies; and
- » Counts down the estimated time until the collective carbon budget for the world’s listed companies would likely be depleted, based on the goals of the Paris Agreement.

¹ The Paris Agreement aims to limit the increase in global average temperature to “well below 2°C” above pre-industrial levels while pursuing efforts to limit the temperature increase to 1.5°C. “The Paris Agreement,” U.N. Framework Convention on Climate Change, 2015. Average global temperatures have already climbed nearly 1.3°C since the second half of the 19th century. See, The Global Warming Index, Environmental Change Institute, University of Oxford.

² “Technical dialogue of the first global stocktake,” UNFCCC, Sept. 8, 2023.

³ Listed companies represented by the MSCI ACWI Investable Market Index (IMI), which includes large-, mid- and small-cap listed companies across 23 developed-market and 27 emerging-market countries. With 9,152 constituents, the MSCI ACWI IMI index covers approximately 99% of the global equity investment opportunity set, as of Aug. 31, 2023. Definitions of emerging and developed markets are based on MSCI’s index framework.

⁴ Our analysis is based on 4,458 companies in the MSCI ACWI IMI that are based in G20-member countries and that were also constituents of the index at the end of both December 2016 and December 2021. That led to removal of Argentina, Russia and Saudi Arabia from the analysis. We also excluded the EU given the focus on individual countries.

Readers will find the comparison of climate action by countries and listed companies starting on page 8 of the report. Examining progress by each in the run-up to COP28 reflects the goal of the Paris Agreement itself to accelerate the reduction of GHG emissions by both public and private entities and to channel capital toward lowering GHG emissions and climate-resilient development.⁵

The report arrives in the final months of what is almost certain to be the hottest year on record, driven chiefly by the build-up of GHGs in the atmosphere.⁶ “Absolutely gobsmackingly bananas,” one climate scientist termed September’s record heat, which was 0.5°C higher than the record set two years ago.⁷ U.N. Secretary-General António Guterres has termed our age “the era of global boiling.”⁸

Delegates at COP28 aim to produce a plan for closing the gap between current country climate commitments and the roughly 22 billion tons of GHGs the UNFCCC’s recent report finds would need to be eliminated to stay within the 1.5°C threshold.⁹

Investors and other capital markets participants will play a critical role. Annual global investment in low-carbon energy would need to more than double, to 4.5 trillion USD within the next decade, to align with the 1.5°C target.¹⁰ “There will be a plan coming out of COP28, but plans without means to implement them are futile,” Simon Stiell, the UNFCCC’s executive secretary, observed recently at the launch of the MSCI Sustainability Institute.¹¹

We hope that the data presented here can inform the stocktake and help to drive global progress toward a new era of sustainable growth.

5 See note 1.

6 “September 2023 – unprecedented temperature anomalies; 2023 on track to be the warmest year on record.” Copernicus Climate Change Service, European Commission, Oct. 5, 2023.

7 Tweet by Zeke Hausfather, Ph.D., Berkeley Earth, Oct. 3, 2023, available at <https://twitter.com/hausfath/status/1709217151452954998>. See also note 6.

8 “Secretary-General’s opening remarks at press conference on climate,” United Nations, July 27, 2023.

9 “Technical dialogue of the first global stocktake,” UNFCCC, Sept. 8, 2023.

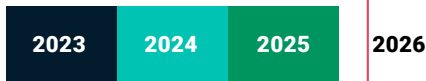
10 “Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach,” 2023 Update, International Energy Agency, September 2023.

11 “Highlights from the MSCI Sustainability Institute’s launch,” MSCI Sustainability Institute, Sept. 21, 2023.

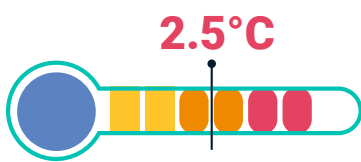


Key findings

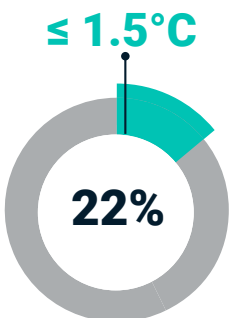
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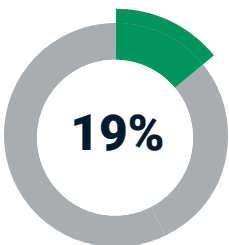
Date by which the world's listed companies are expected to burn through their remaining 1.5°C carbon budget.



Temperature by which listed companies would warm the planet, MSCI's Implied Temperature Rise metric shows



Share of listed companies that align with the goal of holding the rise in average global temperatures to 1.5°C above preindustrial levels.



Share of listed companies whose climate targets align with science and cover all their financially relevant greenhouse gas emissions.

Still peaking

- » **Listed companies are likely to put 12.4 gigatons (Gt) of GHG emissions** into the atmosphere this year, up 11% from 2022.¹²
- » **At their current rate of emissions**, listed companies would use up their share of the global carbon budget for keeping the rise in global temperatures below 1.5°C by April 2026, three months sooner than we projected in July.¹³
- » **Global emissions** are also rising though by less than emissions from listed companies; global emissions are on track reach 60.6 Gt this year, up 0.3% from 2022.

Countries speeding up, companies slowing down

- » **The rate of decarbonization by listed companies** in eight developed-market Group of 20 (G20) nations examined exceeded that of their respective countries in the five years after the Paris Agreement.¹⁴
 - » Listed companies in those markets reduced GHG emissions by an average of 5.1% each year between 2016 and 2021, while governments in those countries reduced domestic GHG emissions by 1.6% per year over the same period.
 - » Domestic emissions in eight emerging-market G20 countries examined rose by an average of 1.2% per year over the period, while emissions of listed companies in those markets climbed 3.2% annually.
- » **Looking ahead**, governments in 13 G20 nations examined are projected to reduce domestic GHG emissions by an average of 4.5% each year between 2022 and 2030, a faster rate of reduction than 0.8% per year for the five years following the Paris Agreement.
 - » There will likely be exceptions, with annual domestic emissions in India, Turkey and Indonesia expected to rise 3.6%, 1.2% and 0.8% per year, respectively, by 2030.¹⁵

¹² 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.

¹³ 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, 2023.

¹⁴ The agreement was adopted on Dec. 12, 2015 and entered into force on Nov. 4, 2016. See "United Nations Treaty Collection," United Nations. Our analysis is based on 4,458 companies in the MSCI ACWI IMI that are based in G20-member countries and that were also constituents of the index at the end of both December 2016 and December 2021. That led to removal of Argentina, Russia and Saudi Arabia from the analysis. We also excluded the EU given the focus on individual countries. Estimates of country emissions based on data from the International Monetary Fund (IMF). Country emissions include domestic GHG emissions from sources located within a country's territory, including energy produced domestically, industrial processes, agriculture and waste; our inventory here excludes land use and forestry. See generally, "Financed Emissions: The Global GHG Accounting & Reporting Standard, Part A, second edition," Partnership for Carbon Accounting Financials, December 2022. Country emissions also include emissions generated within the country's national borders by listed companies incorporated in the country provided the company has a primary listing of its securities there. Classification of emerging and developed markets are based on MSCI's Market Classification framework.

The MSCI Sustainability Institute

This issue of the MSCI Net-Zero Tracker marks the first published by the MSCI Sustainability Institute, which is on a mission to drive progress by capital markets to create sustainable value. The Institute reflects our belief that addressing the biggest global challenges demands new forms of collaboration across finance, academia, business, philanthropy, government, think tanks and civil society.

The Institute is pursuing a series of initiatives designed to boost the immediacy and ambition of efforts to stop climate change. They include:

- » Analyzing simulated impacts of the early phasing out of coal-fired power plants in the Asia-Pacific region to support guidance from the Glasgow Financial Alliance for Net Zero.
- » Exploring investment pathways to speed deployment of technologies that help decarbonize the most stubbornly emissive industries such as cement and aviation, in partnership with investment firm Galvanize Climate Solutions.
- » Piloting a feasibility analysis of companies that could benefit from investments in climate resilience, in support of GARI's (Global Adaptation and Resilience working group) proposed categorization of products and services that aim to improve climate resilience throughout the economy.

For more information and to engage with us, visit msci-institute.com.

- » **At the same time**, listed companies in those countries are due to decarbonize by 2.9% annually, a slowdown from their decarbonization rate of 3.2% per year since the Paris Agreement.
- » National emissions in China are expected to fall by 0.3% by 2030, while GHG emissions from its listed companies are expected to rise 0.5% over the same period.
- » National emissions in India are on track to rise 3.6% by 2030, while GHG output of its listed companies are on track to fall 1.5% over the same period.
- » **With decarbonization** by listed companies expected to slow, companies may increasingly need the power they consume to be produced sustainably together with innovation in technology and policy that can improve predictability while clearing structural barriers to eliminating GHG emissions.

Companies are making gains, but more decarbonization will be needed

- » **Just over (22%)** of listed companies align with a 1.5°C pathway, as of Aug. 31, 2023, the threshold above which the effects of global warming are likely to become far more severe, up from 10% two years earlier.¹⁶
- » **More than half (55%)** of listed companies align with global warming equal to or below 2°C, placing them at the high end of the Paris Agreement's uppermost temperature threshold, up from 43% over the same period.
- » **Listed companies** are on a path to warm the planet 2.5°C above preindustrial levels this century; this trajectory is misaligned with the Paris Agreement but is a half-degree Celsius less than two years ago, based on analysis of their future emissions pathways and current climate commitments.¹⁷

Targets and disclosure tick higher

- » **More than one-third (34%) of listed** companies have set a climate target that aspires to reach net-zero, up from 23% two years earlier.
- » **Nearly one-fifth (19%) of listed companies** have published a science-based net-zero target that covers all financially relevant Scope 3 emissions, up from 6% over the same period.¹⁸
- » **39% of listed companies** have disclosed at least some of their Scope 3 emissions, as of Aug. 31, 2023, up from 31% a year earlier.¹⁹

15 Estimates of country emissions based on data from the IMF.

16 See "The MSCI Net-Zero Tracker," October 2021.

17 Data as of May 31, 2023. The estimate reflects listed companies' MSCI Implied Temperature Rise (ITR), which estimates the increase in average temperatures this century were the economy to overshoot 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.

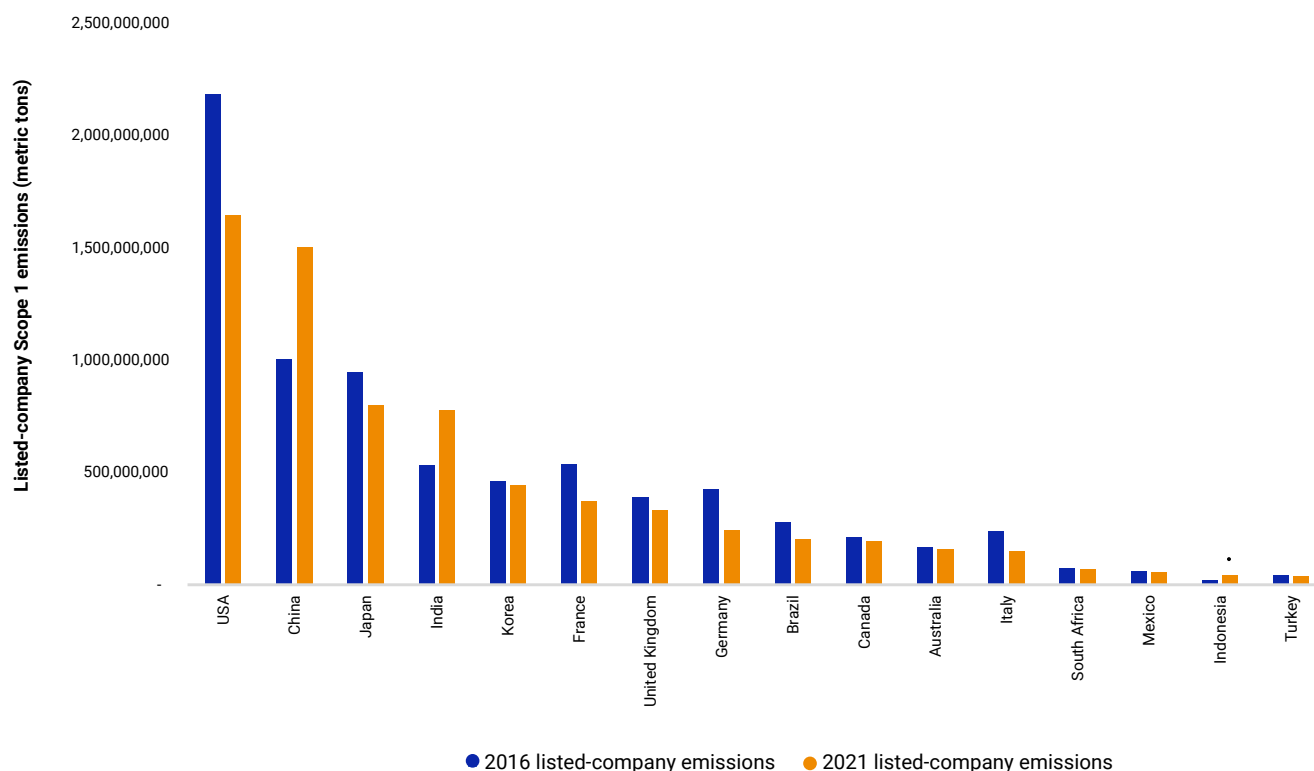
18 A science-based target, such as one that aligns with the corporate net-zero standard published by the Science Based Targets initiative (SBTi), commits to setting near- and long-term climate plans that would align emissions across all scopes with reaching net-zero globally along a pathway that would limit the rise in average global temperatures to 1.5°C. See, for example, "SBTi Corporate Net-Zero Standard, Version 1.1," SBTi, April 2023.

19 See "The MSCI Net-Zero Tracker," October 2022.

Comparing countries and listed issuers' GHG emissions

COP28 is slated to address the actions of countries in driving toward a low-carbon economy. The actions of private-sector entities inform the global stocktake slated to conclude in Dubai and the update of countries' national climate plans.²⁰ The emissions of listed companies comprise roughly one-fifth of global emissions. Governments and policymakers can, if they choose to, influence those emissions. The section that follows compares progress in reducing emissions by 16 G20 countries and the listed companies based in them.

Exhibit 1: Change in listed-company emissions, five years following the Paris Agreement



Source: MSCI ESG Research, based on common constituents of the MSCI ACWI IMI in December 2016 and December 2021

²⁰ "UN Climate Change Unveils Plan to Showcase Leadership and Enhance Accountability," UNFCCC, June 5, 2023.

²¹ Domestic emissions refer to territorial emissions and do not include consumption-based emissions such as those from imported goods.

Listed companies in developed G20 countries decarbonized faster than their respective countries over the five years after the Paris Agreement

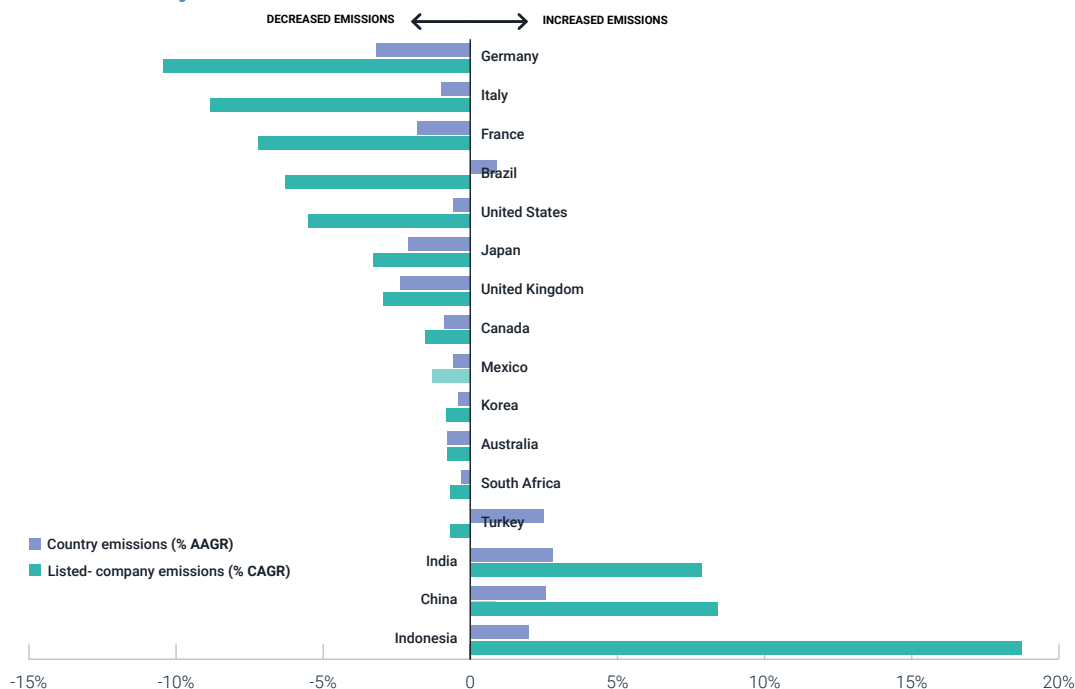
The emissions of developed-market G20 countries (“country emissions” in Exhibits 2 and 4 and the listed companies based in them fell over the five years that ended December 2021. Listed companies in those markets reduced GHG emissions by 5.1% each year on average between 2016 and 2021, while governments in those countries reduced domestic GHG emissions by an average of 1.6% over the same period. Domestic GHG emissions in emerging-market G20 countries rose by an average of 1.2% in the five years after the Paris Agreement, while emissions of listed companies based in those countries rose 3.2% over that period.

Countries’ domestic emissions include, but are not limited to, the emissions of listed companies incorporated in them; national GHG emissions as inventoried here also include emissions from energy produced domestically, industrial processes, agriculture and waste.²² Within emerging-market countries examined:

- » Emissions of listed companies in two emerging markets – Brazil and Turkey – fell amid a rise in domestic emissions.
- » The rise in emissions among listed companies in China, India and Indonesia, by comparison, exceeded the increase in their respective countries’ emissions.
- » Three of eight emerging-market countries – South Korea, Mexico and South Africa – reduced domestic emissions over the same period.

Governments, of course, can influence companies’ emissions through laws and regulations designed to incentivize clean-energy investment, reduce harmful pollution, boost energy efficiency or require companies to publicly disclose their GHG emissions. Still, the comparatively robust climate action by companies and financial institutions in the years immediately following adoption of the Paris Agreement suggests that companies and investors acted sooner and with greater agility to reduce GHG emissions than their home countries.

Exhibit 2: Listed companies’ climate action outpaced action by governments in developed markets over the five years ended December 2021



Source: MSCI ESG Research, based on common constituents of the MSCI ACWI IMI in December 2016 and December 2021. Country emissions data from IMF and estimates.

²² See note 14.

Governments are poised to accelerate decarbonization compared with listed companies

The pace of decarbonization by 13 of the G20 countries examined is set to overtake that of the listed companies based in them this decade (Exhibits 3 and 4).

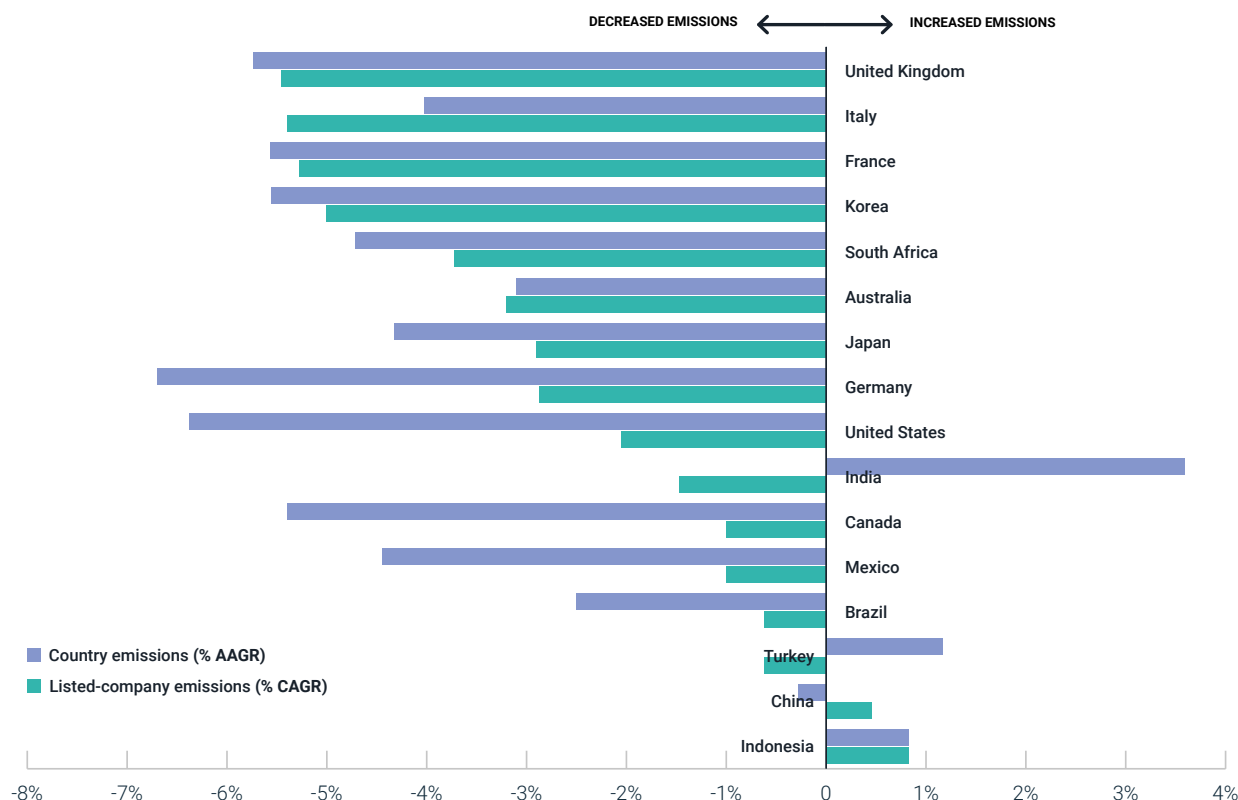
- » There will likely be exceptions, with annual domestic emissions in India, Turkey and Indonesia expected to rise 3.6%, 1.2% and 0.8% per year, respectively, by 2030.

At the same time, listed companies in those countries are due to decarbonize by 2.9% annually, a slowdown from their decarbonization rate of -3.2% per year since the Paris Agreement.

- » National emissions in China are expected to fall by 0.3% by 2030, while GHG emissions from its listed companies are expected to rise 0.5% over the same period.
- » National emissions in India are on track to rise 3.6% by 2030, while GHG output its listed companies are on track to fall 1.5% over the same period.

One possible explanation for the projected slowdown in decarbonization by companies may be that the private sector is increasingly reducing emissions (such as curbing energy demand from less emissions-intensive activities) that it can. Looking ahead, breakthroughs in decarbonizing difficult-to-abate industries as well as the speed of transition to clean energy may play a larger role in private-sector decarbonization. Policy measures that can help to remove structural barriers to decarbonization could also be critical to listed companies' ability to deliver on their net-zero commitments.

Exhibit 3: Climate action by countries is expected to outpace decarbonization by their listed companies in the coming decade



Source: MSCI ESG Research, based on common constituents of the MSCI ACWI IMI in December 2016 and December 2021. Country emissions data from International Monetary Fund and estimates. Projections of country emissions by MSCI ESG Research using PCAF methodology for measuring sovereign financed emissions.

Exhibit 4: Comparing action and ambition: Country and listed-company emissions

Country	Developed (DM) or emerging market (EM)	Country Scope 1 emissions, 2021 (Gt, CO2e)	Listed-company Scope 1 emissions, 2021 (Gt, CO2e)	Annual change (%) in country absolute Scope 1 emissions - 5 years ended Dec. 2021	Annual change (%) in listed-company absolute Scope 1 emissions - 5 years ended Dec. 2021	Country estimated Scope 1 emissions - 2030 (Gt, CO2e)	Projected annual change (%) in country absolute Scope 1 emissions - 2022-2030	Projected change (%) in listed-company absolute Scope 1 emissions - 2022-2030
China	EM	14.2	1.50	2.6%	8.4%	13.8	-0.3%	0.5%
United States	DM	6.3	1.60	-0.6%	-5.5%	3.5	-6.4%	-2.0%
India	EM	3.4	0.80	2.8%	7.9%	4.7	3.6%	-1.5%
Japan	DM	1.2	0.80	-2.1%	-3.3%	0.8	-4.3%	-2.9%
Brazil	EM	1.2	0.20	0.9%	-6.3%	0.9	-2.5%	-0.6%
Indonesia	EM	1.0	0.04	2.0%	18.7%	1.0	0.8%	0.8%
Germany	DM	0.8	0.20	-3.2%	-10.4%	0.4	-6.7%	-2.9%
Mexico	EM	0.7	0.06	-0.6%	-1.3%	0.5	-4.4%	-1.0%
Korea	EM	0.7	0.40	-0.4%	-0.8%	0.4	-5.6%	-5.0%
Canada	DM	0.7	0.20	-0.9%	-1.5%	0.4	-5.4%	-1.0%
Turkey	EM	0.6	0.04	2.5%	-0.7%	0.6	1.2%	-0.6%
South Africa	EM	0.5	0.07	-0.3%	-0.7%	0.3	-4.7%	-3.7%
Australia	DM	0.5	0.20	-0.8%	-0.8%	0.4	-3.1%	-3.2%
United Kingdom	DM	0.4	0.30	-2.4%	-3.0%	0.3	-5.7%	-5.5%
France	DM	0.4	0.40	-1.8%	-7.2%	0.3	-5.6%	-5.3%
Italy	DM	0.4	0.10	-1.0%	-8.8%	0.3	-4.0%	-5.4%

Source: MSCI ESG Research, based on common constituents of the MSCI ACWI IMI in December 2016 and December 2021. Country emissions data from International Monetary Fund and estimates. Projections of country emissions by MSCI ESG Research using PCAF methodology for measuring sovereign financed emissions. Classification of emerging and developed markets are based on MSCI's Market Classification framework.



Assessing countries' climate ambition: An analytical exercise

COP28 will conclude the first global assessment of climate ambition by countries with the aim of accelerating action to align their domestic GHG emissions with the goals of the Paris Agreement.²³ Projections of country-specific warming may help investors and policymakers sharpen their view of countries' emissions trajectories and the credibility of national decarbonization targets as well as the ambition countries bring to climate action.

Investors and policymakers who aim to assess a country's contribution to global warming confront two decisions of consequence for the calculation. First is how to allocate the remaining budget used to determine the amount of GHG emissions a country can still add to the atmosphere without lifting average global temperatures 1.5°C above preindustrial levels.²⁴ Second is whether to extrapolate the trajectory of a country's future emissions from its track record of carbon emissions or to calculate the country's future emissions based on its latest emissions targets.

Emissions budget

There are a range of approaches to estimate a country's remaining emissions budget that represent divergent philosophical and analytical views.²⁵ Here, for demonstration purposes, we use two that have been developed by scientists, academics and standard setters. The first, which incorporates a model adopted by the Network for Greening the Financial System (NGFS), a global group of central bank supervisors, considers shifts in climate policies, advances in clean-energy technologies, and changes in energy and economic systems to outline a potential pathway for achieving net-zero GHG by the year 2050 (NGFS budget).²⁶ The second, one version of which has been developed by faculty at the University of Graz, aims to allocate emissions that remain for alignment with 1.5°C warming among countries based on their current and projected population and resource needs (Graz budget).²⁷

Emissions trajectory

We illustrate two methods for projecting a country's emissions trajectory. Policymakers or investors can either accept a country's national climate target at face value and extrapolate its future emissions accordingly or extrapolate the country's future emissions from its track record in emissions. As Exhibit 5 suggests, the analysis asks what the country's contribution to global warming would be with:

- » An NGFS-based emissions budget, accepting the country's national climate target at face value?
- » An NGFS-based budget, based on the country's track record in emissions?
- » A Graz budget, accepting the country's climate national target at face value?
- » A Graz budget, based on the country's track record in emissions?

²³ Domestic GHG emissions refer to emissions from sources located within a country's territory.

²⁴ Our discussion here assumes that society can emit +/- 1,100 Gt of CO₂e while limiting warming in the year 2100 to 1.5°C above preindustrial levels.

²⁵ In addition to the approaches to allocating carbon budgets cited here, see, for example, "Mitigation Pathways Compatible with Long-term Goals," IPCC Sixth Assessment Report, Mitigation of Climate Change, April 4, 2022. See also Niklas Höhne, Michel den Elzen and Donovan Escalante, "Regional GHG reduction targets based on effort sharing: a comparison of studies," Climate Policy 14 (2014):122-147.

²⁶ The NGFS budget, which supplies a reference for financial institutions, uses a so-called Integrated Assessment Model that considers such shifts with a focus on cost-effective mitigation. See, "Mitigation Pathways Compatible with Long-term Goals," IPCC Sixth Assessment Report, Mitigation of Climate Change, IPCC, April 4, 2022. See also, "NGFS Net Zero 2050 REMIND-MAGPIE scenario," Data & Resources, Scenarios Portal, Network for Greening the Financial System.

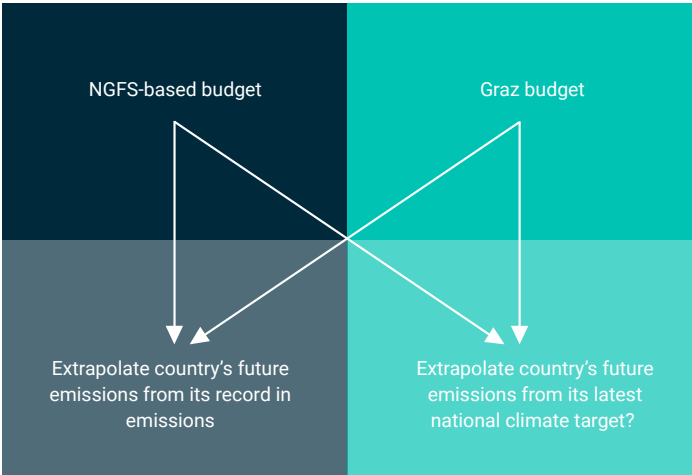
²⁷ What we refer to as the "Graz budget" considers the sufficiency of the remaining budget for countries' anticipated developmental needs based on the U.N. Human Development Index (HDI), a composite index of life expectancy, education, and per capita income. See Keith Williges, Lukas Meyer, Karl Steininger and Gottfried Kirchengast, "Fairness critically conditions the carbon budget allocation across countries," Global Environmental Change 74 (May 2022), which includes discussion of effort-sharing approaches and their respective techniques for allocating emissions budgets.

Exhibit 6 shows the rise in average global temperatures estimated to result from the emissions of 16 G20 countries and those of countries globally based on the choice of emissions budget and trajectory.²⁸ Note how each country’s projected warming varies based on both the distribution of remaining GHG emissions reflected in the budget and the method used to assess the country’s emissions trajectory.

Estimated warming for large economies such as the U.S., Japan and Germany tends to be lower under the NGFS budget and higher under the Graz budget, which considers countries’ current level of development and future sustainable development needs. Not surprisingly, estimates of countries’ future warming tend to be lower if the estimate takes the climate target a government has published at face value instead of extrapolating based on the country’s track record in emissions, which some would consider a “business as usual” trajectory.

As an analytical exercise to summarize these approaches, the column at far right shows estimated warming for each country computed by using as inputs: 1) the average of the NGFS and Graz budgets; and 2) an extrapolation of the country’s emissions toward its national climate target, adjusting the trajectory by the country’s record of actually reducing emissions since the Paris Agreement at the annual rate required to meet its emissions target.

Exhibit 5: Two emissions budgets x Two emissions trajectories



Source: MSCI ESG Research

²⁸ Our global estimate shows estimated warming for 170 countries.

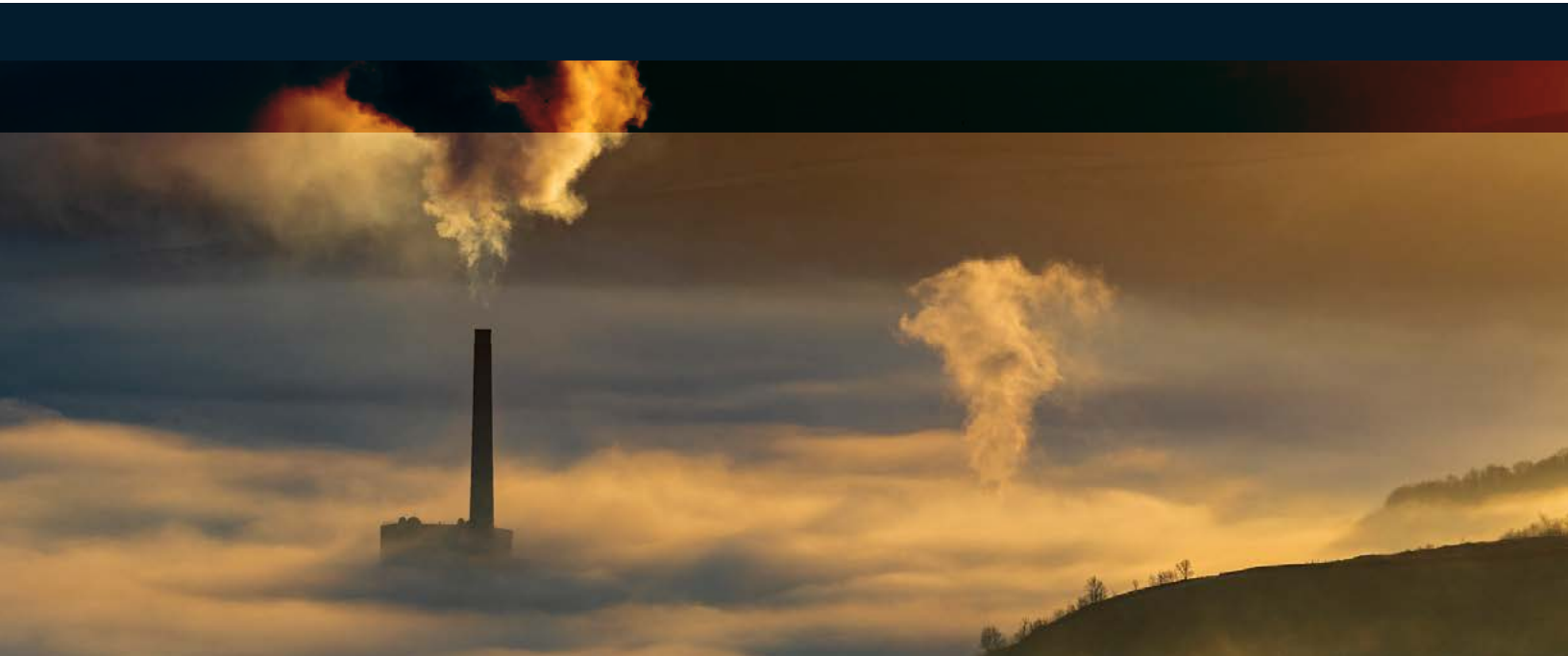


Exhibit 6: Comparing countries' projected warming based on choice of remaining emissions budget and modeling of future emissions trajectory

Country	NGFS Budget Face-value target	NGFS Budget Track record	GrazU Budget Face-value target	GrazU Budget Track record	Blended budgets Adjusted Face-value target
Global	2.0	2.6	2.0	2.6	2.2
India	1.8	2.1	1.5	1.7	1.6
Indonesia	1.7	2.0	1.6	1.9	1.8
Mexico	1.5	2.2	1.6	2.3	1.8
U.K.	1.8	1.9	2.0	2.2	1.9
South Africa	1.4	1.9	2.5	>3.2	1.9
France	1.8	2.4	1.8	2.5	2.0
Brazil	2.0	2.7	1.8	2.4	2.1
South Korea	1.4	2.0	>3.2	>3.2	2.2
Turkey	1.9	2.6	2.4	>3.2	2.2
Italy	2.0	2.6	2.4	>3.2	2.4
Germany	1.8	2.5	>3.2	>3.2	2.6
Japan	1.9	2.6	>3.2	>3.2	2.7
Canada	1.9	3.1	>3.2	>3.2	>3.2
Australia	2.1	>3.2	>3.2	>3.2	>3.2
U.S.	1.8	2.7	>3.2	>3.2	>3.2
China	2.7	>3.2	>3.2	>3.2	>3.2



Source: MSCI ESG Research



As the comparison suggests, investors and policymakers can estimate a range of future warming for countries depending on the inputs and assumptions used. The remaining total global budget is fixed by climate science; investors and policymakers will pursue their own approaches about how to allocate it and how to approximate the trajectory of a country's future emissions. At the same time, the data:

Affirms a need to boost climate ambition. Average global temperatures are on track to rise between 2.0°C and 2.6°C depending on whether countries fully deliver on their current stated climate commitments.²⁹ The data suggests that the goal of constraining warming this century to 1.5°C above preindustrial levels would require greater ambition to decarbonize and the capacity to fully meet that greater ambition.³⁰ It further suggests that delivering on climate commitments can make an outsize contribution to reducing global warming for emissions-intensive economies such as the U.S., China, Australia, Canada, Japan, Germany and South Korea.

Underscores the need for breakthrough innovations and climate finance. While the largest and most-developed economies have enacted policies to catalyze clean-energy investments, accelerating and scaling investment in transition technologies and breakthrough innovations will be required this decade to fend off the worst effects of warming. Nearly half the emissions avoided in the International Energy Agency's net-zero-by-2050 scenario require technologies that are still under development today; the share is higher in emissions-intensive sectors.³¹

Points toward a need for carbon removal. The comparison raises for consideration a conclusion by the Intergovernmental Panel on Climate Change (IPCC) earlier this year that if long-term global warming were to exceed 1.5°C, it could be reduced again over time by achieving net-negative global emissions.³² That would require additional deployment of technology for removing carbon dioxide from the atmosphere, according to the IPCC.³³ Limiting warming to 1.5°C would itself require carbon removal to balance out residual GHG emissions from emissions-intensive industries such as aviation, agriculture and shipping.³⁴

Each of these themes could feature in the discussions among all key stakeholders at COP28.

29 The estimate mirrors those contained in the UNFCCC's synthesis report on the technical dialogue of the first global stocktake, which notes that global temperatures are projected to rise between 1.7°C and 2.6°C, between depending on whether countries fully implement their long-term net-zero targets. See "Technical dialogue of the first global stocktake," UNFCCC, Sept. 8, 2023.

30 The finding echoes the conclusion of the U.N.'s latest emissions gap report, which found that the world is still falling short of global climate goals "with no credible pathway to 1.5°C in place. See "Emissions Gap Report 2022," U.N. Environment Programme, Oct. 27, 2022.

31 "Net Zero by 2050, A Roadmap for the Global Energy Sector," International Energy Agency, Sept. 26, 2023.

32 Net-negative global emissions assumes an ability to remove carbon from the atmosphere. See "Synthesis Report of the IPCC Sixth Assessment Report (AR6), U.N. Intergovernmental Panel on Climate Change (IPCC), March 20, 2023.

33 Carbon removal refers to a range of technologies, including direct air capture and biomass carbon removal. See "Carbon Dioxide Removal, Frequently Asked Questions," U.S. Department of Energy, Fossil Energy and Carbon Management.

34 See note 9.

35 "Sharm el-Sheikh Implementation Plan," Conference of the Parties serving as the meeting of the Parties to the Paris Agreement, UNFCCC, Nov. 20, 2022.



Recalling key takeaways for companies and investors from COP27

While the agenda at COP28 will reflect the imperative and challenges for society to transition away from fossil fuels based on the latest data, it will also be informed by the commitments the last UN climate conference agreed to deliver. Here is a rundown of the biggest takeaways for companies and investors from COP27:

The need for credibility in private-sector climate accounting and commitments. Net-zero pledges should contain interim targets measuring progress along a 1.5°C pathway five years at a time, reaching net-zero by 2050 or sooner; targets should account for companies' complete Scope 1, 2 and 3 emissions, a U.N. high-level expert group recommended.³⁶ Net-zero pledges should include specific targets aimed at ending support for fossil fuels; companies and financial institutions should disclose their affiliations with trade associations. The recommendations underpin a framework for climate action by the private sector being developed by the UNFCCC.³⁷

The importance of climate finance for developing countries. The agreement reached at COP27 established a fund through which wealthy countries would compensate developing countries, which have much lower cumulative GHG emissions than the global average, for loss and damage caused by global warming.³⁸ COP27 also saw the introduction of a series of initiatives designed to lower the cost of climate finance in Africa, turn projects for climate

adaptation and resilience into investable opportunities, and help Indonesia assemble a package of private and public financing to support the country's phasing out coal-fired power plants.³⁹

The importance of data for climate-financial decision-making. COP28 will include release of a proof of concept for a Net-Zero Data Public Utility (NZDPU), a central repository of climate-transition data that was launched at COP27.⁴⁰ The NZDPU, which will focus initially on standardized data for GHG emissions across all emissions scopes, will aim to augment transparency with a trusted central source of verifiable data accessible to all.⁴¹ COP27 further stressed the importance of climate-related disclosure and the value of standardized data in enhancing investors' ability to influence companies' alignment with global temperature goals.

Strengthening carbon markets. A series of initiatives to develop voluntary carbon markets emerged at COP27, which focused on the need for transparency and standardization and for companies, investors and other stakeholders to be able to trust and verify that carbon credits actually remove or avoid emissions.⁴² The Energy Transition Accelerator, an initiative backed by the U.S. State Department, The Rockefeller Foundation, and the Bezos Earth Fund, aims to use a new system of carbon credits to help spur private-sector investment for the climate transition in developing countries.⁴³

36 "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.

37 "UN Climate Change Unveils Plan to Showcase Leadership and Enhance Accountability," UNFCCC, June 5, 2023.

38 For information on the lower global share of GHG emissions that comes from developing countries, see "Synthesis Report of the IPCC Sixth Assessment Report (AR6)," U.N. Intergovernmental Panel on Climate Change (IPCC), March 20, 2023.

39 "What COP27 Means for Companies and Investors," MSCI ESG Research, Nov. 21, 2023.

40 "CDP and NZDPU Collaborate to Accelerate Access to Core Climate Data," NZDPU, Sept. 20, 2023.

41 MSCI Inc. is a member of the NZDPU's Technical Advisory Board.

42 MSCI Carbon Markets specializes in data and analytics on carbon markets, including the use of carbon credits in climate transition plans, the integrity of existing carbon credits and the outlook for carbon pricing.

43 "Bezos Earth Fund, The Rockefeller Foundation, and U.S. State Department Announce Support at COP27 for Design of New Energy Transition Accelerator," The Rockefeller Foundation, Nov. 9, 2022.

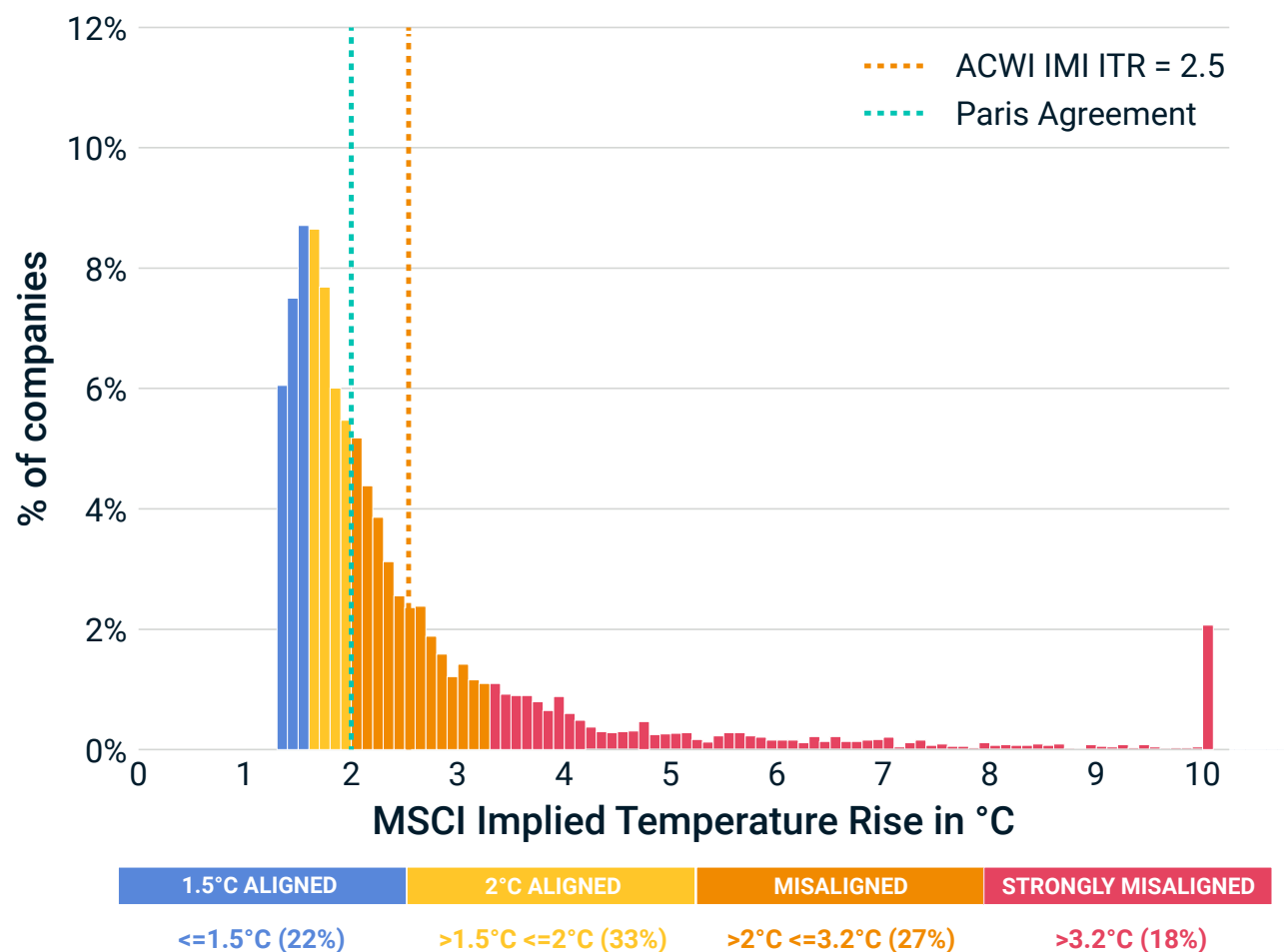


Assessing climate ambition: Listed companies

Listed companies' GHG emissions and projected emissions trajectories would align with warming of 2.5°C above preindustrial levels if the whole economy had the same carbon budget overshoot or undershoot as the companies in question (Exhibit 7).⁴⁴

More than half (55%) of listed companies are on track to keep warming below 2°C, while 22% align with a 1.5°C temperature rise. The data marks progress: Two years ago, just over one-third of listed companies aligned with 2°C warming while 10% of companies aligned with the 1.5°C threshold. Still, pathways that limit warming to either 1.5°C or 2°C, “assume immediate action” to reduce GHG emissions across all sectors, the UNFCCC’s assessment emphasizes.⁴⁵

Exhibit 7: The goal? Out of the red, orange and yellow and into the blue



Source: MSCI ESG Research, data as of Aug. 31, 2023

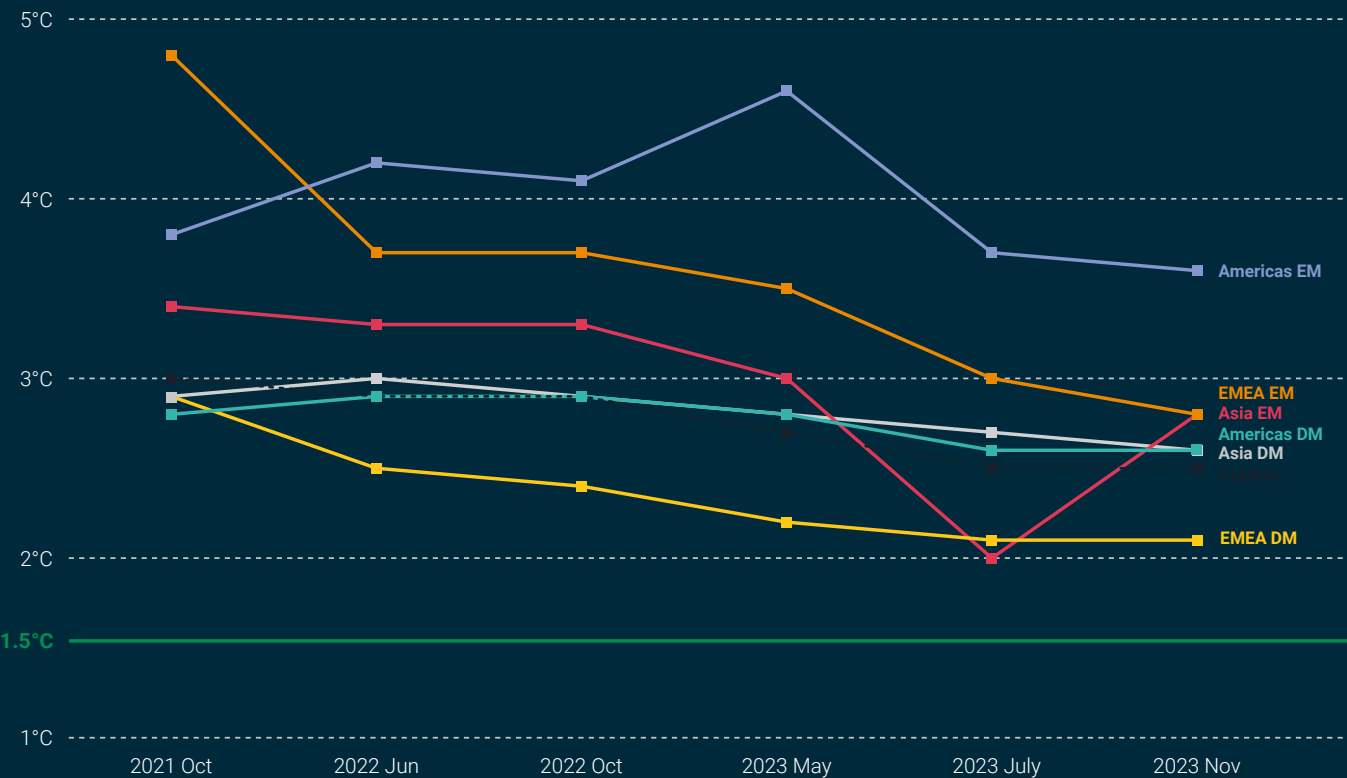
⁴⁴ Estimate is based on MSCI's Implied Temperature Rise model, which indicates how companies and investment portfolios align with global climate targets (in degrees Celsius) based on a company's current carbon emissions and projected emissions trajectory. See "Understanding MSCI's Climate Metrics," MSCI ESG Research, January 2023.

⁴⁵ "Technical dialogue of the first global stocktake," UNFCCC, Sept. 8, 2023.

A private-sector stocktake

The Paris Agreement has fueled action that aims to significantly reduce the risks of future warming, the UNFCCC’s report on the global stocktake finds. Our data confirms the conclusion. In the past two years, the gap between the climate commitments of the world’s listed companies as represented by their net-zero targets and projected future emissions and the threshold for preventing the worst effects of global warming has narrowed by half a degree Celsius here (Exhibit 8). While that rate may suggest that listed companies could align with 1.5°C warming within four years, the data indicates that the rate of reductions is slowing (see Exhibit 3). Society’s ability to further mitigate climate change will depend in part on the ability of companies and investors to maintain, if not accelerate, progress toward closing the gap.

Exhibit 8: Narrowing the ambition gap: Projected warming from the world’s listed companies, if they deliver on their commitments



Source: MSCI ESG Research, as of Aug. 31, 2023

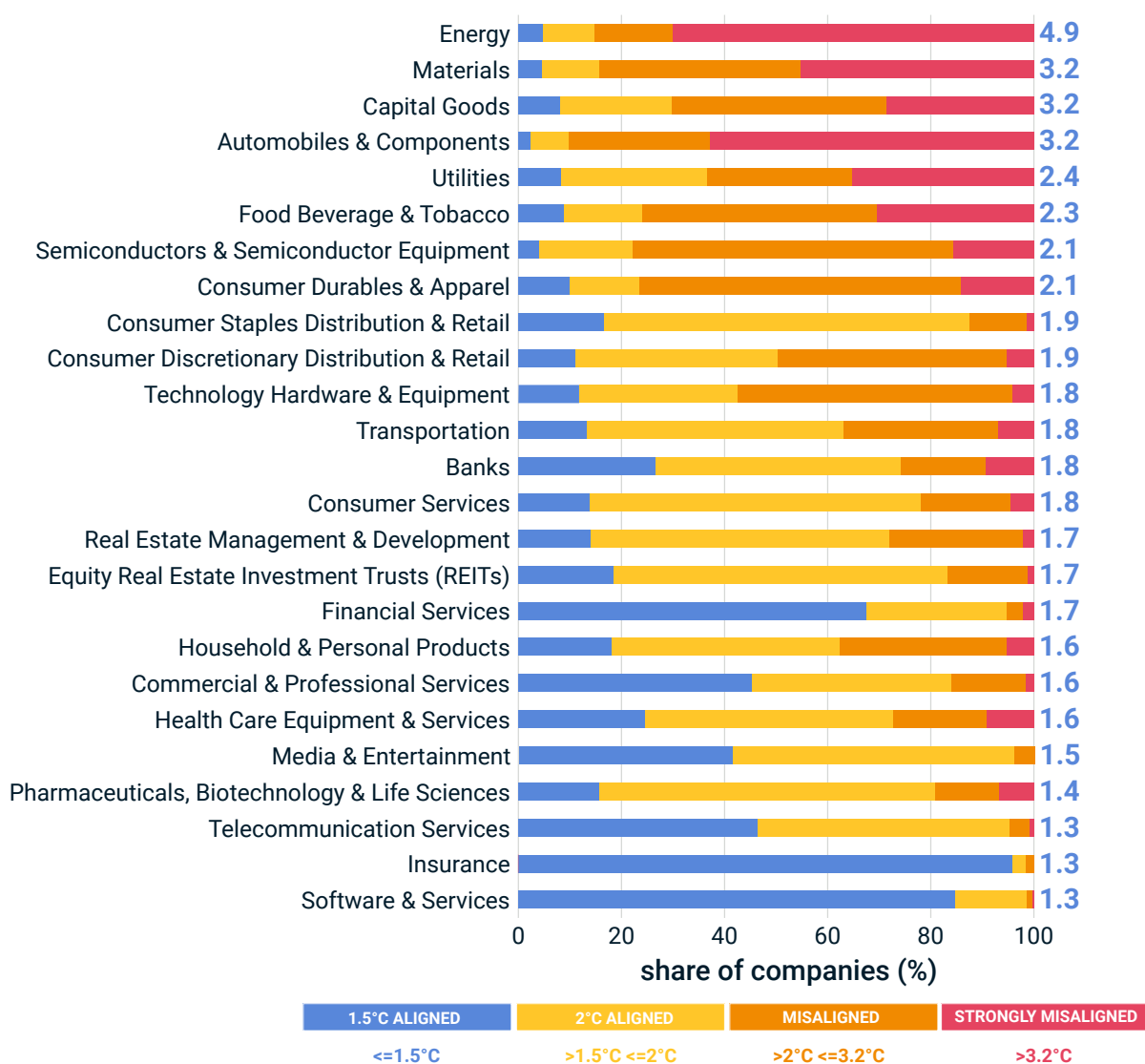


Assessing progress: Industries

Every sector has its sector-specific emissions budget and companies whose emissions trajectories align (or don't) with it. By design, the use of a temperature-alignment metric rather than a snapshot of what companies have already emitted aims to capture the extent to which companies are projected to overshoot or undershoot their sector-specific budget for staying below a target temperature.

Companies within five of 25 industry groups align, on average, with keeping future warming at or below 1.5°C, while those in 17 industry groups align with a 2°C pathway, as of Aug. 31, 2023 (Exhibit 9).⁴⁶ Misaligned industry groups range from the biggest emitters of greenhouse gases, such as energy and materials, to those with large value chain emissions, such as automakers and companies involved in processing, packaging and distributing food.

Exhibit 9: Implied Temperature Rise by GICS® industry group



Source: MSCI ESG Research, data as of Aug. 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. averages.

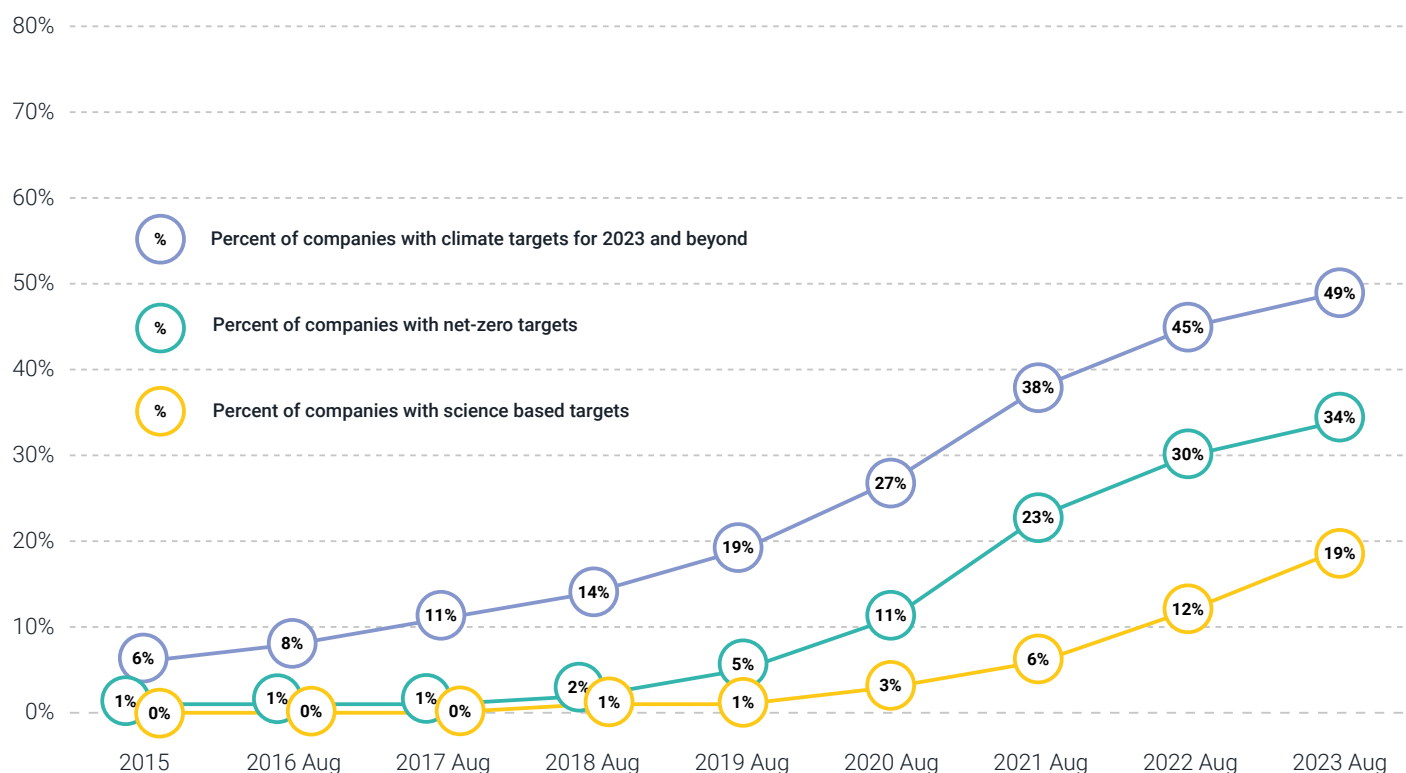
⁴⁶ The Implied Temperature Rise of banks, diversified financials and insurance industry groups covers carbon emissions from portfolio investments and commercial loans with known use of proceeds, as directed by the Greenhouse Gas Protocol, which requires that companies account for their proportional emissions 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.

The number of companies setting climate targets and reporting their Scope 3 emissions edges higher

Nearly half (49%) of listed companies had published a climate target, as of Aug. 31, 2023, up from 38% two years ago, though the ambition and credibility of those pledges vary (Exhibit 10). 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 simply to boost the company's use of energy from renewable sources. Some remain largely aspirational.

A U.N. high-level expert group on net-zero commitments by the private sector has recommended that companies draw on third-party verification to set climate targets and reduce emissions across their value chain.⁴⁷ Whereas 34% of listed companies have set targets that aspire to reach net-zero, just one-fifth (19%) of listed companies so far have targets that align with science-based pathways for aligning all financially relevant emissions with net-zero by 2050 while limiting the rise in average global temperatures to 1.5°C.

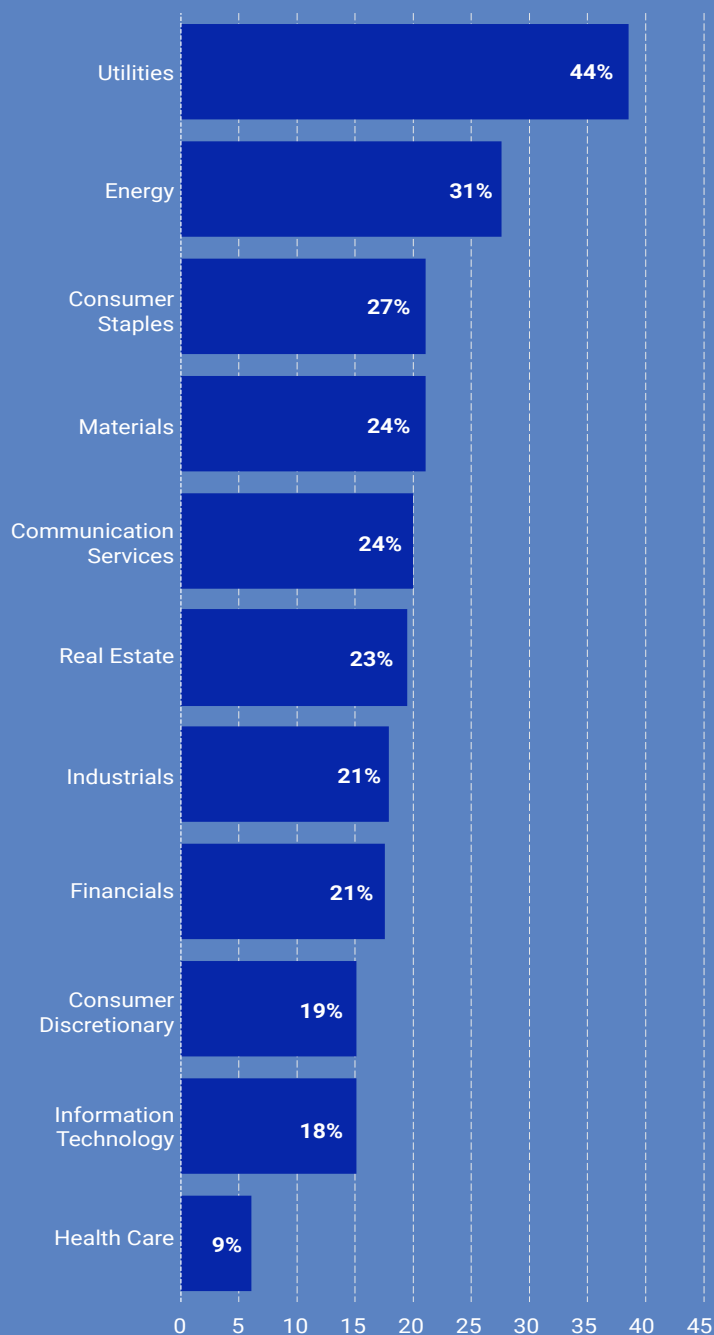
Exhibit 10: More and more companies are setting decarbonization targets



Source: MSCI ESG Research, as of Aug. 31, 2023

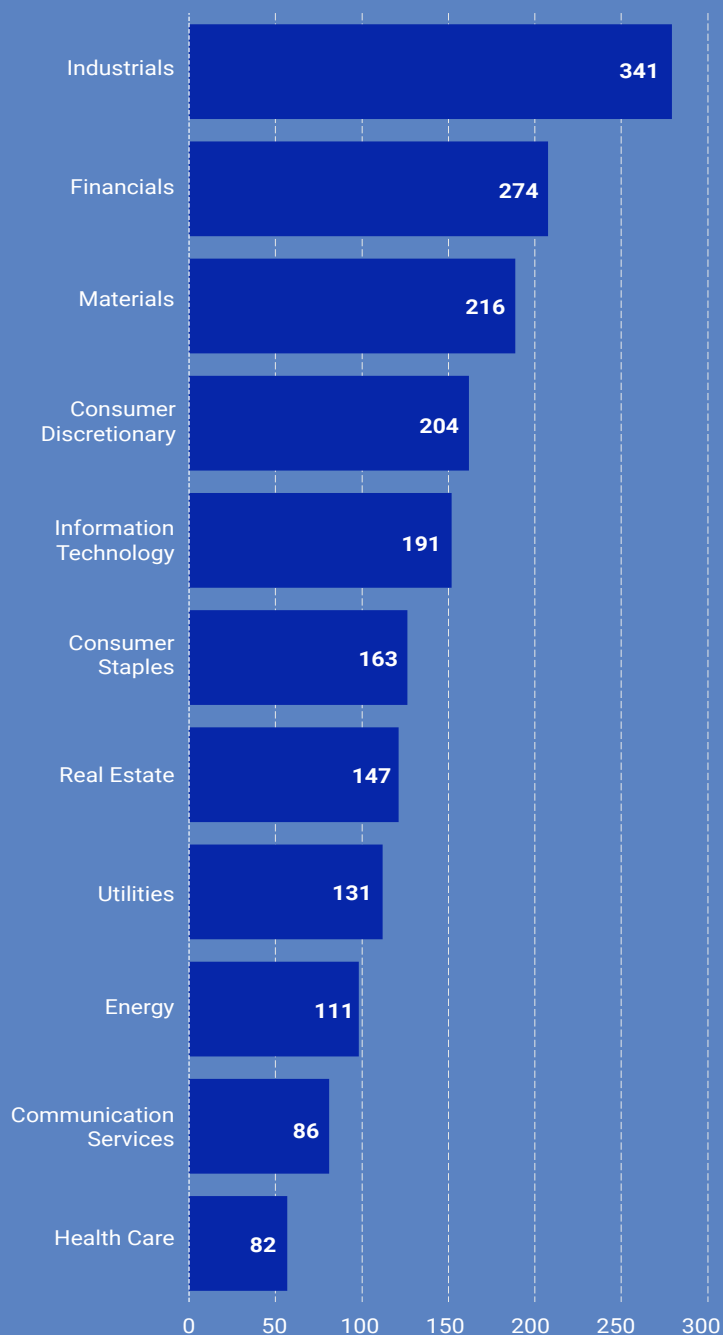
⁴⁷ "Integrity Matters: Net Zero Commitments by Businesses, Financial Institutions, Cities and Regions," Report from the United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities, Nov. 8, 2022. The Expert Group cited SBTi, the Partnership for Carbon Accounting Financials (PCAF), The Paris Agreement Capital Transition Assessment (PACTA), the Transition Pathway Initiative (TPI), and the International Organization for Standardization (ISO) as examples of third-party verifiers. See also, "Assessing Science-Based Corporate Climate Target-Setting," MSCI ESG Research, June 9, 2023.

Exhibit 11: 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 Aug. 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 12: Number of companies with self-declared net-zero targets by GICS® sector



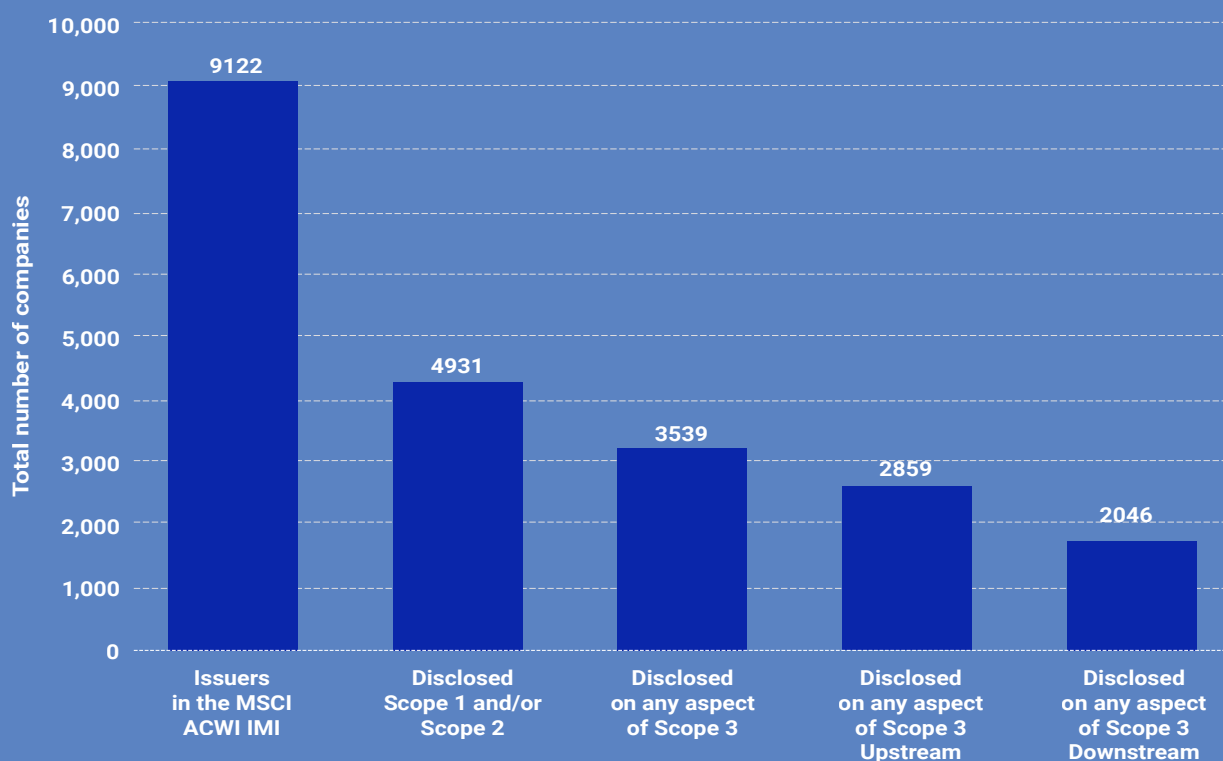
Source: MSCI ESG Research, based on companies in the MSCI ACWI IMI, data as of Aug. 31, 2023

Reporting of Scope 3 emissions ticks higher

Scope 3 emissions, which arise from a company's suppliers or use of its products by customers, matter because such emissions represent the largest source of emissions for all but a handful of industries and the lion's share of emissions of investment portfolios and lending books.⁴⁸ About 39% of listed companies disclosed at least some of their Scope 3 emissions as of Aug. 31, 2023, up 8 percentage points from a year ago. (Exhibit 13).⁴⁹ The rise in Scope 3 disclosure marks progress: Three years ago, only about 18% of listed companies reported any of their Scope 3 emissions.⁵⁰ At the same time, investors who aim to assess climate-related financial risk or to identify companies in every industry that are decarbonizing may want to know companies' emissions across all scopes.⁵¹

Taking inventory of Scope 3 emissions is getting easier as carbon accounting improves, yet reporting them remains a challenge because it requires companies to tally emissions from both upstream and downstream in the value chain. Still, international standards and regulatory requirements reflect a growing consensus that reporting of Scope 3 emissions delivers the clearest picture of companies' exposure to climate-related risks and opportunities; information that informs investment decisions.⁵²

Exhibit 13: Disclosure by listed companies across emissions scopes



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

⁴⁸ "For a financial institution, Scope 3 category 15 emissions, i.e., financed emissions, are often the most significant part of its GHG emissions inventory." See "Financed Emissions, The Global GHG Accounting & Reporting Standard, Part A," Partnership for Carbon Accounting Financials, December 2022.

⁴⁹ "The MSCI Net-Zero Tracker," MSCI ESG Research, October 2022.

⁵⁰ "Scope 3 Carbon Emissions: Seeing the Full Picture," MSCI Research, Sept. 17, 2020.

⁵¹ SBTi's Corporate Net-Zero Standard, for example, requires companies to align all of their financially relevant emissions with a science-based net-zero pathway.

⁵² The EU's Corporate Sustainability Reporting Directive and the climate-disclosure rules proposed by the U.S. Securities and Exchange Commission would require companies to report financially relevant Scope 3 emissions. The global framework published by the International Sustainability Standards Board and recently enacted legislation in California go further and would require companies to report their Scope 3 emissions whether material or not.

The countdown clock to 1.5°C is ticking louder than ever

Listed companies would deplete their share of the global carbon emissions budget for limiting temperature rise to 1.5°C by April 30, 2026, based on their Scope 1 emissions as of Aug. 31, 2023.⁵³ This estimated depletion is three months sooner than our estimate in the July edition of this report (Exhibit 14).⁵⁴ While a 1.5°C-aligned pathway for such companies remains theoretically possible, it looks increasingly unlikely that they can decarbonize in time to avoid using up their share of the global GHG-emissions budget for limiting the rise in average global temperatures to 1.5°C.⁵⁵

- » To limit warming to 1.5°C, listed companies would need to collectively cap future Scope 1 emissions at 33.4 Gt of CO₂e by 2050. Without any change to their current emissions of roughly 12.4 Gt a year, listed companies would deplete their remaining emissions budget in 2 years, 8 months.
- » To limit warming to 2°C, listed companies would need to collectively cap future Scope 1 emissions at 205 Gt of CO₂e by 2050. Without any change to their current emissions of 12.4 Gt a year, listed companies would deplete their remaining emissions budget in 16 years, 6 months.

Exhibit 14



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 Aug. 31, 2023

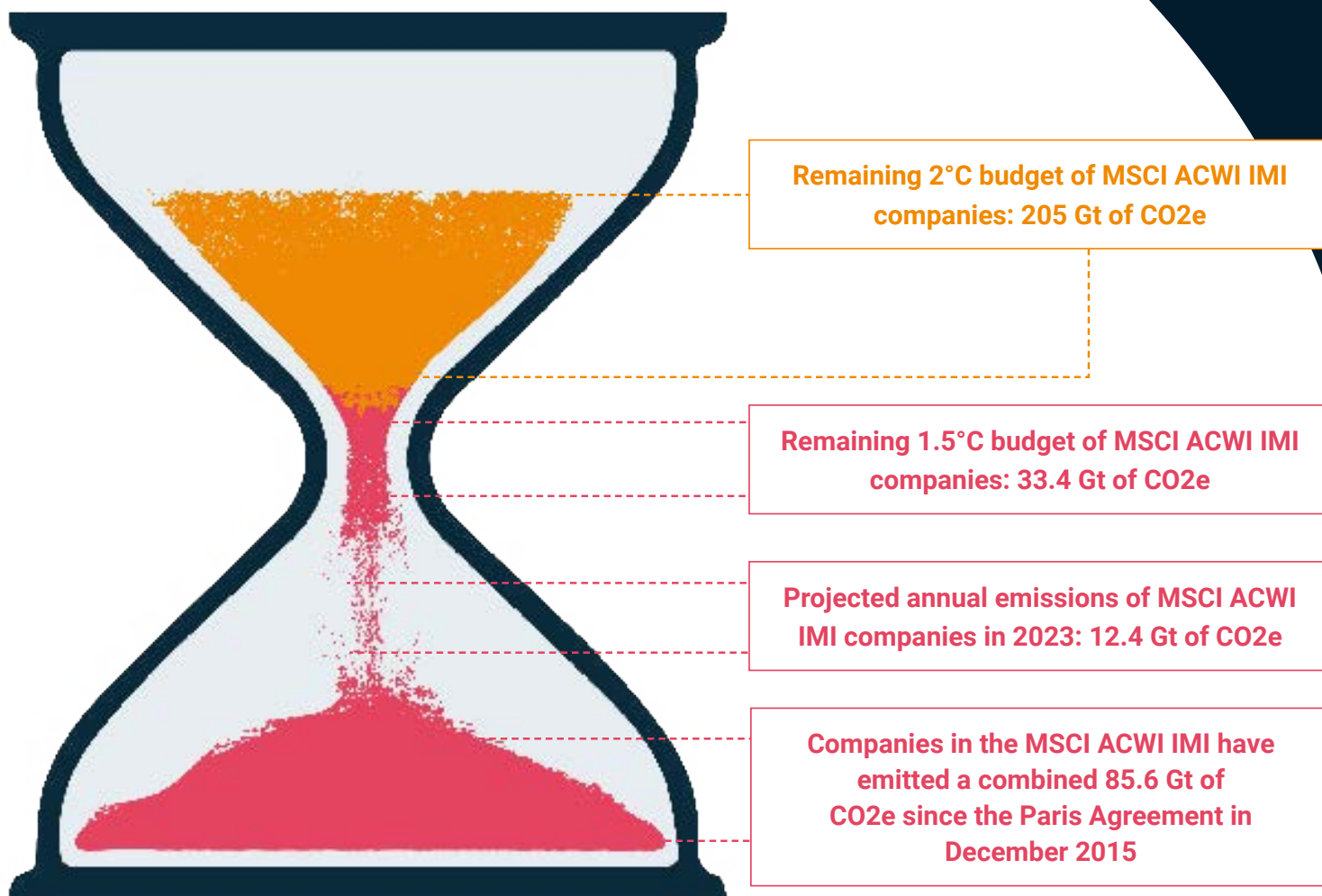
⁵³ We focus here on listed companies' Scope 1 emissions to avoid double-counting.

⁵⁴ "The MSCI Net-Zero Tracker," MSCI ESG Research, July 2023.

⁵⁵ We use a remaining 1.5°C-aligned global budget estimated to be +/- 500 Gt. See IPCC's Sixth Assessment Report, Working Group 1, Chapter 5, FAQ 5.4.



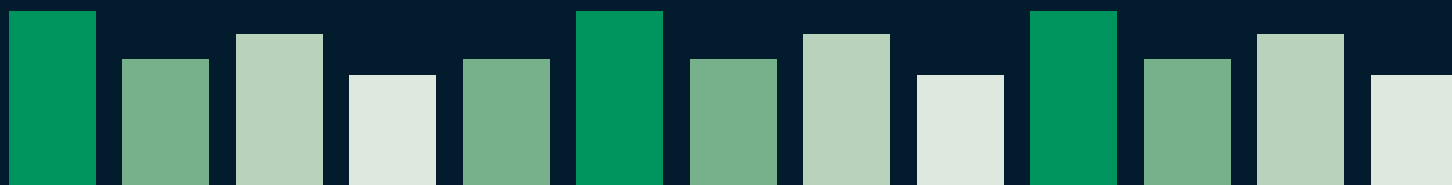
Exhibit 15



Source: MSCI ESG Research, data as of Aug 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 Aug. 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 Aug. 31, 2023.

For now at least, listed companies' emissions are continuing to rise



Whether global GHG emissions are falling – and how quickly – is the measure that matters for assessing progress toward global climate goals. Science-based pathways for constraining the rise in average global temperatures to 1.5°C envision global GHG emissions peaking before 2025.⁵⁶ For now at least, both global GHG and listed-company emissions continue to go up (Exhibit 16). To avoid double counting, we focus here on listed companies' direct (Scope 1) emissions.

We estimate that direct (Scope 1) emissions of the world's listed companies will represent one-fifth (20.4%) of global emissions this year, up about two percentage points from 2022. The table below shows total estimated global GHG emissions and Scope 1 emissions (sum for all index constituents without index weighting) for companies in the MSCI ACWI IMI, as of Aug. 31, 2023.

Exhibit 16

Historical greenhouse gas emissions [Gt CO ₂ e]	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	55.9	59.4	60.4	60.9
MSCI ACWI IMI Scope 1**	10.9	10.4	10.2	9.6	10.2	11.4	11.4	10.4	11	11.2	12.4

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

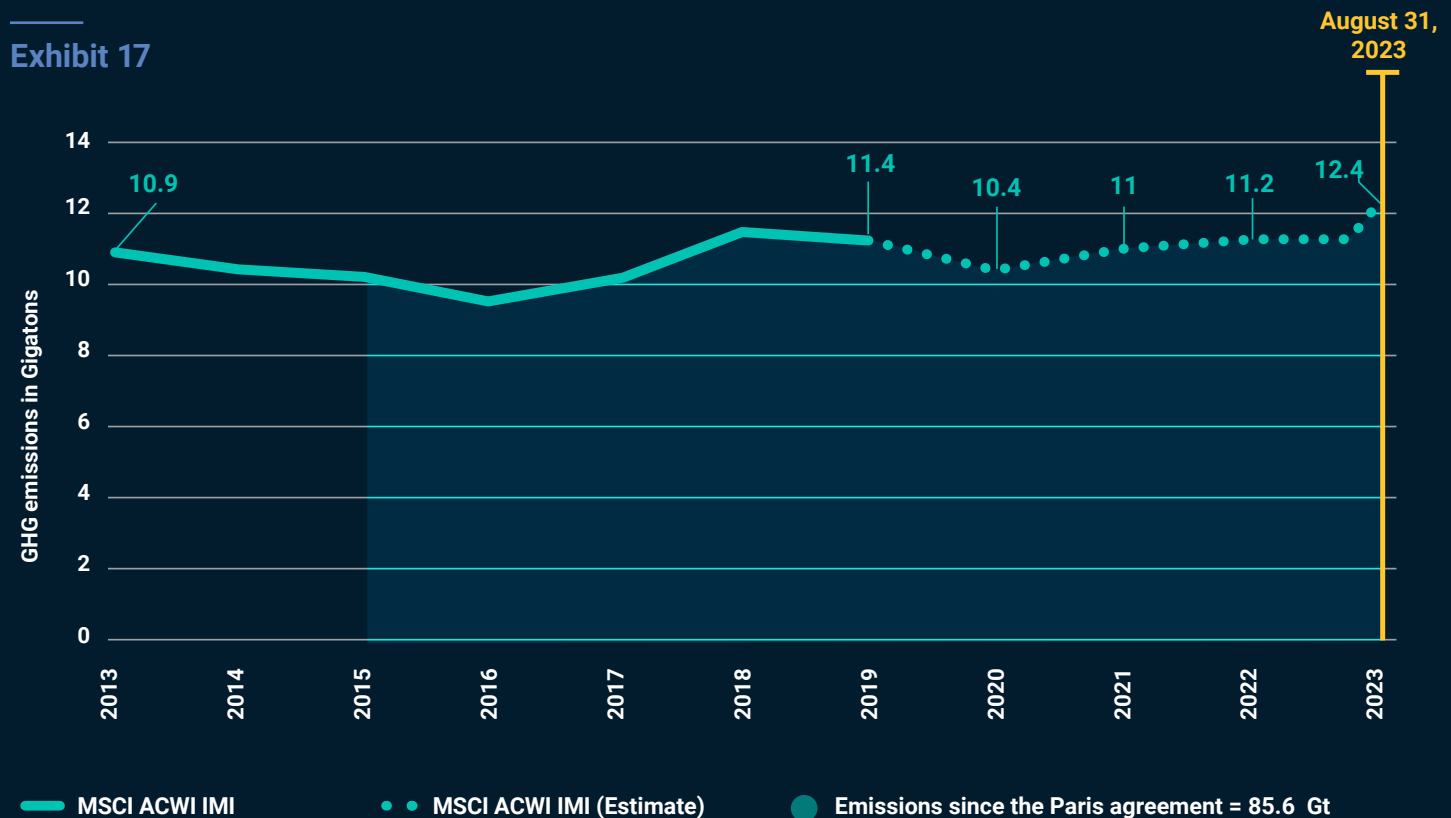
** MSCI ACWI IMI emissions for 2022 as reported by companies or estimated by MSCI, where not reported. Emissions for 2023 are estimated from changes in emissions as reported by Carbon Monitor.

⁵⁶ "Synthesis Report of the IPCC Sixth Assessment Report (AR6), U.N. Intergovernmental Panel on Climate Change (IPCC), March 20, 2023.

Listed companies GHG emissions climbing

Listed companies' Scope 1 emissions are on track to climb nearly 11% this year (Exhibit 17). Such emissions, however, would need to fall by 43% this decade if society is to limit the rise in average global temperatures to 1.5°C.

Exhibit 17



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

Source: MSCI ESG Research, data as of Aug. 31, 2023



The 20 listed companies with the largest carbon footprints



Twenty listed companies were responsible for roughly 12% of all listed-company Scope 1 emissions in the 12 months that ended Aug. 31, 2023. Exhibit TK shows the contribution of each of those companies to the total emissions of listed companies, together with differences in their levels of transparency.

Exhibit 18

Issuer	Country	Total carbon emissions [million tons of CO2e]*	Scope 1 emissions [million tons of CO2e]	Scope 2 emissions [million tons of CO2e]	Estimated Scope 3 emissions [million tons of CO2e]	Does the company have a self-declared net-zero target? (Y/N)	Has the company set a science-based target?
Saudi Arabian Oil Company	Saudi Arabia	2,685.7	189.8	16.8	2479.1	Yes	No
Coal India Ltd.	India	1,163.1	1.2	3.8	1158.2	No	No
Exxon Mobil Corporation	U.S.	941.0	109.0	7.0	825.0	Yes	No
PetroChina Company Limited	China	890.9	119.7	40.9	730.3	Yes	No
China Shenhua Energy Company Limited	China	757.9	172.4	4.0	581.5	Yes	No
Shell PLC	U.K.	709.5	82.0	8.0	619.5	Yes	No
BP PLC	U.K.	676.2	33.9	1.6	640.7	Yes	No
Marathon Petroleum Corporation	U.S.	674.8	60.3	13.4	601.2	No	No
Chevron Corporation	U.S.	650.5	53.0	4.0	593.5	Yes	No
BHP Group Limited	Australia	637.4	9.2	3.1	625.1	Yes	No
Valero Energy Corporation	U.S.	634.8	43.2	9.3	582.2	Yes	No

SAIC Motor Corporation Limited	China	626.0	1.8	3.4	620.8	No	No
VALE S.A.	Brazil	586.3	9.8	1.3	575.2	Yes	No
China Petroleum & Chemical Corporation	China	562.6	137.7	24.1	400.8	No	No
TotalEnergies SE	France	551.2	37.0	2.0	512.2	Yes	No
Rio Tinto PLC	U.K.	535.8	22.8	7.5	505.5	Yes	No
Petroleo Brasileiro S.A. (Petrobras)	Brazil	526.4	61.4	0.4	464.6	No	No
Porsche Automobil Holding SE	Germany	516.2	2.4	1.1	512.7	Yes	Yes
Phillips 66	U.S.	510.7	24.8	6.4	479.5	No	No
Volkswagen	Germany	493.1	4.5	2.1	486.6	Yes	Yes

MSCI ESG Research, data as of Aug. 31, 2023

- * 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.



Conclusion

Staving off the costliest effects of global warming will require society to infuse continued climate action with ambition. It will also require trillions of dollars in annual clean-energy investment, especially for the climate transition in developing countries.

Countries and the private sector alike have made meaningful progress in responding to the threats of a warming world. GHG emissions in 11 of 16 Group of 20 nations fell in the five years following adoption of the Paris Agreement. Emissions of listed companies based in 13 of those countries fell over the same period.

Though the rate of decarbonization by listed companies exceeded that of their respective countries after the Paris Agreement went into effect, that's set to reverse during the remainder of this decade when a slowing rate of decarbonization by companies may suggest the need for policy innovation and technological advances that can continue to accelerate the shift to renewable energy.

For their part, the share of listed companies that are lowering their emissions in line with global goals continues to climb. More than half (55%) align with the benchmark of limiting warming to 2°C while over one-fifth (22%) of listed companies align with limiting to 1.5°C, up 22 and 12 percentage points, respectively, from two years ago. Corporate disclosure of Scope 3 emissions, the most onerous aspect of climate accounting, has continued to tick up as well.

In all, listed companies have lowered the warming associated with their emissions by a half-degree in two years. That's a lot of decarbonization. Still, companies are on track to put nearly 11% more GHG emissions into the atmosphere this year than last and to use up their share of the global carbon budget for constraining warming to 1.5°C three months earlier than they were last spring.

Participants in the technical dialogue that produced the UNFCCC's assessment "highlighted existing and emerging opportunities and creative solutions for bridging gaps" between progress in reducing global GHG emissions achieved and action needed to stop climate change.⁵⁷ All evidence suggests the time to act is now.

⁵⁷ "Technical dialogue of the first global stocktake," UNFCCC, Sept. 8, 2023.

Glossary

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

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

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 (MSCI ACWI IMI): Captures large-, mid- and small-cap listed companies across 23 developed markets and 27 emerging market countries. With 9,152 constituents, the index covers approximately 99% of the global equity investment opportunity set, as of Aug. 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: 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.



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