March 2022

Spotlight on coal

The MSCI Net-Zero Tracker

A quarterly gauge of progress by the world's public companies toward curbing climate risk

Introduction

A net-zero world would mean the end of coal, but is the end of coal really in sight?

Keeping the rise in average global temperatures to 1.5 degrees Celsius (1.5°C) requires phasing out unabated coal-fired power within the next eight years in advanced economies and across the world within the 10 that follow.[1] Though the COP26 climate conference produced new pledges to phase down coal power, coal – the largest source of energy-related greenhouse gas emissions – remains a staple of global electricity production and a key ingredient in the production of steel and other products.[2]

Carbon dioxide (CO2) emissions from coal hit an all-time high in 2021, and could climb further if a surge in natural gas prices sparked by Russia's invasion of Ukraine causes utilities in Europe to boost the burning of coal to produce power.[3]

This edition of the MSCI Net-Zero Tracker looks at the problem of coal through the prism of the world's listed companies.[4] It shows coal reserves of the largest listed miners and consumers of coal, their emissions trajectories and how exposure to coal cuts across sectors. It also shows listed companies with the largest carbon footprints and spotlights leaders and laggards in climate change disclosure.

The data shows that coal is neither yesterday's problem nor one that investors can solve on their own. Some of the largest listed coal companies continue to open new mines and build plants. Government control of the largest coal producers insulates those companies from the pressures of minority shareholders.

For the planet to power past coal, investors will need to exert leverage where they can. That includes using their voice to persuade governments to do more to accelerate the energy transition in time to prevent a climate catastrophe.

1 "Phasing out coal," World Energy Outlook 2021, International Energy Agency, October 2021. Unabated coal-fired power refers to the burning of coal without the use of technology that captures the carbon emissions released into the atmosphere.

2 "Coal 2021: Analysis and forecast to 2024," International Energy Agency, December 2021

3 "Global Energy Review: CO2 Emissions in 2021," International Energy Agency, March 2022

4 Represented by the MSCI All Country World Investable Market Index (ACWI IMI), which includes large-, mid- and small-cap traded listed companies across 23 developed-market and 25 emerging-market countries. With 9,278 constituents, the index covers approximately 99% of the global equity investment opportunity set as of Feb. 28, 2022.

Key findings

The world is awash in coal.

» MSCI has identified at least 130 listed companies that own reserves of thermal or metallurgical coal.
  - Seventy-two of them report their reserves, which total about 90 billion metric tons.
  - Burning those reserves would produce an estimated 183 billion tons (gigatons) of carbon dioxide equivalent (CO_2e), or more than three times total global CO_2 emissions in 2021.
  - At the same time, listed companies that report their reserves own or control less than 10% of the world's proved recoverable coal reserves.

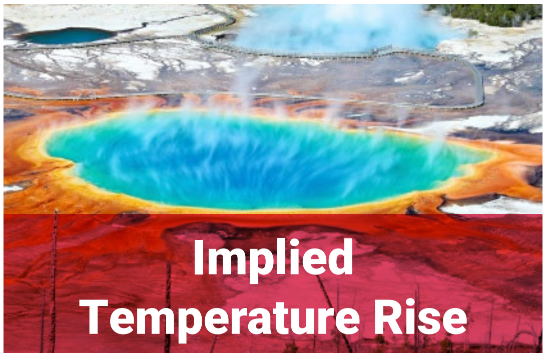
» More coal is coming online.
  - At least 10 listed companies are planning to expand their production of coal-fired power by a combined 139 gigawatts (GW).
  - That's the equivalent of adding 280 new coal-fired plants, which could power 58 million U.S. homes, 24/7, 365 days a year.

» Because coal is integral to the manufacture of products such as steel and cement, its emissions can still warm the portfolios of investors in sectors beyond energy, materials and utilities.
  - Coal-intensive companies vary in their climate trajectories. While most will far overshoot a global temperature rise of 1.5°C, the pathways of some promise to align with a lower temperature rise.

» Neither engagement nor divestment may, by themselves, resolve the problem that coal represents for net-zero investors.
  - Many of the largest coal companies are state-controlled, limiting the leverage investors can exert.
  - More and more investors are dropping coal. At scale, that can exert pressure on further expansion.
  - But divestment alone is insufficient for reducing real-world emissions. To reach net-zero, investors also may need to use their voice to call for policies that speed change in the energy mix.

Coal used to generate electric power. Burning thermal coal to produce steam that turns electricity plant turbines is among the leading sources of greenhouse gas emissions.

Coal used to produce steel and other industrial products. The carbon released from burning metallurgical coal renders steelmaking emissions-intensive.



A forward-looking metric, expressed in degrees Celsius, designed to show the alignment of companies, portfolios and funds with global temperature targets.

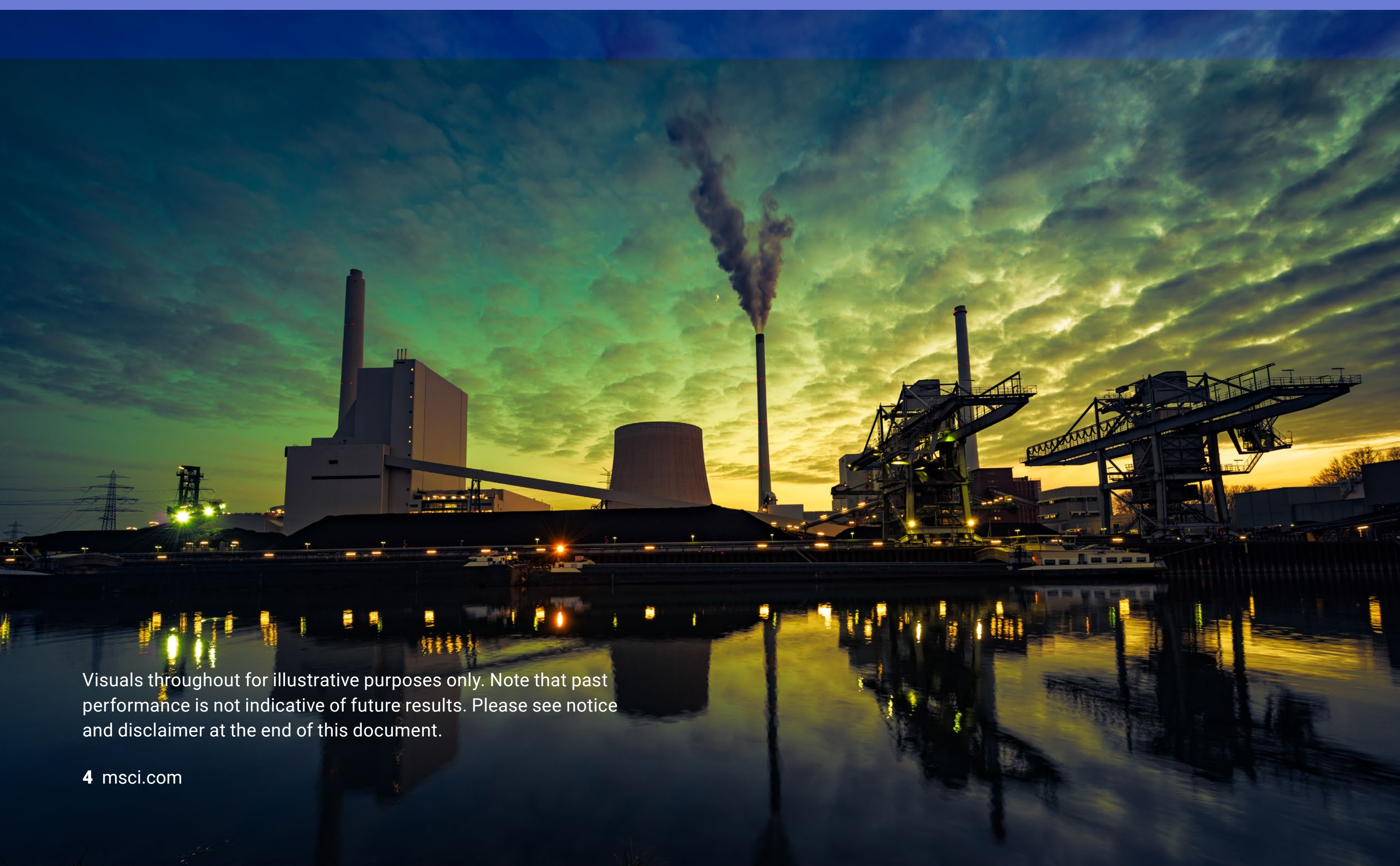
Companies are still running hot

» The world's listed companies continue to put more carbon into the atmosphere as the global economy recovers from the pandemic.

Comparing corporate decarbonization targets

» Not all net-zero targets are worthy of the task. Some companies have set targets that cover their complete carbon footprint, while others set targets that don't. We identify the listed companies with the most- and least-thorough emissions-reduction targets.

There are three categories of corporate greenhouse gas emissions.



Visuals throughout for illustrative purposes only. Note that past performance is not indicative of future results. Please see notice and disclaimer at the end of this document.

Reckoning with coal

Investors that embrace a net-zero target for their investments – or who simply wish the planet to remain habitable – must be ready to confront the hard truth about coal: Its unabated use must be discontinued this decade in advanced economies and across the world within the one that follows to limit global warming to 1.5°C above preindustrial levels.[5] Coal is both the most widely used fuel for electricity generation and the largest source of energy-related CO2 emissions.[6]

MSCI has identified 130 listed companies that own reserves of thermal or metallurgical coal.[7] The 72 among them that report their reserves hold a collective 90 billion metric tons.[8] Burning those reserves would produce an estimated 183 gigatons of CO2e or more than three times global CO2 emissions in 2021.[9]

Given that reality, investors who aren't doing so already will need to weigh the possibilities of asset-stranding and reputational risk of coal assets. Technologies for capturing and storing carbon emissions may hold promise for mitigating the emissions of coal-fired plants someday but for now those technologies remain in their infancy.

The table below shows the reserves, decarbonization targets and emissions trajectories of the 10 listed companies with the largest reserves of **thermal coal**, which is used mainly to generate electricity. It also shows the challenge investors confront in hastening coal's end. Nine of the companies are state-controlled, which can insulate them from the pressures of minority shareholders; five have announced plans to produce more coal. Only one of the 10 companies, AGL Energy Limited, has set a decarbonization target. And listed companies collectively own or control less than 10% of the world's proved recoverable coal reserves.[10]

The 10 listed companies with the largest reserves of thermal coal

Issuer	Thermal coal reserves (metric tons)*	Comprehensiveness of decarbonization target [%]**	Ambition (annual change in emissions) [%]	Implied temperature rise [°C]***	GICS sub-industry	Expansion plans*
COAL INDIA LTD	11,476,417,860	less that 10%	less than 1%	10.0	Coal & Consumable Fuels	Yes (mining & power)
Shaanxi Coal Industry Company Limited	8,213,557,200	less that 10%	less than 1%	10.0	Coal & Consumable Fuels	-
China Shenhua Energy Company Limited	6,029,400,000	less that 10%	less than 1%	10.0	Coal & Consumable Fuels	Yes (mining & power)
Guanghui Energy Co., Ltd.	4,688,510,424	less that 10%	less than 1%	10.0	Integrated Oil & Gas	-
NTPC LIMITED	4,000,000,000	less that 10%	less than 1%	9.0	Independent Power Producers & Energy Traders	Yes (mining & power)
Bukit Asam Tbk PT	3,180,000,000	less that 10%	less than 1%	10.0	Coal & Consumable Fuels	Yes (mining & power)
Yanzhou Coal Mining Company Limited	2,738,400,000	less that 10%	less than 1%	10.0	Coal & Consumable Fuels	-
AGL ENERGY LIMITED	2,500,000,000	85.0%	-2.7%	1.4	Multi-Utilities	-
INNER MONGOLIA YITAI COAL CO., LTD	2,471,385,549	less that 10%	less than 1%	10.0	Coal & Consumable Fuels	-
Huadian Power International Corporation Limited	2,200,000,000	less that 10%	less than 1%	5.2	Independent Power Producers & Energy Traders	Yes (mining & power)

* Reserves reflect company disclosures of reserves as of the year that ended Dec. 31, 2020, the latest period for which all of the companies have published their reserves. Data on expansion plans courtesy of Urgewald.

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

*** Expressed in degrees of temperature rise between 1.3°C and 10°C. For definition of implied temperature rise, see Glossary. For methodology that MSCI uses to calculate Implied Temperature Rise, see "Implied Temperature Rise Methodology," MSCI ESG Research, Sept. 2021.

The table below shows the reserves, decarbonization targets and emissions trajectories of the 10 listed companies with the largest reserves of **metallurgical coal**, a key ingredient in the manufacture of steel, cement and other products. Only one of the companies, BHP, which operates as a dual-listed company, has set a decarbonization target. Three have announced plans to produce more coal.

The 10 listed companies with the largest reserves of metallurgical coal

Issuer	Metallurgical coal reserves (metric tons)*	Comprehensiveness of decarbonization target [%]**	Ambition (annual change in emissions) [%]	Implied temperature rise [°C]***	GICS sub-industry	Expansion plans*
COAL INDIA LTD	3,896,652,800	less than 10%	less than 1%	10.0	Coal & Consumable Fuels	Yes (mining & power)
EVRAZ PLC	1,893,309,516	less than 10%	less than 1%	5.4	Steel	-
INNER MONGOLIA JUNZHENG ENERGY & CHEMICAL GROUP CO., LTD.	1,800,000,000	less than 10%	less than 1%	3.4	Commodity Chemicals	-
China Shenhua Energy Company Limited	1,700,600,000	less than 10%	less than 1%	10.0	Coal & Consumable Fuels	Yes (mining & power)
BHP GROUP LIMITED	1,643,495,000	less than 10%	less than 1%	7.4	Diversified Metals & Mining	-
BHP GROUP PLC	1,643,495,000	less than 10%	less than 1%	7.1	Diversified Metals & Mining	-
Mitsubishi Corporation	1,496,295,000	less than 10%	less than 1%	4.1	Trading Companies & Distributors	Yes (power)
Guanghui Energy Co., Ltd.	1,322,400,376	less than 10%	less than 1%	10.0	Integrated Oil & Gas	-
Ressources Teck Limitee	887,200,000	less than 10%	less than 1%	10.0	Diversified Metals & Mining	-
CORONADO GLOBAL RESOURCES INC.	575,419,488	less than 10%	less than 1%	9.4	Steel	-

* Reserves reflect company disclosures of reserves as of the year that ended Dec. 31, 2020, the latest period for which all of the companies have published their reserves. Data on expansion plans courtesy of Urgewald.

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

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

5 "Net-Zero by 2050: A Roadmap for the Global Energy Sector," International Energy Agency, May 2021.

6 "Coal," International Energy Agency," Jan. 17, 2022. See also, "Where does our electricity come from?" and Hannah Ritchie and Max Roser, "CO2 and Greenhouse Gas Emissions 2020," both retrieved from Our World in Data.

7 Based on reporting by companies in the MSCI ACWI IMI as of the year ended Dec. 31, 2020, the latest period for which the lion's share of companies have reported their coal reserves.

8 Based on annual reporting by MSCI ACWI IMI companies. Fifty-eight listed companies do not report their coal reservices. MSCI does not estimate coal reserves for companies that don't report them.

9 To convert reserves to potential emissions, we use a methodology published by the Potsdam Institute for Climate Impact Research. For global emissions in 2021, see "Global Energy Review, 2021," International Energy Agency.

10 Based on a comparison of proved and probable reported reserves of listed companies in the MSCI ACWI IMI with global proved reserves of just over 1 trillion tons. Source: "Statistical Review of World Energy 2021," BP. The remainder of the world's coal reserves are held by both private investors and governments. See, e.g., "Private Equity Funds, Sensing Profit in Tumult, are Propping up Oil," *New York Times*, Oct. 13, 2021.

Companies that are **expanding their coal portfolios**

Investors who think coal is yesterday's problem might think again. Despite the long-term trend toward decarbonization, some companies are adding coal to an already coal-intensive energy picture. The table below shows the 10 largest expansions of coal-fired power announced by listed companies, according to data from the environmental nonprofit Urgewald. The expansion totals 139 GW, which is just 29% of new coal-fired power in the global pipeline.[11]

Limiting global temperature rise to 1.5°C, however, would require shutting down 870 GW of coal power by 2030, according to the International Energy Agency.[12] Most of the coal coming online would fire coal-heavy utilities in Asia. China alone accounts for roughly half of global coal consumption and about 40% of new coal in the pipeline.[13]

The 10 largest expansions of coal-fired power planned by listed companies would produce 139 GW. That's the equivalent of:

280
coal-fired plants*

which could power

58 million
U.S. homes 24/7, 365 days a year**

* Assumes average plant capacity of 500 MW

** Assumes average output of coal-fired plants at 50% capacity factor and average U.S. residential consumption of 10,715 kilowatt-hours annually. See, "Annual U.S. coal-fired electricity generation will increase for the first time since 2014," U.S. Energy Information Administration, Oct. 18, 2021; see also "How much electricity does an American home use?" U.S. Energy Information Administration, Oct. 7, 2021.

Nine of the companies listed below are state-controlled. Taken together, their plans illuminate the persistence of coal-fired power and the challenge of curbing its consumption.

Company	Country	Planned expansion (MW)	Project locations	State-controlled
China Energy Investment Corp (China Energy/ CHN Energy)	China	31,797	China, Indonesia	Yes
China Datang Corp	China	16,113	China	Yes
Power Finance Corp Ltd	India	16,000	India	Yes
China Huaneng Group Co Ltd	China	15,957	China	Yes
NTPC Ltd	India	13,573	India, Bangladesh	Yes
China Huadian Co Ltd	China	10,964	China, Bangladesh, Indonesia, Cambodia	Yes
State Power Investment Corp (SPIC)	China	10,230	China, Turkey, Mongolia	Yes
Beijing Energy Holding Co Ltd	China	8,340	China	Yes
Perusahaan Perseroan (Persero)	Indonesia	8,185	Indonesia	Yes
Adani Group	India	7,845	India	No

Source: "Global Coal Exit List," Urgewald

11 Based on data from Urgewald showing 480GW of new coal-fired power capacity in the global pipeline

12 "Coal Fired Power," International Energy Agency, Nov. 2021

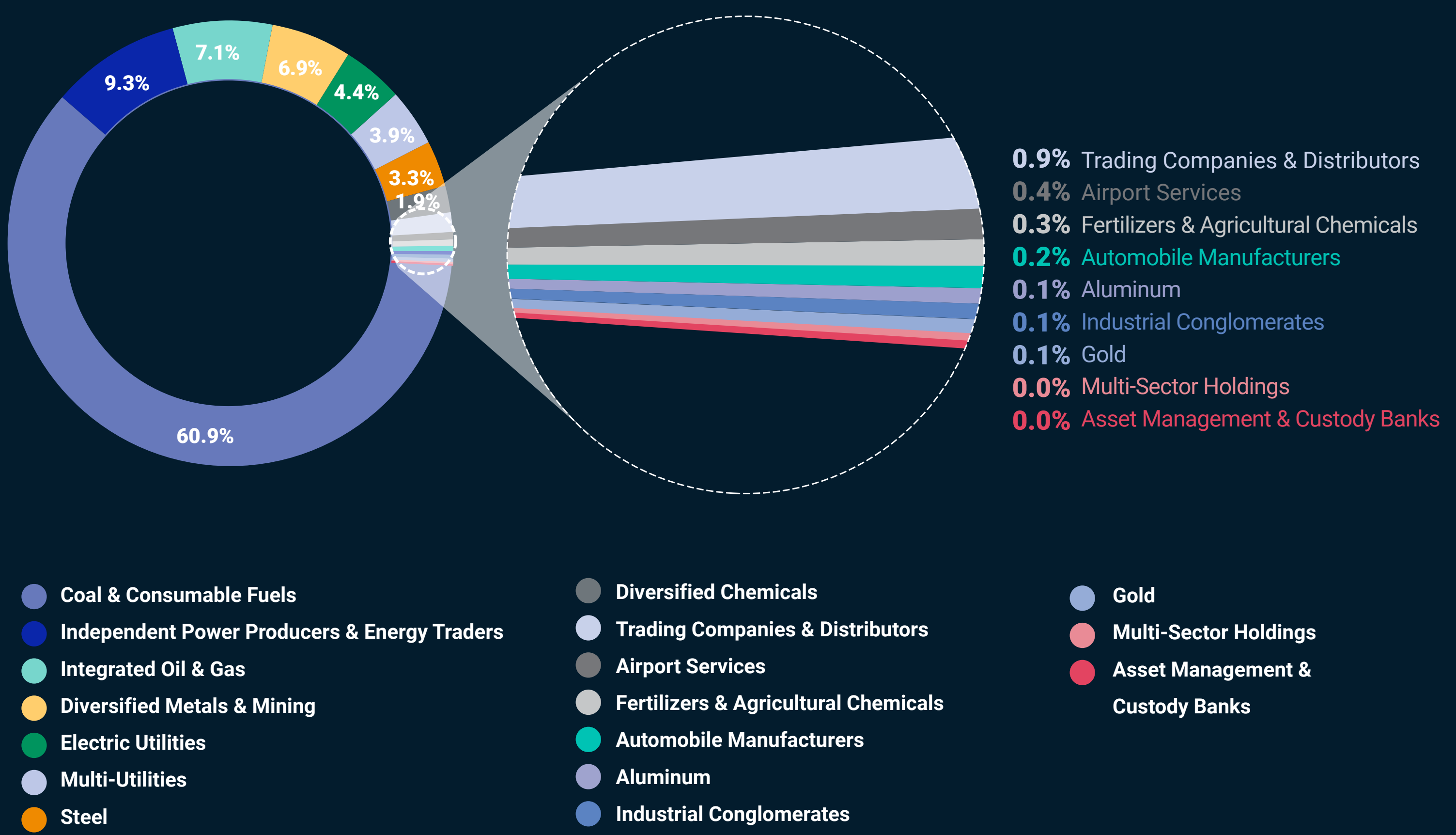
13 "Coal 2021," International Energy Agency , Dec. 2021. See also "Mapped: The world's coal power plants," Carbon Brief, March 26, 2020.

Coal seams within sectors

Investors may also be investing in coal indirectly. Besides being the most emissions-intensive fossil fuel, coal is integral to the manufacture of such products as steel and cement. That means investors may find that emissions from reserves of metallurgical coal in such hard-to-abate sectors warm their portfolios even if they avoid companies in the energy, materials and utilities sectors.

A growing number of steel producers, construction firms and other stakeholders are committing to low-carbon or net-zero steel in the years to come. Their decarbonization targets will reveal the strength of that commitment.[14]

Ownership of thermal coal reserves by sector



As of Dec. 31, 2021

14 See, e.g., "There's power in the collective: SteelZero members join forces to tackle embodied carbon in the built environment," The Climate Group, Oct. 13, 2021.

Engagement, divestment **and advocacy**

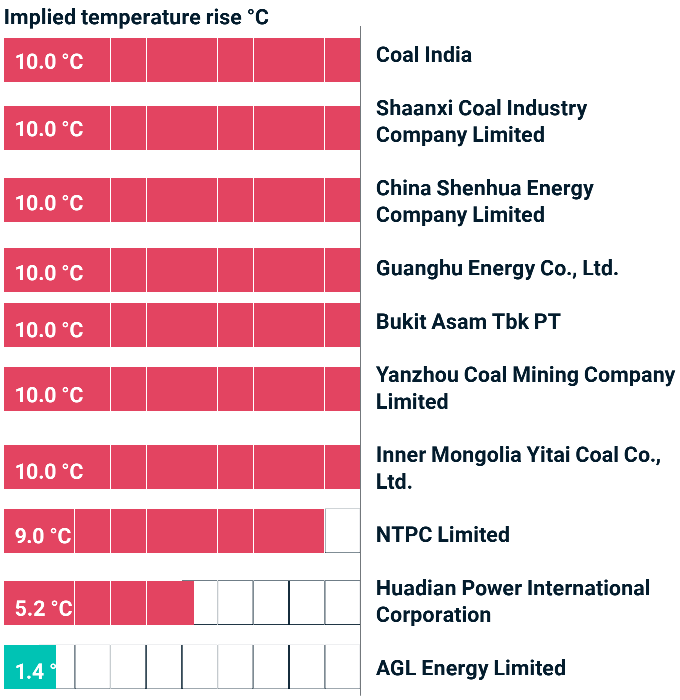
Informing engagement

Even within emissions-intensive sectors such as energy and utilities, companies vary in their decarbonization targets and emissions trajectories. Such targets suggest a path that lies between divesting coal stocks or doubling down on engagement: discerning among companies based on their projected emissions pathways and allocating capital toward those that align with global temperature targets and away from those that don't.

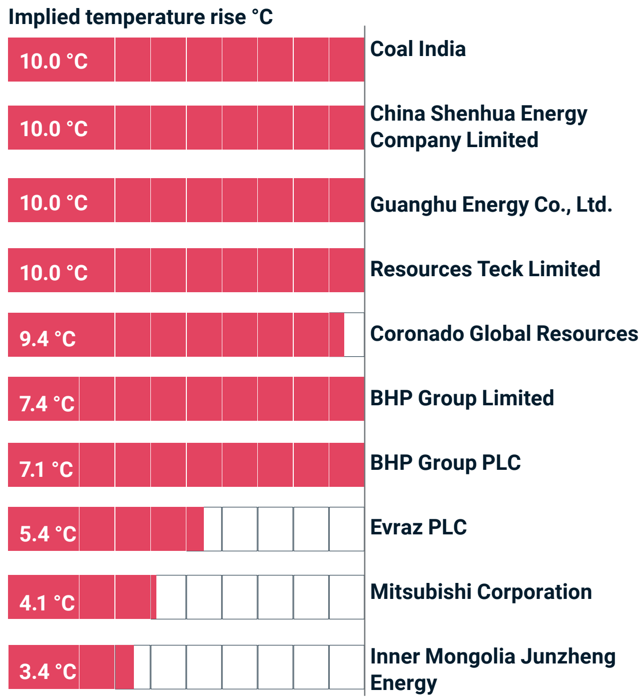
For example, although AGL Energy Limited generates about 84% of its power from burning coal, the company has set a decarbonization target that covers 80% of its emissions and promises to put the company on a future emissions pathway that aligns with a 1.4°C temperature rise.[15] The emissions trajectories of some producers of metallurgical coal could also lay a foundation for engagement.

The charts below show the implied temperature rise of the largest producers of thermal and metallurgical coal, respectively. The information underscores both the need for climate targets based on quantitative data and the ability of investors to consider forward-looking indicators rather than rely solely on companies' current carbon footprint, which measures retrospectively. The emergence of portfolio alignment tools such as implied temperature rise equips investors to draw such distinctions.

Emissions trajectories of the largest producers of thermal coal



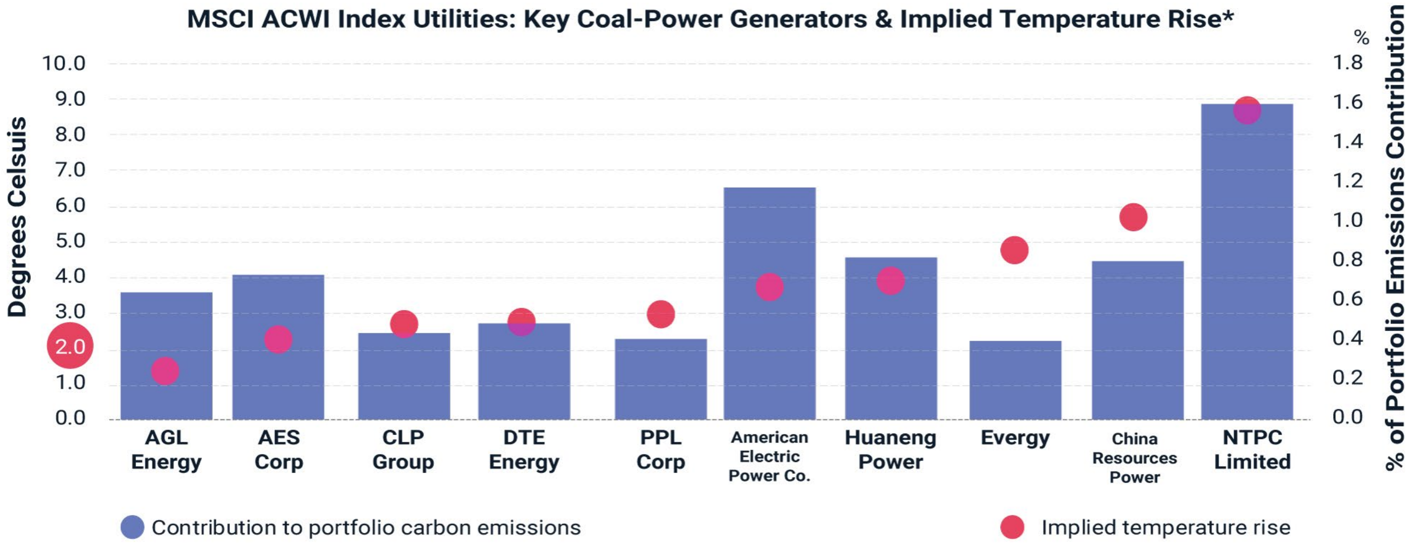
Emissions trajectories of the largest producers of metallurgical coal



15 See "2022 Half-Year Result," AGL Energy Limited

Investors who look past companies with the biggest coal reserves will find still further variation in climate trajectories among listed coal-fired power generators. The chart below shows 10 listed companies in the utilities sector, their contribution to portfolio emissions and implied temperature rise.

Climate trajectories of select coal-fired power generators



* The MSCI All Country World Index (ACWI) captures large- and mid-cap representation across 23 developed market and 25 emerging market countries. With 2,959 constituents, the index covers approximately 85% of the global investable equity opportunity set as of Feb. 28, 2022.

How investors are approaching coal divestment

More and more institutional investors are abandoning listed coal companies altogether.[16] While divestment that reaches a critical mass may impact the way targeted companies do business, government control of the largest coal producers may diminish divestment's effect.

As the table below indicates, a number of leading investors have established criteria to guide divestment. The data suggests both the scope of the task of divesting and the potential to inform decision-making that clear thresholds can offer.

The most frequently used criteria for coal divestment

	Financing of coal mines, plants and infrastructure projects	Development of new coal plants	Coal share of revenue or power production (%)	Annual thermal coal production (MT) or total coal-based installed capacity (MW)	Coal phaseout commitment expectations
Examples of exclusion thresholds	No project finance	Ban if adding >300 MW to the grid	Ban if >20%	Ban if production >10MT or installed capacity: >10GW	2030 for OECD and EU 2040 for rest of world

Source: Coal Policy Tool, Reclaim Finance

16 "Global Fossil Fuel Divestment Commitments Database," Stand.earth and 350.org

The following examples illustrate how investors' coal policies reflect these criteria.

- The French bank Natixis declines to finance the purchase of coal mines, plants or infrastructure projects, or to serve as an adviser to companies that are primarily in the business of coal-fired power generation or mining.[17]
- South Korea's National Pension Service announced last May it would discontinue investment in coal mining and power generation by phasing in a step-by-step plan for negative screening.[18]
- Storebrand, the Norwegian insurer, will not invest in companies that derive more than 5% of their revenue from coal-related activities or that have coal-fired plants greater than 1000 MW of capacity under construction.[19]
- La Banque Postale excludes from its portfolio companies in Europe or the Organization for Economic Cooperation and Development that have yet to publish a plan to phase out coal by 2030 (or by 2040 for companies worldwide).[20] To qualify as a phasehout, the asset manager requires that plans anticipate the final sale of coal assets and consider the social impacts of plant closures.

Policy advocacy

Neither engagement nor divestment alone may, by themselves, resolve the problem that coal represents for net-zero investors. Such investors also may need to assert a louder voice in discussions of climate policy. That may include advocating policies that remove incentives for fossil fuels, support development of renewable power generation and advance technologies for producing steel and other industrial products more cleanly.

Both the Net-Zero Asset Owner Alliance and the Net Zero Asset Managers initiative, for example, require members to contribute to policies that speed the phasing-out of fossil fuels. Members of the Net-Zero Asset Owner Alliance are expected to contribute to work to align governments' emissions-reduction targets with net-zero goals, promote policies designed to speed the decarbonization of sectors and promote mandatory climate change reporting and transition plans from portfolio companies.[21]

17 "CSR sector policy applicable to the coal industry: Coal-fired power plants, thermal coal mines and thermal coal-related infrastructures," Natixis, Oct. 27, 2020

18 "2020 National Pension Fund Annual Report," National Pension Service Investment Management, Sept. 14, 2021

19 "Product-based Exclusions," Storebrand

20 "Politique Charbon LBPAM," La Banque Postale Asset Management, April 2021

21 "Target Setting Protocol Section Edition," Net-Zero Asset Owner Alliance. See also, "Network Partners' expectation of signatories with regard to fossil fuel investment policy," Net Zero Asset Managers initiative.

Global and MSCI ACWI IMI Scope 1 emissions

Corporate greenhouse gas emissions are continuing their comeback. We estimate that direct (Scope 1) emissions of the world’s listed companies climbed nearly 5% last year as a rebound in global economic activity drove demand for fossil fuels.

Listed companies' emissions accounted for nearly one-fifth (19%) of last year’s total global carbon emissions of 58.6 gigatons.

The table below shows the total MSCI ACWI IMI Scope 1 greenhouse gas emissions (sum for all constituents without index weighting) and total global emissions, as of Dec. 31, 2021.

Historical greenhouse gas emissions [Gt C02e]	2013	2014	2015	2016	2017	2018	2019	2020	2021
Global*	51.2	51.7	51.8	51.9	53.5	55.3	59.1	55.7	58.6
MSCI ACWI IMI**	10.9	10.4	10.2	9.6	10.2	11.4	11.3	10.7	11.2

* Global emissions through the end of 2020 are based on annual UN Environment Programme reports. Global emissions forecasts for 2021 are estimates based on changes in emissions as reported by Carbon Monitor.

** ACWI IMI emissions through the end of 2019 as reported by companies. Estimates for 2020 and 2021 are based on changes in global emissions as reported by Carbon Monitor.

The 10 listed companies with the largest carbon footprints

The table below shows the 10 largest emitters in the MSCI ACWI IMI based on total greenhouse gas emissions in the 12 months that ended Dec. 31, 2021. It also shows the contribution of each of those companies' emissions to the total emissions of listed companies, as well as differences in transparency.[22] The presence in the table of Gazprom and Rosneft, with which Shell and BP have severed equity partnerships and an ownership stake, respectively, in response to Russia's invasion of Ukraine, highlights how the invasion has forced investors to navigate an energy transition on a timetable not of their own choosing.

Issuer	Country	Scope 1 emissions [tons of CO2e]	Scope 2 emissions [tons of CO2e]	Scope 3 emissions [tons of CO2e]	Total carbon emissions [tons of CO2e]*	Reported emissions (sum) as a percentage of MSCI estimated total emissions**	Ratio of total company emissions (reported/ estimated) vs ACWI IMI total emissions****
Saudi Arabian Oil Company	Saudi Arabia	Incomplete reporting	Incomplete reporting	Not reported	2,221,022,284	Estimated only***	3.5%
GAZPROM PAO*****	Russia	210,300,000	11,730,000	1,078,500,000	1,364,531,400	95.31	2.0%
COAL INDIA LTD	India	Incomplete reporting	Incomplete reporting	Not reported	1,013,640,003	Estimated only***	1.6%
NK ROSNEFT' PAO *****	Russia	59,400,000	21,800,000	243,000,000	949,225,787	34.15	1.5%
PetroChina Company Limited	China	127,570,000	39,870,000	Not reported	827,637,527	20.23	1.3%
EXXON MOBIL CORPORATION	U.S.	105,000,000	7,000,000	540,000,000	739,200,392	88.20	1.2%
China Shenhua Energy Company Limited	China	126,680,000	8,220,000	Not reported	664,027,420	20.32	1.0%
ROYAL DUTCH SHELL PLC	Netherlands	63,000,000	9,000,000	1,339,550,000	657,031,708	214.84	1.0%
BP P.L.C.	U.K.	41,300,000	4,200,000	327,600,000	638,409,079	58.44	1.0%
Daimler AG	Germany	1,027,000	1,035,000	102,237,000	561,071,237	18.59	0.9%

22 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, Shell, Greenhouse Gas Emissions, at shell.com.

*	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 Scope 2 and 3 emissions. The comparison here, on average, cancels this double counting by comparing each listed company's share of total emissions to ACWI IMI total emissions.

***** MSCI announced on March 2, 2022 the removal of Russian securities from all global and regional indexes within the MSCI Global Investable Market Indexes, including, but not limited to, MSCI ACWI Indexes.

Scope 3 disclosures by listed companies

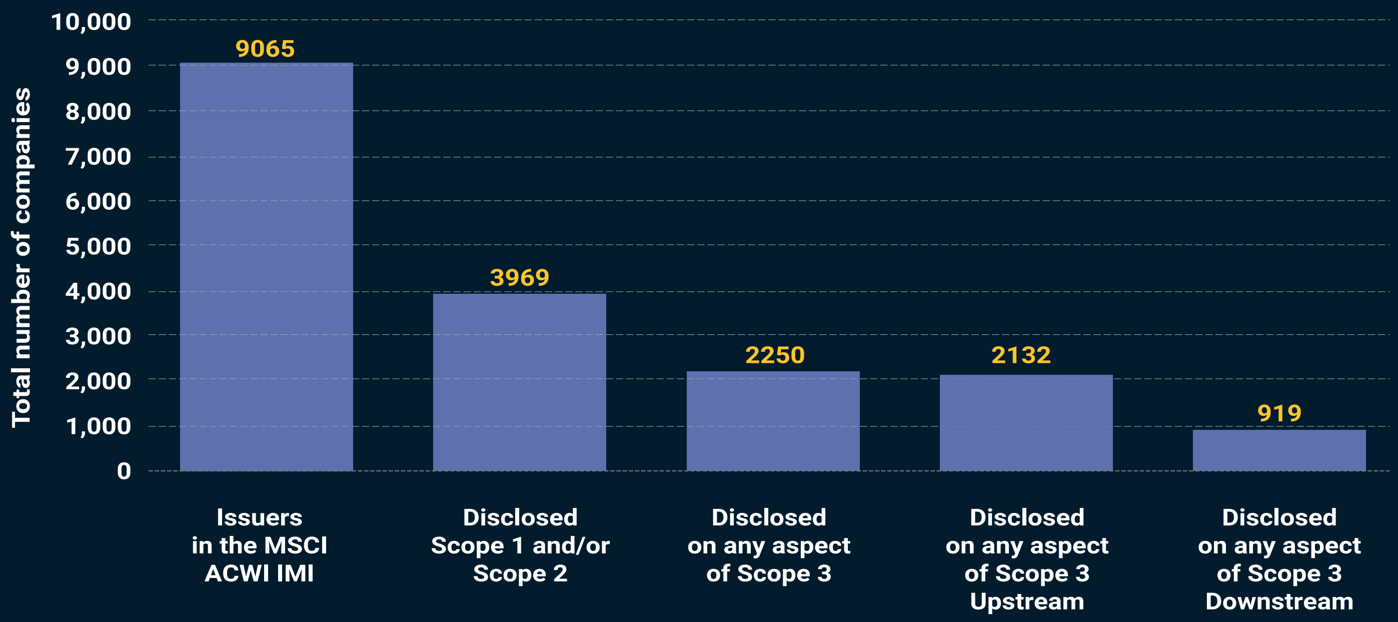
Investors need to know companies' complete carbon footprint to measure a portfolio's financial exposure to potential changes in climate policy, to technology displacement and to changes in market demand.

For all but a handful of industries, the largest part of companies' emissions occur in their value chain, or Scope 3, which refers to the emissions of a company's suppliers, from the use of its products by customers or from the companies in which a financial institution invests. Yet Scope 3 emissions remain a black box, with just one-quarter of listed companies disclosing any information about them.

To counter the paucity of such data, MSCI estimates 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.

As the chart below shows, many companies have yet to report their carbon emissions. Fewer still report emissions for their value chain. The data underscores both the inconsistency in emissions reporting and the need for mandatory reporting of companies' complete carbon footprint across all emissions scopes.

Companies are providing less than the full picture of their carbon footprint



Source: MSCI ESG Research, data as of Dec. 31, 2021

Shining a light on disclosure: leaders and laggards

What gets measured can get managed. Investors need emissions disclosures to assess the resilience of companies to climate change. Disclosure helps investors 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 the 15 largest listed companies by market capitalization in the MSCI ACWI IMI that reported additional scopes or categories of greenhouse gas emissions in the 12 months that ended Dec. 31, 2021. The companies below are now reporting substantially all their emissions across all emissions scopes.

Issuer	Country	Total reported emissions [tons CO2e]	Total estimated emissions [tons CO2e]	Reported emissions (sum) as a percentage of MSCI estimated total emissions*
PPL CORPORATION	U.S.	31,808,119	29,969,594	106%
SANTOS LIMITED	Australia	36,910,000	34,892,984	106%
MERIDIAN ENERGY LIMITED	New Zealand	857,445	817,912	105%
Clariant AG	Switzerland	4,990,000	4,863,929	103%
ULTRATECH CEMENT LIMITED	India	63,249,067	61,841,573	102%
THE AES CORPORATION	U.S.	52,201,792	51,263,332	102%
WOODSIDE PETROLEUM LTD.	Australia	36,543,000	35,955,356	102%
EASYJET PLC	U.K.	5,393,980	5,247,349	103%
Iberdrola, S.A.	Spain	77,721,041	75,617,157	103%
Otter Tail Corporation	U.S.	4,092,491	3,987,753	103%
Ferrovial, S.A.	Spain	4,036,905	4,092,462	99%
UNITED MICROELECTRONICS CORP.	Taiwan	4,087,204	4,151,184	98%
L'OREAL SA	France	11,212,100	11,607,192	97%
EQUINOR ASA	Norway	263,500,000	274,310,271	96%
GAZPROM PAO	Russia	1,300,530,000	1,364,531,400	95%

* 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.

The largest emitters that have not disclosed their greenhouse gas emissions

The table below shows the 10 largest emitters based on MSCI's estimates of emissions across all emissions scopes that had not reported any of their greenhouse gas emissions as of Dec. 31, 2021.[23]

Issuer	Country	Emissions reference year	GICS® sector	Total estimated emissions [tons CO2e]
Shaanxi Coal Industry Company Limited	China	2020	Energy	199,200,752
Berkshire Hathaway Inc.*	U.S.	2020	Financials	146,814,617
China State Construction Engineering Corporation Limited	China	2020	Industrials	93,669,496
Shanxi Coking Coal Energy Group Co.,Ltd.	China	2019	Energy	82,534,966
Pbf Energy Inc.	U.S.	2020	Energy	75,332,910
Shanxi Lu'an Environmental Energy Dev. Co., Ltd.	China	2020	Energy	73,857,910
China Aviation Oil (Singapore) Corporation Ltd.	China	2020	Energy	64,153,719
Dongfang Electric Corporation Limited	China	2020	Industrials	57,586,774
Huayu Automotive Systems Company Limited	China	2020	Cons. Consumery	53,289,015
Mastec, Inc	U.S.	2020	Industrials	41,013,329

* Berkshire Hathaway Inc., a holding company, had not reported carbon emissions as of Dec. 31, 2021. 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.

23 The table remains unchanged from the October 2021 edition of the Net-Zero Tracker, which reported data as of Aug. 31, 2021. The difference in total estimated emissions for Shaanxi Coal Industry Company between Aug. 31 and Dec. 31 reflects an adjustment to the model we use to estimate such emissions.

Listed companies with the most-thorough emissions-reduction targets

Not all decarbonization targets are worthy of the task at hand. 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 Dec. 31, 2021, listed in descending order of their implied temperature rise.

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.[24]

Issuer	Country	Latest target announcement year	Scope 1 emissions reported otherwise estimated [tons of CO2e]	Scope 2 emissions reported otherwise estimated [tons of CO2e]	Scope 3 emissions reported otherwise estimated [tons of CO2e]	Annual total emissions [tons of CO2e]	Projected normalized change in absolute emissions per year [%]	Comprehensiveness of target [%]	Target year	Implied temperature rise (°C)
APPLE INC.	U.S.	2021	42,512	93,999	19,297,675	19,434,186	-5.33	100	2036	1.3
Telefonaktiebolaget LM Ericsson	Sweden	2019	285,000	0	20,856,000	21,141,000	-8.50	100	2030	1.3
Airbus SE	Netherlands	2020	47,430	0	22,547,000	22,594,430	-3.20	96	2050	1.3
LA BANQUE TORONTO-DOMINION	Canada	2020	117,000	662,000	24,256,000	25,035,000	-4.76	100	2040	1.3
NISSHIN SEIFUN GROUP INC.	Japan	2021	40,000	74,000	34,159,000	34,273,000	-9.09	100	2030	1.4
ELECTRICITE DE FRANCE SA	France	2020	1,125,000	511,000	38,493,000	40,129,000	-3.23	100	2050	1.5
FAURECIA SE	France	2021	28,164,630	4,854,698	69,256,631	102,275,959	-9.09	100	2030	1.6
Schlumberger N.V.	U.S.	2021	28,000,000	300,000	107,000,000	135,300,000	-3.23	100	2050	1.8
DOW INC.	U.S.	2020	88,942	303,019	159,361,459	159,753,420	-3.23	100	2050	1.9
Lundin Energy AB	Sweden	2020	470,000	313,000	443,402,000	444,185,000	-9.09	100	2030	1.9

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

Listed companies with the least-thorough emissions-reduction targets

Companies whose targets fail to address their complete emissions or bypass a substantial share of business activity may produce a burst of publicity but fail to help investors chart the company's future emissions pathway.

The table below shows the 10 companies in the MSCI ACWI IMI that we believe have published the least-thorough decarbonization targets in the 12 months that ended Dec. 31, 2021, listed in descending order of their implied temperature rise. While the targets stand out for a lack of completeness, they distinguish the companies that publish them from the nearly two-thirds (63%) of listed companies that have yet to set any type of decarbonization target.[25]

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.[26]

Issuer	Country	Latest target announcement year	Scope 1 emissions reported otherwise estimated [tons of CO2e]	Scope 2 emissions reported otherwise estimated [tons of CO2e]	Scope 3 emissions reported otherwise estimated [tons of CO2e]	Annual total emissions [tons of CO2e]	Projected normalized change in absolute emissions per year [%]	Comprehensiveness of target [%]	Target year	Implied Temperature Rise (°C)
EQT CORPORATION	U.S.	2021	291,000	279,000	23,746,000	24,316,000	1.02	less than 10%	2025	10.0
TS TECH CO., LTD.	Japan	2021	664,316	253,188	81,194,813	82,112,317	1.00	less than 10%	2022	7.1
JTEKT Corporation	Japan	2020	6,319	60,170	2,381,076	2,447,565	0.99	less than 10%	2030	6.7
ITAUSA S.A.	Brazil	2018	98,507	582,861	7,344,100	8,025,468	0.91	less than 10%	2021	6.7
DCC PUBLIC LIMITED COMPANY	Ireland	2021	15,070	31,175	73,901,446	73,947,691	1.15	less than 10%	2050	5.4
OSAKA GAS CO., LTD.	Japan	2021	77,000	19,000	33,011,513	33,107,513	0.91	less than 10%	2021	5.3
PALFINGER AG	Austria	2019	5,215,428	297,386	22,270,832	27,783,646	0.97	less than 10%	2030	5.1
CNH Industrial N.V.	U.K.	2020	18,420	33,280	8,151,694	8,203,394	1.12	less than 10%	2050	4.9
FORD MOTOR COMPANY	U.S.	2021	151,000	236,000	41,171,351	41,558,351	0.93	less than 10%	2035	4.5
KUBOTA CORPORATION	Japan	2021	940,000	2,020,000	39,700,000	42,660,000	0.92	less than 10%	2030	3.9
CANADIAN TIRE CORPORATION, LIMITED	Canada	2017	54,432	32,714	3,938,881	4,026,027	0.99	less than 10%	2022	3.8

25 Source: MSCI ESG Research, as of Dec. 31, 2021

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

Conclusion

Investors will struggle to reach net-zero without confronting coal-related investments this decade. Despite global momentum moving away from coal, it continues to power a significant share of electricity production in both emerging and advanced economies. Russia's invasion of Ukraine has brought investors face-to-face with an energy transition on a rapidly accelerated timetable and highlighted the challenges of moving to a clean-energy economy amid continued reliance on fossil fuels. At the same time, emissions from coal reserves owned by listed companies, if burned, would undermine any chance of holding the rise in global temperatures to 1.5°C.

Investors who commit to align their portfolios with net-zero are working to avoid coal emissions in a variety of ways. Some are abandoning coal investments altogether. Others are differentiating among listed producers or consumers of coal based on their emissions trajectories and tailoring engagement accordingly. Still, coal not only seeps into a series of sectors, but many of the largest listed producers of coal are opening new mines or building coal-fired plants.

To compound the challenge, both engagement and divestment run up against the reality that listed companies control a small fraction of the world's recoverable reserves. Many of those companies are government-controlled, which can further diminish whatever leverage investors may have.

To power past coal, investors may need to use their voice to push for policies that speed the change in how power is generated. More broadly, the persistence of coal shows why investors need data about companies' complete carbon footprint, the location of their facilities and the names of their largest suppliers. Some companies have broadened their emissions reporting and targets to align with global goals. Others have committed to net-zero but have yet to detail how they will get there. Still others have yet to disclose their emissions at all.

The commitment by investors to align with net-zero means that companies will continue to be asked for their climate plans. And to prevent the worst effects of a warming world, greenhouse gas emissions of companies in every sector will need to go down.

Glossary

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

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

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

Implied temperature rise: A measure that converts a company's current and projected greenhouse gas emissions across all emissions scopes (based on the company's track record and stated reduction targets) to an estimated rise in global temperatures by comparing those emissions with the global carbon budget for limiting temperature rise to well below 2°C. For methodology that MSCI uses to calculate implied temperature rise, see "Implied Temperature Rise Methodology," MSCI ESG Research, Sept. 2021.

Metallurgical coal: Coal used to to produce steel and other industrial products. The carbon released from burning metallurgical coal renders steelmaking emissions-intensive.

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

GICS®: The 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-cap companies across developed- and emerging-market countries. With 9,278 constituents (as of Feb. 28, 2022), the index covers approximately 99% of the global equity investment opportunity set.

Remaining emissions budget: A company's future emissions budget, in tons of CO2e, for staying within a 1.5°C or 2°C warming scenario.

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 C02e.

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.

Thermal coal: Coal used to generate electric power. Burning thermal coal to produce steam that turns electricity plant turbines is among the leading sources of greenhouse gas emissions.

Unabated coal-fired power: The burning of coal without the use of technology that captures the carbon emissions released into the atmosphere.

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