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Net-Zero Alignment

Objectives and Strategic Approaches for Investors

Guido Giese, Zoltan Nagy, Chris Cote

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Contents

Executive Summary

The 2015 Paris Agreement bound the world's nations to limit climate change to an average temperature rise of well below 2°C by 2100, and preferably to no more than 1.5°C. Meeting that goal means decarbonizing the global economy. Investors have a key role to play in this process and a financial incentive to help make it happen as efficiently as possible. Hence the rise of net-zero investing.

Net-zero investing means implementing a decarbonization pathway for a portfolio, using its "emissions budget" to achieve a temperature scenario well below 2°C. While an investor could theoretically do this by holding a highly (or increasingly) concentrated portfolio of low- or zero-emissions companies, such an approach would both be impractical for many large institutions and generally would fail to address the larger challenge of decarbonizing the broader economy. In effect, net-zero investing means taking action to promote decarbonization of the economy as well as the portfolio.

We investigated three common approaches to net-zero investing to see whether they can have a real impact on decarbonizing the economy: 1) shifting capital from more-carbon-intensive to less-carbon-intensive investments, theoretically influencing companies' share price, cost of capital and access to capital; 2) engaging with individual issuers directly, whether through shareholder voting or other stewardship activities (sometimes known as "alpha engagement") to spur faster decarbonization among laggards; and 3) directing investments toward low-carbon technology.

Policy advocacy for changes that affect the market as a whole, so-called "beta engagement," is a fourth option, though it is more indirect. Climate change exists in part because of a broad failure of the market to price in greenhouse gas (GHG) emissions, which has benefited carbon-intensive assets. While governments are best positioned to eliminate this free-rider problem, large investors may effect change by advocating that governments bring about such policies quickly.

To achieve a consistent decarbonization and a synchronized shift of capital, voting and engagement in favor of financing renewable technology, a top-down approach may be needed. For example, active and indexed asset managers may support investors with net-zero-related portfolio construction methodologies, climate-related risk management and reporting services, and support in stewardship.

From a portfolio construction perspective, a decarbonization pathway could be implemented in at least three different ways:

- ***Tilting toward low emitters:*** This approach periodically rebalances toward low emitters. It is relatively easy to implement — requiring only carbon-

footprint data — but may lead to more concentrated portfolios and, in the long run, may result in crowding effects in less-carbon-intensive assets.

- ***Tilting toward decarbonization leaders:*** This approach periodically rebalances toward decarbonization leaders. It requires a forward-looking assessment of companies' rate of decarbonization. It also requires a sufficiently large universe of emission-reducing companies, which would have been a limiting factor in the past.
- ***Combined approach:*** Investors may try to combine both approaches to achieve consistent decarbonization rates over time and mitigate the risk of crowding in less-carbon-intensive assets. This combined approach may be a natural outcome over time as the decarbonization of the economy creates more opportunities for net-zero investing.

Our analysis suggests that the four strategic levers that investors have at their disposal to accelerate companies' decarbonization — a shift of capital, active stewardship, financing of low-carbon solutions and policy advocacy — can incentivize companies to lower their carbon footprints. However, our analysis also showed that these levers haven't yet been used at sufficient scale. A more consistent and coordinated investor effort across all four economic levers may help accelerate change.

Introduction: What is Net-Zero?

Climate change is the single greatest challenge humankind has faced and its consequences are already all too apparent. There has been an enormous rise in climate disasters over the past two decades, leading to the deaths of over 1.2 million people and affecting more than 4 billion people in total.[1] To safeguard the livability of our planet for future generations, global political leaders adopted a goal of limiting the increase in global average temperatures to well below 2°C above pre-industrial levels under the 2015 Paris Agreement.[2]

Efforts to achieve the Paris Agreement goal of limiting temperature rise are now widely called "net-zero," a scenario in which no more greenhouse gas emissions enter the atmosphere than are removed.

It is important to emphasize that to limit global warming well below 2°C, reaching net-zero emissions in the long run is not sufficient. Greenhouse gas emissions accumulate in the atmosphere, so there is a limit to how much we can emit along the journey to net-zero: The IPCC[3] (Intergovernmental Panel on Climate Change) has estimated the world's remaining "emissions budget" to be cumulative emissions of 400 gigatons (Gt) of C02 to limit warming to 1.5°C and 1,150 Gt of cumulative C02 emissions to limit warming to 2°C, with a 67% confidence level (with budgets starting as of Jan. 1, 2020).

As shown in Exhibit 1, these emissions budgets are effectively the area under the world's decarbonization pathways.[4] Depending on the targeted temperature and the assumed shape of the decarbonization pathways, this may result in different net-zero forecasts for when the world ultimately achieves net-zero emissions. Nevertheless, it is widely recognized that the world needs to reach net-zero by 2050 at the very latest, remaining within its emissions budget — to maximize the likelihood of achieving the objective of the Paris Agreement.[5]

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[1] "Human cost of disasters: An overview of the last 20 years, 2000-2019." Centre for Research on the Epidemiology of Disasters and UN Office for Disaster Risk Reduction. Nov. 3, 2020.

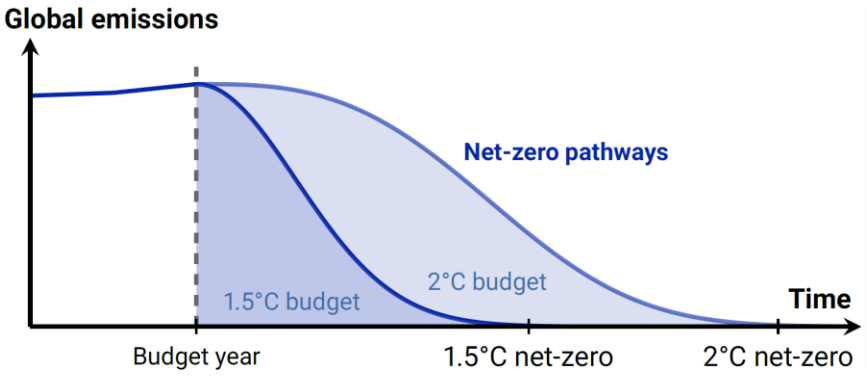
[2] The IPCC Special Report on Global Warming of 1.5°C uses the reference period 1850–1900 to represent pre-industrial temperature. See the "Frequently Asked Questions" section of the report.

[3] "Climate Change 2021: The Physical Science Basis." 2021. Intergovernmental Panel on Climate Change. Climate

[4] Decarbonization pathways refer to the pace and trajectory of GHG emissions reduction of the economy to stay within a carbon budget. They include assumptions on policy, technology, and market shifts, among other factors.

[5] "Net Zero by 2050." International Energy Agency, 2021.

Exhibit 1: Global Decarbonization Pathways and Remaining Emissions Budgets



WHY NET-ZERO?

The purpose of this series of papers is to provide insights that may support investors in building their net-zero alignment strategy and its implementation. Given the size and nature of the challenge, this requires implementing a net-zero framework that covers all relevant areas of the asset management value chain (Exhibit 2).

Exhibit 2: MSCI Net-Zero Investment Framework

In this first paper of the series, we address the following conceptual questions, which are linked to the definition of net-zero objectives and their strategic implementation:

- Does net-zero investing align with investors' overall interests?
- Can net-zero investing help lead to a net-zero economy?
- What are practical considerations for creating a net-zero portfolio that also drives decarbonization in the real economy?

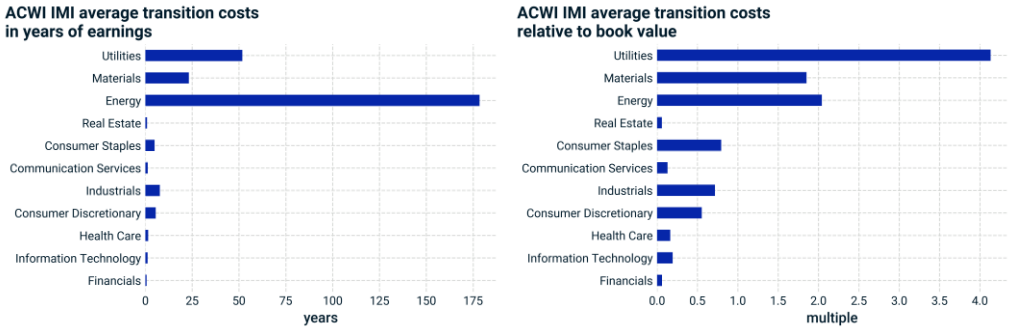
Subsequent research will address more practical questions of net-zero investing, such as capital allocation and portfolio-construction methodologies, portfolio risk management frameworks, and stewardship and engagement considerations.

Setting Net-Zero Objectives: The Role of Capital-Markets Participants

Capital markets have a crucial role to play in the construction of a net-zero economy, from driving change in existing businesses to financing technological progress in order to create less-carbon-intensive businesses. The transition to a net-zero economy presents investors with entirely new risks and opportunities. As with the previous industrial revolutions, investors may expect what the Austrian economist Joseph Schumpeter called a phase of "creative destruction," where new innovative (low-carbon) technology replaces existing (carbon-intensive) technology. To provide a sense of the size of this creative destruction, we simulated the discounted future cost of implementing a 1.5°C-compliant decarbonization pathway for companies in the MSCI ACWI Investable Markets Index (IMI), using the MSCI Policy Climate Value-at-Risk methodology.

Exhibit 3 shows that the energy, utilities and materials sectors bear the brunt of expected decarbonization costs, which were expected to exceed companies' current book values and equal several decades of companies' current earnings. While some of these decarbonization costs may be offset by generating new earnings from clean-technology solutions, it seems unlikely that this new revenue will exactly match the decarbonization costs in their size and the timing. Therefore, the results in Exhibit 3 suggest that the most affected sectors will very likely need fresh capital to finance their low-carbon transition and to develop new technology that can generate new carbon-free revenue.

Exhibit 3: Simulated Cost of Implementing a 1.5°C Decarbonization Pathway



Source: MSCI ESG Research LLC. Data as of June 30, 2021.The charts show the simulated discounted future cost of decarbonization in years of current earnings (left) and in multiples of current book values (right).

This raises two important questions for investors:

1. How to best position capital allocations to avoid losses and/or profit from this economic reconstruction?
2. To what extent can reducing the carbon intensity of capital allocations help drive the necessary decarbonization of the global economy?

Since the Paris Agreement was signed in 2015, listed companies' carbon intensity increasingly has affected financial performance: Giese et al. (2021) found that since 2015, the most-carbon-intensive companies in the MSCI ACWI IMI started to underperform less-carbon-intensive sector peers in terms of both stock performance and earnings growth (before and after controlling for other equity factors). At the same time, companies that were less carbon-intensive outperformed the market after controlling for other factors. However, these financial effects mainly materialized in the most-carbon-intensive companies and the leading companies in low-carbon solutions; about 75% of MSCI ACWI IMI constituents were little affected financially.

The second question is linked to the impact that investors can have on the economy. Ultimately, the bulk of global emissions in the listed equity markets comes not directly from the financial sector but from the corporate sector, especially the utilities, materials and energy sectors.[6] However, investors can exercise significant influence on companies, including those in these carbon-intensive sectors, through

[6] While financial institutions direct Scope 1 emissions and Scope 2 emission are typically relatively low compared to other GICS sectors, they can have significant Scope 3 emissions, e.g., through their lending business.

capital allocation and active ownership, thereby impacting their decarbonization pathway.

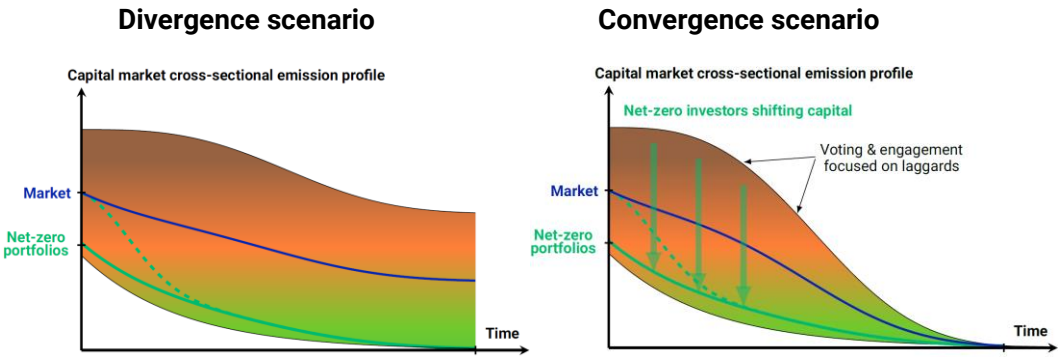
There is also a financial benefit linked to this impact argument: Scientific experts have developed climate scenarios to illustrate potential pathways for the global economy to move toward a net-zero economy. While they differ on their assumptions and simulated pathways, they concur that the **long-term cost-minimizing solution — i.e., humanity's best outcome — is to achieve net-zero as quickly as possible and no later than 2050**.[7] Therefore, accelerating companies' decarbonization is also a way to minimize the overall negative costs for the global economy and for investors, thus aligning their interests.

In other words, while the first question — how to take advantage of the climate revolution within a portfolio — is about creating "better alpha" in an investor's portfolio, the second question — shifting the real economy onto a net-zero path — is about creating a better "market beta," alongside better outcomes for humanity and the planet.

If investors focus only on the first question, we could end up with a "divergence" scenario as illustrated in Exhibit 4, in which only some companies within the MSCI ACWI IMI become net-zero. Consequently, only very concentrated investment portfolios that focus on net-zero leaders would be able to reach net-zero. In contrast, the broad market and the economy at large would incur higher costs (monetary, human and environmental) across the global economy. A focus on both questions could drive a "convergence" scenario in which net-zero investors lead the broad market in their decarbonization pathway, but the market eventually catches up — preferably before 2050.

[7] IPCC. 2018. "Summary for Policymakers." In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty."

Exhibit 4: Net Zero Pathway Scenarios of Capital Markets



How can investors help drive convergence? The main strategic levers we have identified are:

- **Capital Reallocation**: Limiting capital allocated to high-carbon emission entities
- **Stewardship and Engagement**: Using voting and engagement targeted on net-zero laggards.
- **Climate Solutions**: Directing financing of low-carbon projects and technology through private markets, corporate lending and investing in green bonds.
- **Policy Advocacy**: Advocating for rules and regulations that internalize the cost of GHG emissions.

In the next section, we examine whether these levers have already helped investors decarbonize their portfolios and the economy.

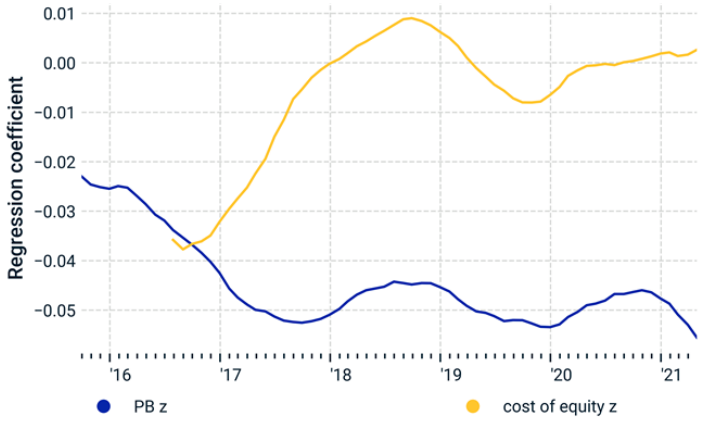
Can Investors Drive Convergence?

ALLOCATING CAPITAL AWAY FROM HIGH EMITTERS

As a first step, we looked at whether companies' carbon intensity has affected their valuation and cost of capital over time. In short, we found that, since 2014, there has been a **statistically significant change in how equity markets priced companies' book value and cost of capital depending on their fossil-fuel exposure.**

While existing literature analyzes how companies' overall ESG profile has affected the cost of capital in equity markets (El Ghoul et al., 2011; Lodh, 2020), comparable research related to climate change is more limited. In this analysis, we focused on global equity markets as defined by the MSCI ACWI IMI from October 2014 through March 2021. On a monthly basis, we regressed companies' price-to-book ratio (P/B) and companies' cost of equity capital versus their carbon intensity (Scope 1 and 2 emissions per USD sales, as reported, or estimated where not reported) as explanatory variables, using company size, industry and style factors as control variables (Exhibit 5).[8]

Exhibit 5: Regression Coefficients of Monthly Cross-Sectional Regression of Companies' P/B and Cost of Equity vs. Emissions Intensity



Source: MSCI ESG Research. MSCI ACWI IMI data from October 2014 to March 2021. The chart shows the history of monthly cross-sectional regression coefficients for companies' price to book (P/B) and cost of equity, regressed versus companies' Scope 1 and 2 emission intensity.

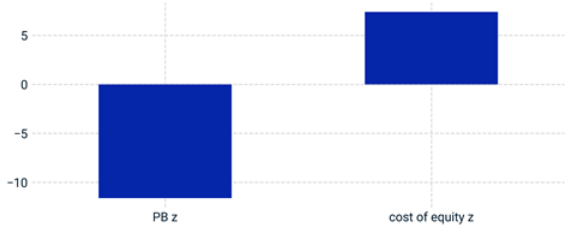
[8] Scope 1 emissions stem from direct use while Scope 2 emissions are from purchased energy.

While the absolute values of the regression coefficients for P/B and cost of equity capital were relatively small, we observed two trends: First, **carbon-intensive companies saw a relative decline in their P/B ratio,** all other parameters being equal. This means that financial markets became increasingly cautious in valuing companies whose book value had a high likelihood of containing potentially stranded assets due to their involvement in the fossil-fuel value chain.

The second observation is that **carbon-intensive companies also experienced a trend toward increasing cost of capital**. The impact on their cost of capital was not as strong as seen in the previously cited studies looking at ESG ratings, possibly because ESG ratings, and in particular governance-related risks, have existed longer and therefore have been priced in by markets, while markets only recently have started to price climate change into equity valuations (Giese et al., 2021).

Both these trends were statistically significant, as we can see in Exhibit 6.

Exhibit 6: T-Statistic of Trend in Regression Coefficient of Companies' P/B and Cost of Equity vs. Emissions Intensity



Source: MSCI ESG Research. MSCI ACWI IMI data from October 2014 to March 2021.

ENGAGING WITH LAGGARDS

As a second step, we looked for empirical evidence of the effectiveness of investor engagement with individual companies on climate-related targets. We call this approach "alpha engagement."[9] Anecdotally, we found that, **at least in certain instances, investor engagement or pressure may cause a company to alter its behavior**.

More broadly, there is established literature highlighting the effectiveness of company engagement in changing company behavior and performance. For

[9] For more on the distinction between alpha and beta engagement, see Lee, L.-E. et al., "2016 ESG Trends to Watch: Power in Numbers." MSCI. Jan. 11, 2016.

instance, a study on the financial effect of engagement by CalPERS on 188 U.S.-listed companies from 1999 to 2013 found abnormally high average stock returns in the period after successful engagements (Junkin, 2015). Similar results were found by Bebchuk et al. (2017), who looked at engagement at U.S.-listed companies from 2000 till 2013. They found "that activist engagements that produce settlement agreements are associated with higher abnormal stock returns at the time of the activist's initial 13D filing. These patterns are overall consistent with the view that the market views favorably the boardroom composition and other changes that activist settlements produce, and are inconsistent with the view that such changes can be expected to be disruptive and detrimental to target shareholders."

However, there exists little substantive research on the effectiveness of engagement with respect to climate change, in part because not quite five years have elapsed since the Paris Agreement became effective in November 2016. Nevertheless, some recent examples of engagement with large fossil-fuel-intensive companies illustrate the degree of leverage investors can have. For instance, in April 2021 Exxon Mobil bowed to shareholder pressure to report its Scope 3 emissions; in addition, activist investor Engine No.1 won the election of three board members in response to complaints about the company's lack of initiative regarding climate change.[10, 11] Another recent example is Equinor ASA of Norway, which announced new and more stringent climate targets following a shareholder petition seeking them.[12] While these examples demonstrate the effectiveness of shareholder engagement on climate-change strategies in specific cases, it is unclear to what extent engagement may lead to wider systemic changes.

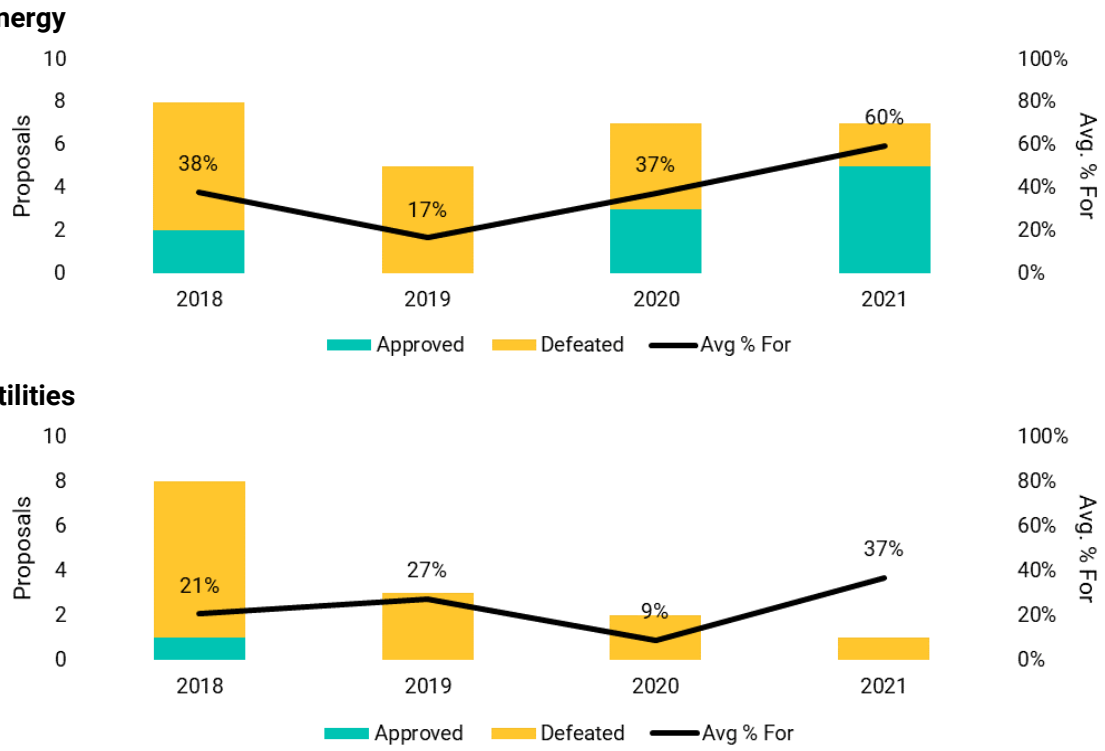
To address this question, we first looked at all climate-related shareholder proposals at U.S. energy and utilities companies from 2018 through July 2021. For both sectors, the number of climate-related proposals was highest in 2018 (Exhibit 7). The energy sector experienced the highest approval rates for climate-related proposals in 2020 and 2021 (and a corresponding increase in average percentage votes in favor of the proposals), showing that investors in U.S. energy companies became more concerned with climate change risks. In contrast, in the utilities sector the number of proposals and accepted proposals decreased over time.

[10] "Scope 3 emissions." ExxonMobil, April 23, 2021.

[11] Phillips, M. "Exxon's Board Defeat Signals the Rise of Social-Good Activists." *New York Times,* June 9, 2021.

[12] See "Proposals from shareholders and responses from the board of directors." for Equinor ASA." May 11, 2021.

Exhibit 7: Number of Approved/Defeated Climate Proposals in US Energy and Utilities



Source: MSCI ESG Research. The chart shows the number of defeated and approved climate-related shareholder proposals in the U.S. energy and materials sectors (left scale) and the average percentage of votes in favor (right scale).

These mixed trends in two carbon-intensive sectors suggest that while investors were able to affect companies' climate policy in specific cases, engagement had not been used at a large scale to drive decarbonization efforts across a broad investment universe.

An important question is whether coordinated investor actions may help to increase the frequency and effectiveness of engagement. One such investor-led initiative is Climate Action 100+, which was founded in December 2017 to support more targeted engagement on climate change. The organization maintains a public list of the world's largest GHG emitters, including 38 U.S. companies. These companies included in their proxy statements on average 8.3 climate-related shareholder proposals from 2017 to 2021. This compares to an average of 3.9 climate proposals of the 506 U.S. companies in MSCI ACWI IMI that had at least one shareholder

proposal. The average market capitalization of the 38 companies (USD 99.9 billion) was somewhat higher than the larger control group (USD 68.3 billion). While this may not prove causality, it shows that U.S. companies on the Climate Action 100+ list experienced a higher frequency of shareholder engagement on climate. Such coordinated actions may increase as others leverage this list: The Net-Zero Asset Owner Alliance recommends focusing engagement on top emitters.

INVESTING IN CLIMATE SOLUTIONS

Investors can help decarbonize the economy by allocating capital away from carbon-intensive businesses and by engaging with companies to change their behavior. The third main lever for change that we examined is the direction of capital *toward* businesses that can help facilitate the transition to a net-zero economy. Investing in companies that prioritize the development, sale or deployment of low-carbon tech solutions — e.g., wind turbines and solar, green buildings, agricultural innovations — can reduce emissions in a portfolio and in the economy.

We approach this section in three parts: First, we present a case study of the coal-to-gas transition among U.S. power generators in the 2010s that shows how, under the right circumstances, an industry can undergo a rapid reduction in emissions. Next, we show that companies with higher shares of low-carbon revenue have posted better market performance during our study period (i.e., earnings per share and returns) among carbon-intensive industries such as energy, utilities and materials. Finally, we examine capital expenditure rates in renewable energy in these industries to see the extent of future investment that may be required.

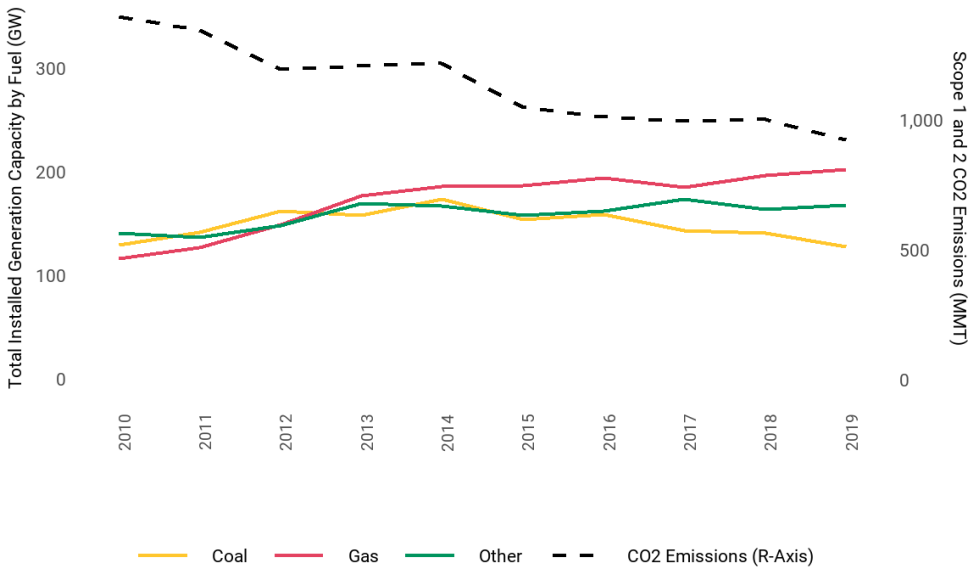
CASE STUDY: COAL TO GAS TRANSITION AMONG US POWER GENERATORS

Investments can help drive the move to a low-carbon society. One key example of this is the U.S. utilities sector, where the shift from coal to gas in the U.S. beginning in 2000 led to a reduction in operational carbon emissions (Scopes 1 and 2) among power generators. While natural gas is not a renewable or low-carbon technology, generating electricity from natural gas instead of coal can reduce emissions by as much as 40%.[13]

[13] Lifecycle emissions of generating electricity from combined cycle natural gas are 490 CO2 equivalent per kilowatt hour (gCO2e/kWh), compared to 820 gCO2e/kWh from pulverized coal. Source: "Annex III: Technology-specific Cost and Performance Parameters. Table A.III.2. Emissions of selected electricity supply technologies (gCO2eq/kWh)." Intergovernmental Panel on Climate Change. 2018

A significant shift from coal to gas occurred from 2010–2019 among constituents of the MSCI USA IMI with power-generating capacity (Exhibit 8)[14] We estimated that constituent companies invested USD 83.7 billion to add 86.2 gigawatts (GW) of natural gas capacity during this 10-year period.[15] Partially as a result of this shift from coal to gas, Scope 1 and 2 CO2 emissions declined among these companies by 34% during the same period, from 1.4 gigatons in 2010 to 0.9 gigaton in 2019.

Exhibit 8: Electricity Generation Capacity and Scope 1 and 2 Carbon Emissions, 2010 – 2019



Source: MSCI ESG Research; U.S. Energy Information Administration, as of June 2021. Data based on MSCI USA IMI constituents as of July 2021.

Three main factors help explain this outcome: technological advancements, market fundamentals (supply and demand) and regulatory changes.

First, technological advancements — principally the success of hydraulic fracturing ("fracking") — led to increased availability of natural gas in the U.S.[16] For example,

[14] 48 constituents of the MSCI USA IMI as of Jul. 14, 2021.

[15] Overnight capital costs of USD 970,000 per MW of natural gas combined cycle capacity. Source: "Levelized Cost of New Generation Resources in the Annual Energy Outlook 2013." U.S. Energy Information Administration. 2013.

[16] It is important to note that the advent of fracking has led to other environmental problems, and there is widespread disagreement on the role natural gas should play in a low-carbon transition. The point here is to simply illustrate that a shift from coal to gas led to a reduction in emissions from power generation.

U.S. natural gas production from shale plays, which are fracked to extract oil and gas, increased to 16.65 billion cubic feet per day (bcfd) in 2010, nearly five times greater than the 3.63 bcfd produced in 2000.

Second, this surge in natural gas supply outpaced demand, which grew, but at a slower pace. The growing surplus pressured U.S. natural gas prices to fall by 50% from 2010 to 2020.

Third, regulations also played a significant role in shifting the U.S. power sector away from coal (and implicitly toward gas as the most competitive alternative). Namely, the U.S. Environmental Protection Agency in 2010 promulgated a rule that limited mercury emissions from power plants, requiring coal-fired power plant owners to install exhaust scrubbers, switch to gas or retire plants. In the following decade, plants with almost 50 GW of electricity-generating capacity produced from coal were retired and nearly 30 GW of capacity were converted to or replaced by natural gas plants.[17]

Importantly, the costs of these capacity additions would likely have been passed on to customers, with the utilities receiving a set rate of return on investments approved by the relevant regulatory body, usually a state public utilities commission.

This example illustrates how technological, market and regulatory developments have helped investors reduce the carbon footprint of their portfolios at the same time emissions declined.

LOW-CARBON REVENUE AND PERFORMANCE

Next, we examined how companies' relative exposure to low-carbon revenue has affected their performance over the last six years.[18] We define low-carbon solutions revenue as the share of a company's revenue derived from alternative energy, energy efficiency and use of green buildings. Using an equal-weighted quintile analysis, we compared the quintile of each sector with the highest share of low-carbon revenue with the bottom quintile in terms of stock performance and earnings growth.[19]

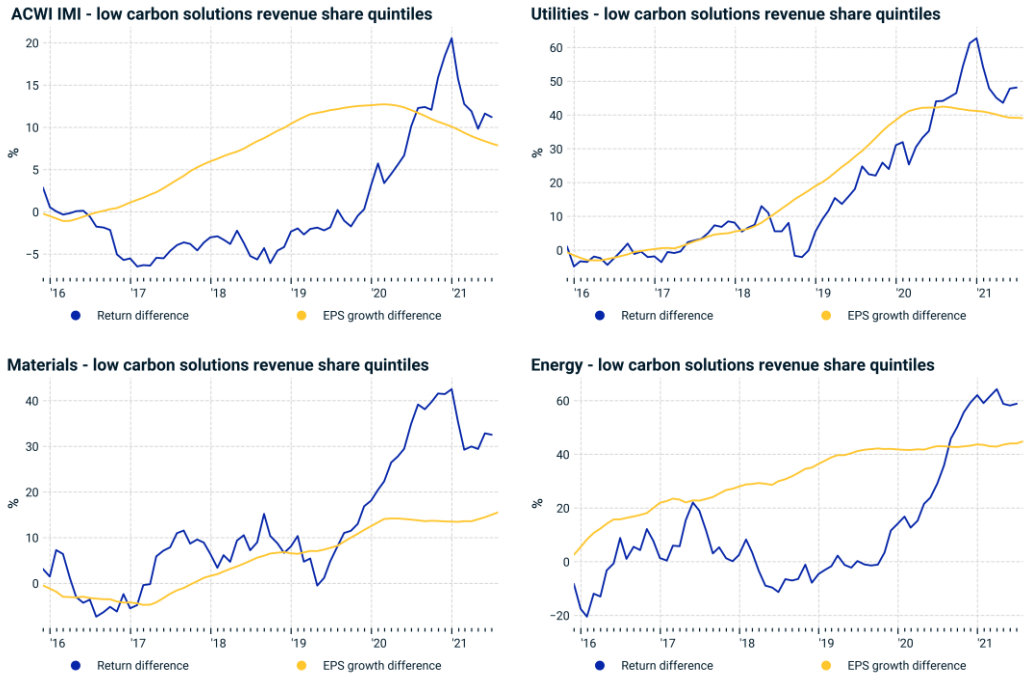
[17] "More than 100 coal-fired power plants have been replaced or converted to natural gas since 2011." U.S. Energy Information Administration. Aug. 5, 2020.

[18] The analysis and observations in this report are limited solely to the period of the relevant historical data, backtest or simulation. Past performance — whether actual, backtested or simulated — is no indication or guarantee of future performance. None of the information or analysis herein is intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision or asset allocation and should not be relied on as such.

[19] Such quintile analyses enable us to analyze performance differences between companies with high exposure to low-carbon solutions technology versus companies with little exposure.

Exhibit 9 shows the results for the MSCI ACWI IMI from October 2015 through June 2021.

Exhibit 9: Top Quintile in Low-Carbon Solutions Revenue Share vs. Bottom Quintile



Source: MSCI ESG Research. Data from October 2015 to June 2021 Low-carbon solutions cover energy efficiency, alternative energies and green buildings.

We observed a clear trend of companies with higher low-carbon solutions revenue share outperforming companies with lower low-carbon solutions revenue share. Probing deeper, we found that this outperformance was attributable entirely to three sectors: utilities, energy and materials, which are the three most carbon-intensive sectors and have been early movers into renewable energy.

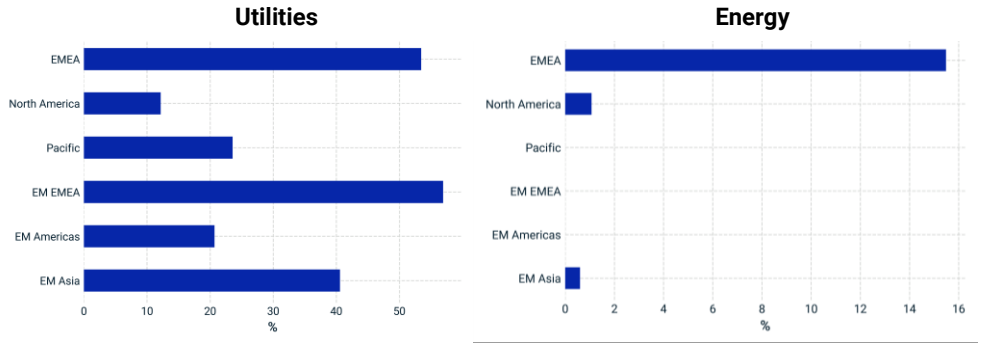
CAPEX NEEDS

To what extent will capital be needed to fund this transition to a low-carbon economy, especially in sectors that may need to replace existing fossil-fuel-based infrastructure? The existing book value in fossil-fuel infrastructure that could be written off is estimated at around USD 25 trillion and is largely located in the utilities

and energy sectors.[20] This means that these sectors will require significant new investments.

Exhibit 10 shows the share of capital expenditure (capex) in regional utilities sectors that is used to finance renewable energy technologies — e.g., wind, solar and geothermal. While the share of renewable energy capex in utilities already has reached levels above 50% in both developed and emerging Europe, it is still relatively low in other regions. In the energy sector, renewable energy capex was relatively low, with only EMEA showing significant investments.

Exhibit 10: Share of Renewable Energy Capex



Source: MSCI ESG Research. Data as of June 30, 2021

Thus, a significant increase in investments will be needed in coming years to finance the development of renewable energy technology, especially outside of EMEA. For example, the International Energy Agency estimates that annual investments in electricity generation would need to triple to USD 1.6 trillion by 2030 from USD 500 billion (the average for 2016 to 2020); such investments would need to remain near that level for the following decade, with almost all that increase in renewable forms of energy.[21]

Overall, preliminary evidence suggests that investors, to some degree, are already influencing valuation levels and companies' cost of capital based on their net-zero alignment. But it is still early days on the path to net-zero.

All the same, low-carbon energy technologies still compete with carbon-intensive technologies and fuels on an uneven playing field because GHG emissions are not

[20] "2020 vision: why you should see peak fossil fuels coming." Carbon Tracker, Sept. 10, 2018

[21] "Net Zero by 2050: A Road Map for the Global Energy Sector." International Energy Agency. May 2021. p. 153.

priced in most markets. We now look at options to address this market failure, specifically carbon-pricing mechanisms.

ADVOCATING FOR CARBON-PRICING POLICIES

While engagement with corporations can lead to more ambitious decarbonization strategies, governments can help set standards, drive change and even out the playing field among high- and low-carbon emitters through policies that price in the externalities of GHG emissions. (Externalities refer to uncompensated costs or benefits created by one party that are borne by unrelated third parties.) Governments can also drive research and fund innovation. Investors can benefit from such policies, as well as other types of beta engagement that seek to change the risk-return characteristics of the broader market. They therefore may consider advocating for such policies and regulation.

Investors in general face the risk of externalities caused by heavy emitters ''free-riding'' on emissions that potentially create costs for other portfolio companies. For instance, emissions of companies in the energy, materials and utilities sectors drive climate change, which may later result in increasing losses for reinsurers who have to cover the cost of damage caused by increasingly frequent extreme weather risks. The financial impact and occurrence of these externalities are very difficult to predict, making it unlikely that investors can "hide" from these externalities by adopting more concentrated portfolios designed to avoid these costs. Given the complexity of global supply chains, such costs (and the costs of decarbonization) may be spread across all or many industries. An interesting, if basic, example is illustrated by a loaf of bread: One life-cycle analysis showed that fertilizers, largely derived from natural gas, used during wheat production are the largest contributor to the product's overall GHG emissions footprint, but transportation and plastic packaging contributed as well.[22] It is unclear who will ultimately bear the cost of decarbonizing this supply chain, among others.

Such free-riding on fossil-fuel emissions — where entities that generate emissions do not pay their fair share of the costs — can be reined in by governments.

Universal owners (i.e., large global pension funds and sovereign wealth funds) have an especially important role when it comes to using stewardship and policy advocacy to tackle the problem of emission free-riding. Universal owners effectively own a slice of the entire market and therefore can be expected to be fully exposed to all of the externality costs in the market. In addition, these large institutional

[22] Goucher, L., and Bruce, R., et al. "The environmental impact of fertilizer embodied in a wheat-to-bread supply chain." *Nature Plants*. Mar. 1, 2017.

investors may have greater awareness of externalities and may be in a better position, given their resources, to respond to these challenges. Therefore, universal owners may include the elimination of emissions free-riding in their policy advocacy strategy. For example, the Net-Zero Asset Owner Alliance recently supported carbon pricing.[23]

Many economists prefer a carbon tax as a cost-effective way to reduce emissions, but there are other mechanisms that have won more political support and exist in several regional markets.[24] One prominent example is the emissions trading scheme, a "cap and trade" system where market participants trade emissions "allowances" or credits to reduce emissions at the lowest marginal cost of abatement. Several such systems have existed for more than a decade, including, perhaps most prominently, the European Union's Emissions Trading Scheme (EU ETS), which currently covers its power and industrial sectors.[25]

Another example of an effective emissions trading scheme is California's Low Carbon Fuel Standard, which targets a 20% reduction in carbon emissions from the state's transport sector by 2030. The carbon price that has resulted is one of the highest in the world: Credits have traded around USD 200 per metric ton of CO2 since late 2019, more than three times the EU ETS carbon price, which traded for more than EUR 60 per metric ton in August 2021.

This high price has inspired investment and experimentation among many different types of fuel producers and sources. Most notably, it drove significant investment in so-called renewable diesel — a diesel-equivalent fuel made from soybeans or waste greases or fats such as used cooking oil — which emits roughly 30% of the carbon of the diesel it replaces on a life-cycle basis.[26] The program has certified a variety of pathways that have extremely low — and in many cases negative — carbon intensities (Exhibit 11).[27]

[23] "Discussion paper on governmental carbon-pricing." U.N.-convened Net-Zero Asset Owner Alliance. July 2021.

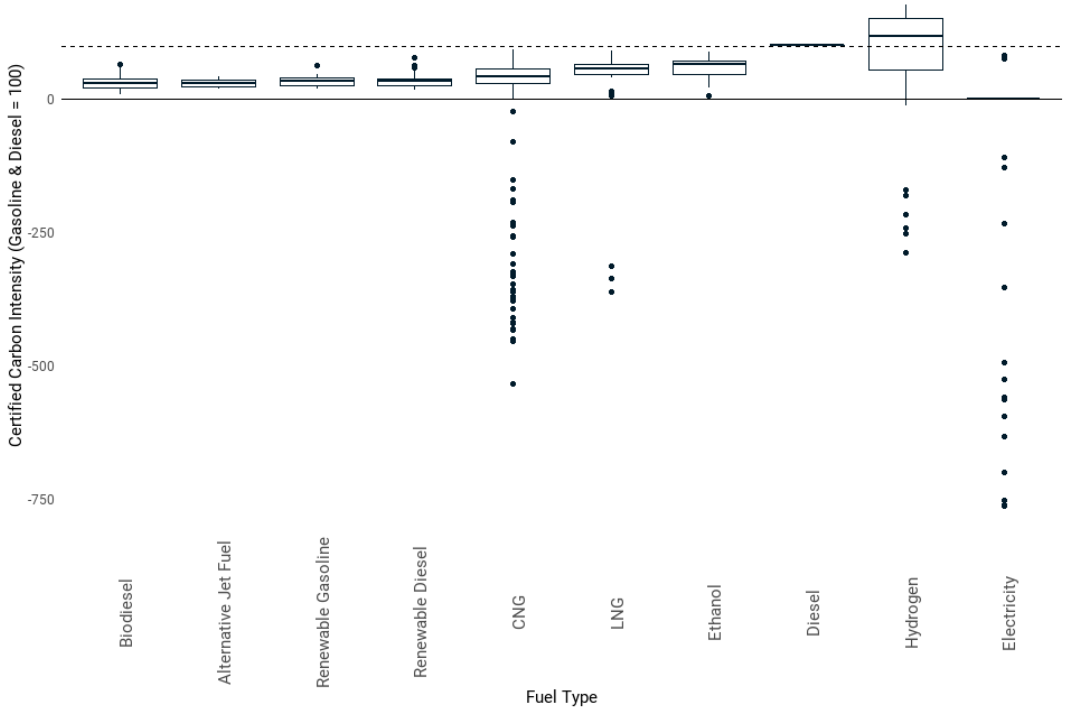
[24] See, for example: "Economists' Statement on Carbon Dividends." *Wall Street Journal*. Jan. 16, 2019.

[25] The EU views the EU ETS as "a cornerstone of the EU's policy to combat climate change and its key tool for reducing greenhouse gas emissions cost-effectively." https://ec.europa.eu/clima/policies/ets_en

[26] "Low Carbon Fuel Standard Reporting Tool Quarterly Summaries," California Air Resources Board as of July 2021. https://ww3.arb.ca.gov/fuels/lcfs/lrtqsummaries.htm

[27] A negative carbon intensity signifies that the fuel removes more emissions than it emits on a lifecycle basis.

Exhibit 11: Fuel Pathways Certified under the California Low Carbon Fuel Standard



Source: MSCI ESG Research; California Air Resource Board as of July 2021

While it's still too early to assess the impact of California's fuel program on investments, it is clear that it has been an engine of innovation for U.S. transport fuel producers, providing incentives for companies to invest in low-carbon technologies and alternative fuels.

Governments also can foster innovation through spending on research and development, which could further increase opportunities in emerging low-carbon solutions such as hydrogen produced through renewable energy and electrolysis or with carbon capture and storage. Recently, the European Commission proposed providing large sums to jump-start low-carbon hydrogen production, while proposed legislation in the U.S. has focused on hydrogen and carbon capture storage through government research and development (R&D) and tax credits.[28, 29] The U.S. used this

[28] "A hydrogen strategy for a climate-neutral Europe." European Commission, July 8, 2020.

[29] "DOE Announces $52.5 Million to Accelerate Progress in Clean Hydrogen," U.S. Department of Energy. Jul. 7, 2021.; S.799 – 117th Congress (2021-2022): Storing CO2 and Lowering Emissions Act or the SCALE Act. Mar. 17, 2021.

model, a combination of the two, in the past to help create a runway for renewable power development.

Thus, engaging with governments on net-zero policies can be an important avenue to further investor goals, supporting net-zero convergence between portfolios and the economy.

Given this alignment of interests, and the possibility of driving convergence, we turn next to how to implement net-zero investing in practice, looking at two portfolio-level decarbonization options.

Implementing Portfolio Net-Zero Pathways in Practice

How can investors implement net-zero in their portfolios?

Historically, investors started to integrate ESG considerations using either a bottom-up approach, where ESG consideration is implemented mandate by mandate over time, or a top-down approach, where overall ESG investment objectives are defined at a policy level, then broken down into ESG objectives for all mandates (Giese et al., 2019). The top-down approach typically has resulted in a more consistent form of ESG integration than the bottom-up approach.

To fully align with a net-zero target, a top-down approach is crucial to ensure consistent coverage of the entire investment portfolio and consistent application of all relevant parts of the investment process, i.e., capital allocation, portfolio construction, risk management and reporting and active ownership.

Regarding a timeline, both the Net-Zero Asset Owner Alliance and the Net-Zero Asset Managers Initiative propose a decarbonization of all investment portfolios by 2050, in line with emissions budgets outlined by IPCC.

Both active and indexed portfolios will need to be re-assessed and potentially re-balanced periodically toward more net-zero aligned investments to achieve a continuous rate of self-decarbonization. IPCC recommends between 5% and 15% per year; the EU Paris alignment benchmark uses a 7% decarbonization annual rate. How can investors achieve these goals, both at the asset allocation and individual portfolio level?

TWO OPTIONS FOR CONSTRUCTING NET-ZERO PORTFOLIOS

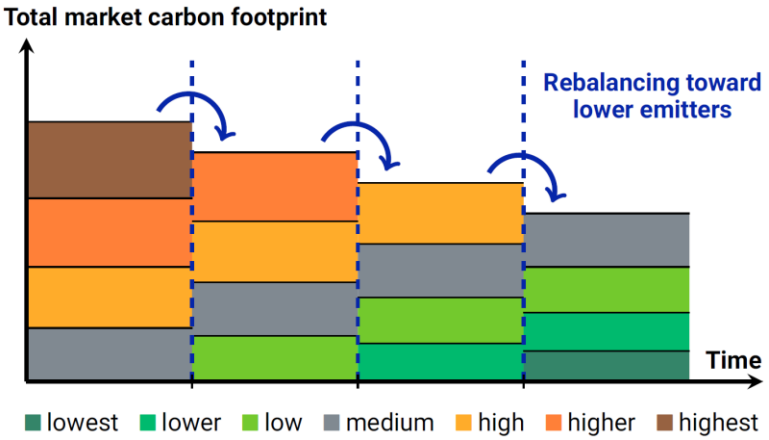
Technically speaking, we have identified only two basic options to decarbonize portfolios continuously over time: Tilting toward lower emitters or “emissions

improvers", i.e., companies reducing their emissions. These approaches can be implemented via periodic rebalancing. They also can be combined, which is effectively the third of three options we will analyze.

Portfolio Decarbonization Option 1: Periodic Rebalancing Toward Lower Emitters

One way of implementing a self-decarbonization pathway is by periodically rebalancing the portfolio toward lower emitters, as shown in Exhibit 12. The advantage of this approach for investors is that it is straightforward: It only requires periodically updated historical GHG emissions data per investment and a portfolio construction methodology that at each rebalancing date shifts more capital from high emitters to low emitters to achieve the desired annual decarbonization target.

Exhibit 12: Stylized Portfolio with Periodic Rebalancing Toward Lower Emitters



However, the disadvantage of this methodology is that it does not necessarily shift capital toward companies that improve their emissions over time. For example, it might shift weight away from utilities decarbonizing via investment in wind and solar because those companies' overall emissions remained above the required threshold. Such a scenario may lead to increasingly concentrated portfolios that capture an ever-smaller fraction of the market in the long run and — in the most extreme scenario — could lead to a divergence between the net-zero portfolio and the broad market as shown in Exhibit 4. Abandoning energy to concentrate only in financials or consumer discretionary does not actually mitigate climate risk — the market beta will still deteriorate.

Sectoral constraints can help to reduce this risk of divergence from the broad market. Given that GICS® sectors have very different emission intensities on

average, any portfolio decarbonization pathway that does not constrain sector exposures would shift capital from more-carbon-intensive sectors toward less-carbon-intensive sectors.[30] Therefore, if investors would like to maintain a broad benchmark-style investment in their net-zero portfolios, they may seek to impose sector constraints on their decarbonization pathways.

One way of accomplishing this would be to impose explicit constraints on active sector exposures by rebalancing within sectors but not changing the weight of the respective sectors. The EU regulation defining Paris-aligned benchmarks does not allow underweighting highly carbon-intensive sectors.

In addition, investors may define sector-specific decarbonization pathways with sector-specific decarbonization rates, as proposed by the Net-Zero Asset Owner Alliance. Such pathways may ensure that highly emissions-intensive sectors decarbonize at a faster rate than low-intensity sectors. This sector-constrained approach ensures that portfolio decarbonization is mainly achieved by rebalancing within each sector, while maintaining a broad sector representation.

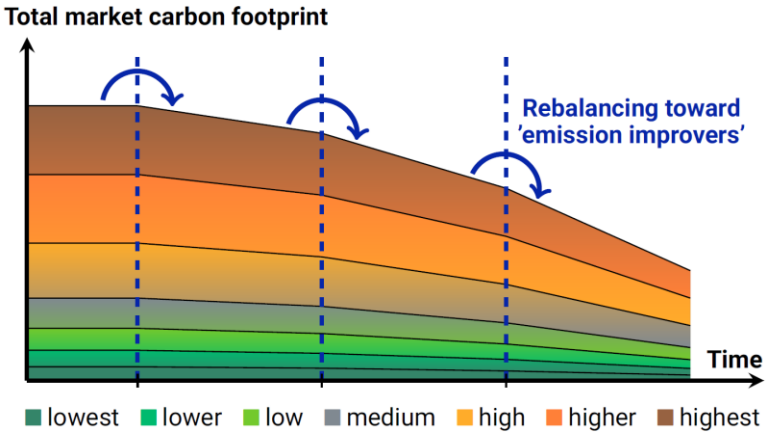
Sectoral constraints in this first option for portfolio decarbonization, however, may present an additional challenge: Opportunities for rebalancing could run out in a short amount of time as the portfolio becomes increasingly tilted toward each sector's lower-emitting "leaders," depending on the threshold. This leads us to the second option.

Portfolio Decarbonization Option 2: Shift Capital Toward 'Emissions Improvers' with Each Rebalance

A second option is a continuous decarbonization pathway that shifts capital at every rebalancing toward "emissions improvers" — companies that are reducing their emissions over time, even if they are still relatively high (Exhibit 13). This approach could help mitigate the risk inherent in Option 1, where a net-zero portfolio could end up highly concentrated and widely divergent from the broader market, and where the larger problem of climate change and the decarbonization of the global economy are not being addressed.

[30] The Global Industry Classification Standard (GICS) was jointly developed by MSCI and S&P Global Market Intelligence.

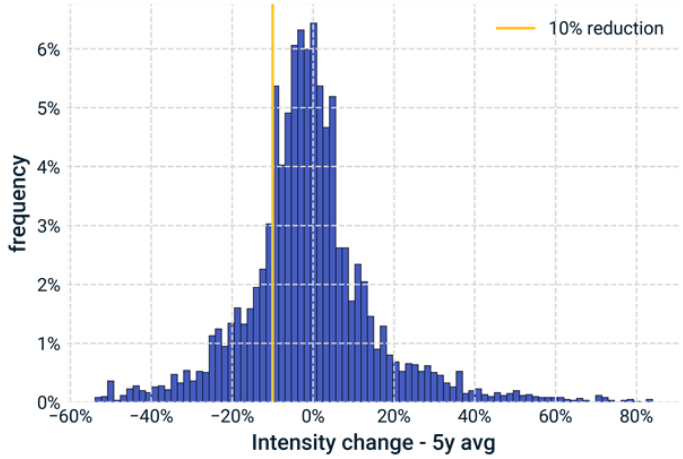
Exhibit 13: Stylized Portfolio with Rebalancing Toward 'Emission Improvers'



While investing in emissions improvers is naturally aligned with the idea of driving companies to net-zero over time, it is more challenging to implement than the previous approach, as it requires a sufficiently large number of companies to decarbonize and forward-looking estimates on companies' decarbonization pathways. Going forward, this approach may become easier to implement as more companies adopt and disclose decarbonization targets. However, it also requires that investors assess companies' effectiveness in reaching these targets, as well as forward-looking cross-sectional decarbonization to compare companies' alignment with net-zero.

Most important, this option relies on companies achieving significant GHG emissions reductions over time, something most companies have not accomplished to date. Exhibit 14 shows the distribution of companies' change in emissions intensity across MSCI ACWI IMI constituents over a five-year study period. Less than a quarter of the companies achieved decarbonization of at least 10% per year, meaning that it would not have been possible to build broad global equity portfolios of companies that reduced their emissions at this rate during this period.

Exhibit 14: Change of Emissions Intensity in ACWI IMI Constituents Over 5 Years



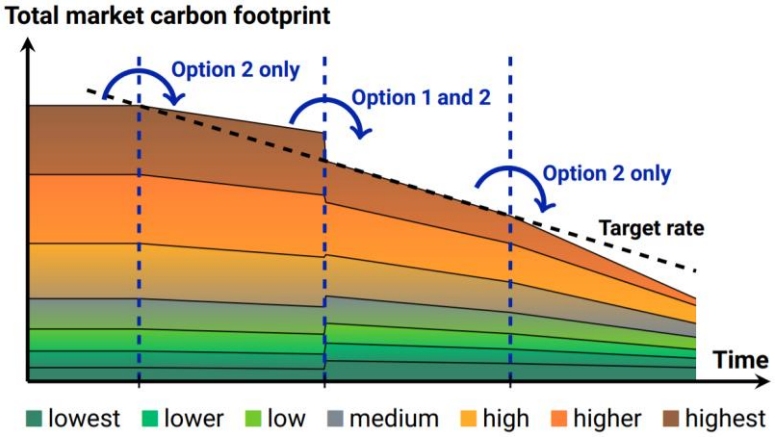
Source: MSCI ESG Research; annual company emissions data between 2016 and 2021

Portfolio Decarbonization Option 3: Combined Decarbonization Approach

The previously mentioned options have clear advantages and disadvantages: Option 1 can be implemented even when the constituents in the portfolio don't decarbonize but that may lead to highly concentrated portfolios. By contrast, Option 2 can avoid the risk of concentrated portfolios, but can be implemented only if there are enough decarbonizing constituents in the portfolio.

Therefore, portfolio managers may seek to combine both approaches. For instance, they can use Option 2 as a baseline approach, i.e., rebalancing toward companies that have ambitious emissions reduction targets and strong track records (Exhibit 15). However, if greater decarbonization of the portfolio is desired (either because companies failed to achieve their emissions targets or the opportunity set of companies with such targets was too small to achieve the desired portfolio decarbonization rate), cross-sectional rebalancing toward lower emitters (Option 1) could be added (second rebalancing illustration in Exhibit 15). Using such a combined methodology, the effective decarbonization rate would depend on the size of the respective opportunity sets (the number of low emitters versus the number of successfully decarbonizing emitters). This rate may change over time.

Exhibit 15: Stylized Portfolio with Combined Rebalancing Approach



In this hypothetical example, the first rebalancing shown is toward emissions improvers; the second rebalancing is toward emissions improvers and toward lower emitters, as some companies that are expected to improve their emissions fail to realize their targets; the third rebalancing is again toward emissions improvers, as the remaining companies continue to improve and more companies set ambitious and feasible climate targets.

TAKING THE TEMPERATURE OF PORTFOLIO COMPANIES

With more companies announcing net-zero targets, opportunities for investing in emissions-reducing companies may increase in the future. But to put the world on a path to limit temperature rise to the extent required by the Paris Agreement, drive better market beta and maintain an adequate breadth of investment opportunities, investors may seek to exercise their influence through assessments of decarbonization strategies and direct engagement of corporate management.

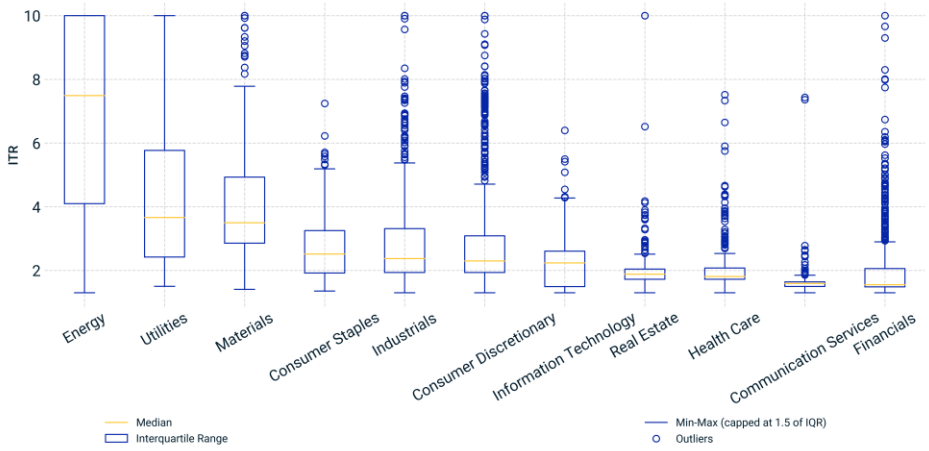
One way to assess companies' self-decarbonization strategies in a more forward-looking way — and perhaps identify where to focus efforts to influence companies toward decarbonization — is the so-called Implied Temperature Rise methodology proposed by the Task Force on Climate-related Financial Disclosures (TCFD).[31] This metric estimates the ratio of the future emissions pathway of a company over its remaining emissions budget and expresses the result as a temperature. This temperature shows with which warming scenario a company's emission pathway is aligned.

[31] "Forward-Looking Financial Sector Metrics: Consultation." Task Force on Climate-related Financial Disclosures, October 2020.

For instance, MSCI has developed a methodology that measures the remaining emissions budget for each company within the MSCI ACWI IMI and calculates an Implied Temperature Rise, taking into account companies' Scope 1, 2 and 3 emissions and any emissions reduction targets. The Implied Temperature Rise shows a company's alignment with its remaining emissions budget and may be used to assess decarbonization pathways and track decarbonization progress.

The distribution of Implied Temperature Rise values in Exhibit 16 shows that sectors, as well as companies within each sector, display very different degrees of alignment between their emission pathways and budgets.

Exhibit 16: Distribution of Implied Temperature Rise Values Across and Within GICS Sectors



Source: MSCI ESG Research. Data as of May 31, 2021

The chart shows that different sectors may require very different decarbonization efforts to achieve their respective remaining emissions budget. In particular, the energy sector requires the strongest reduction efforts, followed by utilities and materials. At the same time, the chart shows that investors have ample room to shift capital within each sector toward Implied Temperature Rise leaders, which is a crucial component to encourage the convergence scenario summarized in Exhibit 4.

Therefore, a consistent approach to implementing a decarbonization pathway would be to define a pathway for each sector to reach a portfolio Implied Temperature Rise of well below 2°C by 2050. This approach may also have the advantage of shifting capital toward emerging decarbonization or carbon-removal technologies — e.g., low-carbon hydrogen, sustainable aviation fuel and direct air capture — if currently carbon-intensive companies incorporate such technologies into their own decarbonization strategies, R&D and capex.

Conclusion

To keep global warming well below 2°C — the objective of the 2015 Paris Agreement — the world needs to remain within its emissions budget. Investors can drive companies' decarbonization efforts through a shift in capital from existing fossil-fuel-based investments to renewable energy investments, through active stewardship to decarbonize individual companies and by financing the development of new low-carbon technologies.

Our analysis showed that it is in investors' self-interest to actively drive this transition: The faster the low-carbon transition, the lower the total costs and hence the better the overall "market beta" may be in the long run. However, capital markets cannot deal with the problem alone: The regulatory framework needs to adapt to eliminate the "free-rider" problem and to set incentives for companies to adopt less-carbon-intensive business models.

When regulatory, financial and market incentives align, reductions in emissions from carbon-intensive sectors can happen rapidly. The shift from coal to natural gas among U.S. power generators provides an example of how a change in the regulatory framework, combined with technological progress, led to a dramatic shift in electricity generation and a reduction in carbon emissions. The costs of this transition were largely passed on to customers. In the utilities sector, the shift from gas to renewables can be seen as a next logical phase of this transition. This shift may be instructive for assessing and engaging with other carbon-intensive sectors, especially energy and materials.

To implement net-zero investing, asset owners following the recommendations of the Net-Zero Asset Owner Alliance may adopt a top-down capital allocation approach to achieve consistent decarbonization of their overall portfolio. This requires defining decarbonization pathways that are aligned with companies' remaining emissions budgets. Decarbonizing a portfolio may involve portfolio-construction methodologies for active or indexed investments that periodically shift capital toward less-carbon-intensive assets and/or investments in self-decarbonization leaders. While the former approach can be implemented using carbon-footprint data, the latter approach requires a more forward-looking assessment of companies' decarbonization progress. In addition, significant amounts of capital may be needed to fund the development of new low-carbon technologies.

Asset managers may seek to support asset owners in their decarbonization efforts, which will require new skills and methodologies along the entire asset management value chain, i.e., portfolio construction, risk management, reporting and stewardship.

To conclude, our empirical analysis suggests that the four strategic levers that investors have at their disposal to accelerate companies' decarbonization — a shift of capital, active stewardship, financing of low-carbon solutions and policy advocacy — can incentivize companies to change their behavior. However, our analysis also showed that these levers haven't yet been used at sufficient scale. Therefore, a more consistent and coordinated investor effort using all four economic levers may help accelerate change.

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Appendix: Objectives for Net-Zero Investing

Asset Owner Objectives for Net-Zero Investing

To achieve consistency, asset owners may choose to define overall net-zero objectives in their investment policy that apply to their entire portfolio, for example:

- Define minimum decarbonization pathways for the future (sector- and region-specific).
- Define impact investment targets (investments in low-carbon technology in private markets and green bonds).
- Integrate climate into risk management and risk reporting framework (especially TCFD reporting guidelines).
- Define voting and engagement strategy in relation to climate change and guidelines for divesting from climate change laggards.
- Ensure compliance with regulation and fiduciary duties related to climate change.

Asset Manager Objectives for Net-Zero Investing

Asset owners need the support of asset managers in their net-zero alignment in all relevant areas: setting objectives, capital allocation and portfolio construction, active ownership, risk management and climate reporting, as reflected in the recommendations of the Net-Zero Asset Managers Initiative, which can be summarized as follows:

1. Set decarbonization targets to reach net-zero no later than 2050 and to set an interim goal for 2030 in line with the requirement in the IPCC's special report, "Global Warming of 1.5°C." These targets should take into account Scopes 1, 2 and (if possible) 3 emissions. The overall objective is to reach net-zero across all asset portfolios by 2050.
2. Create investment products aligned with achieving net-zero in 2050 and investment products that facilitate investing in low-carbon solutions.
3. Provide analytical tools to asset owners for portfolio management, risk management and reporting regarding climate change.
4. Implement a voting and engagement and escalation policy in line with achieving net-zero by 2050.
5. Implement TCFD reporting across all portfolios.

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