# Managing investment portfolios for the carbon transition

## How investors can perform decarbonisation analysis


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### In brief

- The ongoing low-carbon transition creates investment opportunities, but also poses material investment risks if not managed effectively. Preparing portfolios for a changing world requires investors to understand the transition potential of the companies in which they invest.
- A crucial step for investors in climate risk analysis is to look at companies' decarbonisation commitments. An increasing number of companies have set emission reduction targets. However, not all of the targets are equally ambitious, reflecting decarbonisation uncertainties and challenges across sectors and companies that investors need to be aware of.
- Not all decarbonisation targets will be achievable. To predict how likely companies are to meet their decarbonisation commitments, investors should include in their analysis a range of broader transition indicators. Furthermore, public policy will remain a major external factor affecting the ability of companies to decarbonise within their chosen timescales.
- Comprehensive transition analytics can help investors to manage the decarbonisation rate of their portfolios in an investment landscape that is increasingly influenced by climate change.


### Transition presents investment opportunities and material financial risks

The energy transition away from fossil fuels to renewables is well underway. Renewable energy capacity increased by a record 13% in 2022, led by solar photovoltaics (PV), and is forecast to grow by a further 85% in the following five years.[1,2] However, the future pace of decarbonisation across sectors is subject to demand, policy and technology uncertainties, which all pose significant risks, as well as creating opportunities, for investors.

The investment risks of decarbonisation cannot be ignored, not least due to the potential impact of tightening climate regulations. For example, the share of global emissions covered by carbon taxes or emission trading systems (ETS) reached 23% in 2023.[3] While more emissions are becoming subject to carbon pricing, the price of carbon permits themselves have also risen sharply in recent years. Permits issued under the European Union's (EU's) ETS reached a record high of over EUR 100 per tonne of carbon dioxide ($tCO_2$) in February 2023, from trading in single digits between 2011 and early 2018.

1 International Energy Agency, "Renewable Energy Market Update: Outlook for 2023 and 2024", June 2023.
2 International Energy Agency, "Renewables 2022", December 2022.
3 World Bank, "Carbon Pricing Dashboard", March 2023.

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Companies most exposed to carbon prices are feeling the impact. Shell spent USD 493 million to comply with carbon pricing schemes in 2022, which although relatively small compared to the company's profits of USD 40 billion for the same year, is set to rise fast. Shell's own projections suggest that spending on carbon pricing will rise to USD 800 million in 2023 and could triple by 2032.[4,5] Sudden movements in carbon prices can have an impact on share prices through compressed margins and a higher cost of capital for companies in high-emitting sectors.[6] Carbon prices can also affect consumers, making carbon-priced products more expensive if the costs are passed through. As a result, companies that do not reduce their carbon footprint are likely to come under greater scrutiny not only by regulators and policymakers but also the investment community. The lack of credible emission reduction strategies is likely to raise the risk of a higher imputed cost of capital, and could reduce the intrinsic value of the shares.

While these transition risks need to be managed in investment portfolios, the decarbonisation of the global economy also represents a huge long-term investment opportunity, with energy transition investments surpassing USD 1 trillion in 2022.[7] One of the major drivers is the policy incentives around the world to encourage decarbonisation. The EU spent EUR 500 billion on renewable energy subsidies between 2015 and 2021.[8] In the US, the Inflation Reduction Act (IRA) is expected to unlock nearly USD 400 billion of federal funding to tackle climate change and support the energy transition this decade.

In order to manage these transition risks in portfolios effectively, and take advantage of the opportunities created by carbon transition, investors need to understand the future emissions profile of the companies in which they invest. This paper discusses three key steps for investors to approach this challenge:

1. Assessment of corporate targets to determine the **future direction of portfolio emissions**;
2. Analysis of transition metrics to assess the **likelihood of companies reducing emissions** and achieving their decarbonisation targets;
3. Consideration of policy and economic factors to identify barriers to the **pace at which companies are able to decarbonise**.

Given the formidable challenges posed by the energy transition, the focus of this paper is specifically on electric utilities and energy companies, with select examples from other high-emitting sectors.

## Understanding where portfolio emissions are headed

An increasing number of companies across sectors have set emission reduction targets over time, with Scope 1 and Scope 2 targets reaching 56% of global equity market capitalisation in 2021 (**Exhibit 1**).[9] While having a target does not mean that a company will actually decarbonise, evidence suggests that companies with targets are more likely to see emission reductions (**Exhibit 2**).[10] As a result, portfolios invested in these companies would also see emissions reductions.

However, there can be significant disparities in the quality of these corporate emissions reduction targets. To cut through the noise, we discuss here a set of criteria emerging in the industry to help investors determine the quality of corporate decarbonisation commitments, ensure comparability, and identify transition leaders and laggards.[11]

[4] 2023 increase driven by demand as a result of expected cold weather and low wind power output.

[5] Shell, Annual Report 2022.

[6] Bolton, P., Lam, A., Muùls, M., "Do Carbon Prices Affect Stock Prices?", Imperial College, April 2023; Hengge, M., Panizza, U. & Varghese, R. "Carbon Policy Surprises and Stock Returns: Signals from Financial Markets", IMF Working Papers, 27 January 2023.

[7] Bloomberg New Energy Finance, "Energy Transition Investment Trends 2023", January 2023.

[8] European Commission, "Study on Energy Subsidies and Other Government Interventions in the European Union – 2022 edition", August 2022.

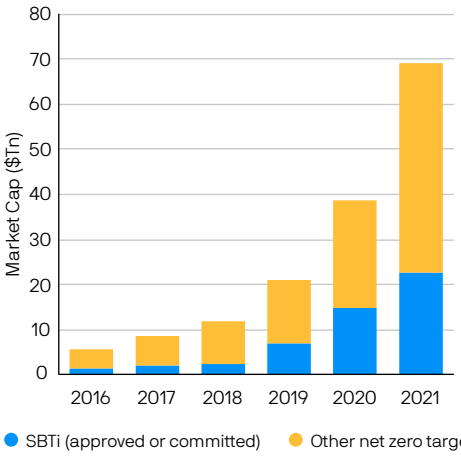
[9] However, the share of global emissions covered by Scope 1 targets (to avoid double counting) is only 11%. By comparison, sovereign net zero targets cover 92% of GDP and 88% of global emissions. Net Zero Tracker, "Net Zero Stocktake 2023", June 2023; Carbon Action Tracker, "CAT Net Zero Target Evaluations", November 2022.

[10] According to the Greenhouse Gas Protocol, Scope 1 emissions cover direct emissions from owned or controlled sources, while Scope 2 emissions cover indirect emissions from the purchase of electricity, steam, heating and cooling.

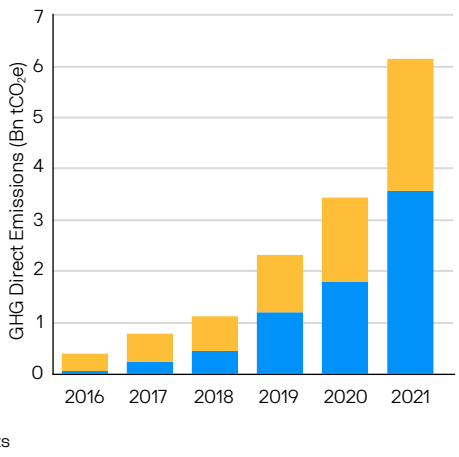
[11] Among others, guidance by the Science Based Targets initiative (SBTi), Transition Pathway Initiative (TPI), Institutional Investors Group on Climate Change (IIGCC).

**Exhibit 1: An increasing number of companies have set decarbonisation targets**

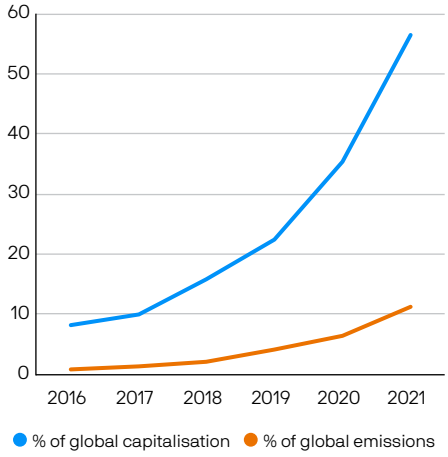
Global equity market capitalisation covered by targets




Global emissions covered by targets

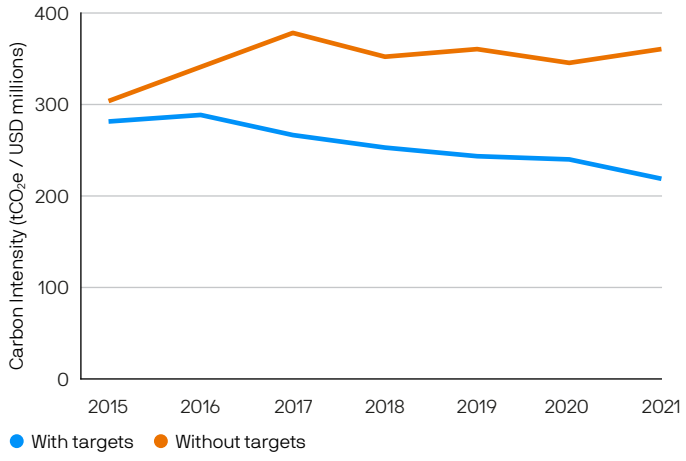



% of global capitalization and emissions covered by targets




Source: J.P. Morgan Asset Management. Data from Bloomberg, FactSet, Statista, Our World in Data. Note: The left graph shows the global equity market capitalisation covered by Scope 1-2 targets. The middle graph shows the volume of Scope 1 emissions covered by targets (Scope 1 only, to avoid double counting). The right chart shows the corresponding share of global emissions and global equity market capitalisation covered by targets.

**Exhibit 2: Companies with emission reduction targets have decarbonised faster**




Source: J.P. Morgan Asset Management. Data from Factset, S&P Global, CDP. Note: The sample includes MSCI All Companies World Index constituents as of June 2023. Carbon intensity refers here to owned emissions over owned revenues. Operational targets refer to those covering Scope 1-2 emissions as reported to CDP. "With targets" refers to the index constituents that had or set emission reduction targets during the covered time period, "without targets" refers to the companies with no emission reduction targets in that period.

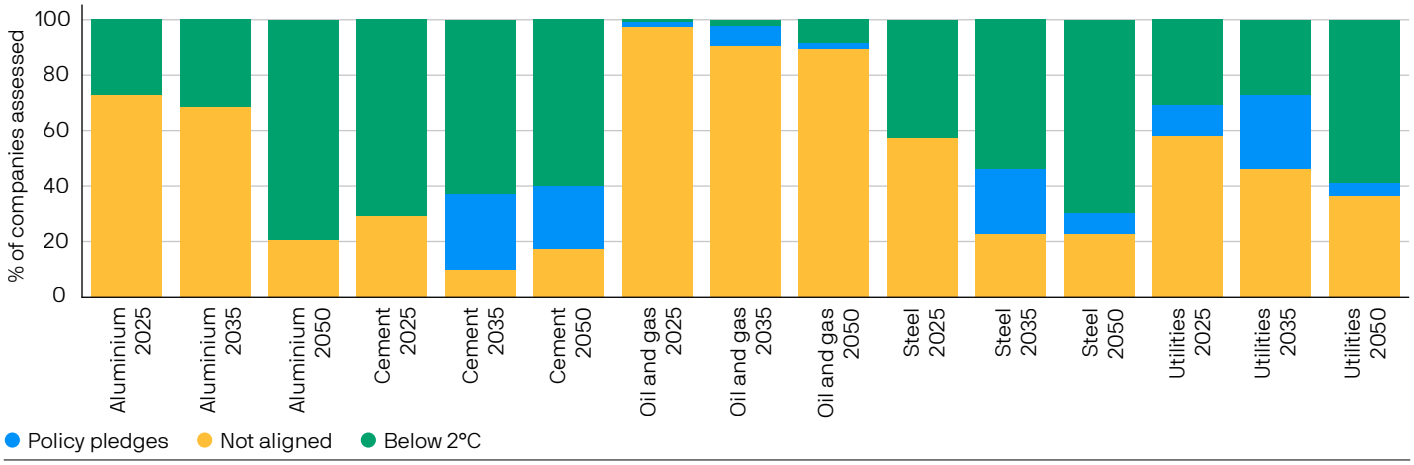
## Emission reductions need to be sufficiently ambitious

When looking at corporate targets, the first question investors ask is whether the targets are sufficiently ambitious to insulate the company from transition risks. To this end, investors benchmark companies' projected emissions against various climate change mitigation scenarios, ranging from the business-as-usual (BAU), to more rapid decarbonisation pathways, consistent with the Paris Agreement objectives.[12] For a company to be aligned to a BAU scenario implies that it follows the broad decarbonisation trend of the rest of the economy and limits exposure to present transition impacts. Alignment to a more ambitious scenario would therefore signal leadership, potentially enabling a company to prepare its business for a pickup in the future pace of the transition.

As it currently stands, most companies in high-emitting sectors, at least in the short term, are not aligned to the BAU, let alone a well-below 2° Celsius (C), pathway (**Exhibit 3**). These companies may therefore be exposed to significant present and future transition risks.

[12] BAU scenarios project the impact of current policies on global warming. Currently implemented policies are projected to result in a median temperature rise of 2.7°C by 2100. Source: Climate Action Tracker, 10 November 2022. Climate scenarios consistent with the Paris Agreement objectives explore actions needed to limit global warming to well below 2°C, and preferably 1.5°C, compared to pre-industrial levels.

**Exhibit 3: Share of companies aligned to either the 2°C, policy pledges scenario, or not aligned**




Source: J.P. Morgan Asset Management. Data from Transition Pathway Initiative. Note: The Policy Pledges scenario is consistent with a carbon budget that limits the global mean temperature rise to 2.6°C by 2100 with a 50% probability. TPI assesses 61% (70% weighted by market capitalisation) of MSCI ACWI companies in the select high-impact industries.

However, slow decarbonisation is not always a sign of weakness. One company could be decarbonising quite quickly by divesting its high-emitting assets. In some instances, these assets may be sold to another, possibly private, company, which might not be subject to the same level of public or regulatory scrutiny, and therefore might not always operate these assets efficiently. Another company, on the other hand, might be decarbonising more gradually by phasing out, rather than selling, polluting assets over time, which in some cases could be considered more responsible.

Another constraint worth noting is that although benchmarking companies' emissions reductions against climate scenarios is a useful tool, current off-the-shelf climate scenario-based benchmarks may not always reflect the full complexity of a company's decarbonisation journey. While there is general acceptance that sectors have different decarbonisation pathways, the divergence of decarbonisation options within sectors, particularly prominent in the energy sector, is often overlooked (**Box 1**).[13]

## The longer the target, the less certainty there is that it will be achieved

Long-term decarbonisation is subject to significant uncertainties around technological innovation and the policy environment. The options for decarbonising steel production, for example, are conditional on the supply of high-quality steel scrap (for electric arc furnaces), and the scalability of nascent solutions, such as green hydrogen (for direct reduced iron), and carbon capture, utilisation and storage (CCUS) – including for blue hydrogen.[14] Similarly, reducing the use of clinker, which acts as the binder and could account for as much as 90% of emissions in cement production, depends on the availability of scarce substitute inputs and innovation.[15] The complete decarbonisation of cement production before 2050 is unlikely without CCUS solutions, the commercial viability of which is yet to be proven.

Reflecting these uncertainties, over 90% of companies with emissions reduction targets have only set them on a short- or medium-term time horizon (**Exhibit 4**). Near-term targets are an important milestone, holding current boards and management teams accountable and ensuring that interim emissions reductions are not delayed. If an energy company has a long-term target to reduce emissions to net zero by 2050 but has no plans to decrease production in the lead up to 2030, this can hardly be deemed a credible strategy.

[13] For a discussion on the use of climate scenarios by investors, see Alova, G. and Thomas, R., "Climate Scenarios: What Are They, Why Are They Important, and How They Are Applied to Investment Portfolios", J.P. Morgan Asset Management, 2022.

[14] Green hydrogen refers to the production of hydrogen from renewable energy through electrolysis. Blue hydrogen refers to the production of hydrogen form natural gas using carbon capture and storage. For more discussion on the role of hydrogen in the energy transition, see Alova, G., O'Shea, S., Rott, R., "The Role of Hydrogen in the Energy Transition: A Complementary Option, Not a Silver Bullet", J.P. Morgan Asset Management, September 2023.

[15] Heincke, S., Maksimainen, J., Reiter, S., "Decarbonising Cement and Concrete Value Chains: Takeaways From Davos", McKinsey & Company, 3 February 2023.

### Box 1: Within the energy sector, the ability of companies to decarbonise and set Scope 3 targets varies significantly

For independent oil companies, setting a Scope 3 target on downstream emissions would be synonymous to going out of business. Instead, these companies tend to focus on improving the emissions efficiency of their operations, that is Scope 1 and 2 emissions. Nevertheless, business models remain exposed to the risk of oil demand declining as the energy transition accelerates. Similar to independent producers, oil refineries face limited transition options, one of which is the conversion to renewable diesel and sustainable aviation fuel.

For integrated oil companies, there are more transition opportunities. Besides entering the renewable energy business, policy incentives such as the IRA in the US are opening new and potentially attractive options in the carbon capture, utilisation and storage (CCUS), and blue hydrogen space by drawing on their core competencies. Besides their own use, energy companies can offer CCUS as a service to heavy industry sectors with hard-to-abate emissions.

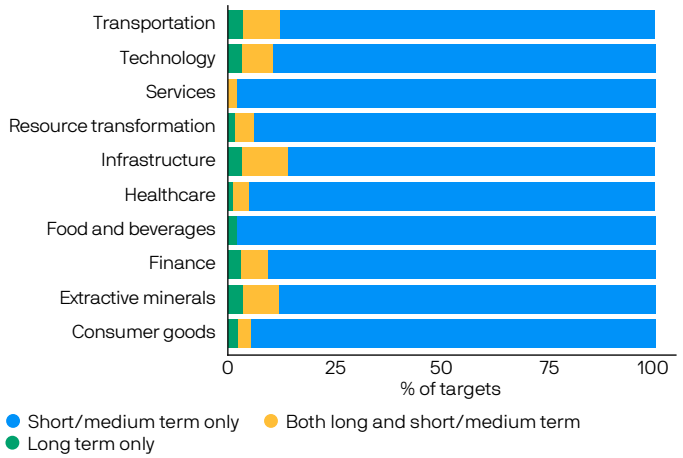
Despite the materiality of Scope 3 emissions, operational efficiency—particularly in the current context of capital discipline—remains the priority for oil majors as they compete, led by Saudi Aramco, to produce the lowest-cost and the lowest-carbon barrel of oil to meet ongoing demand.*

Oilfield services companies face a different set of challenges. Their operational emissions are a fraction of those generated by oil producing companies, while the majority of Scope 3 emissions comes from oil and gas producers using their equipment. As a result, opportunities to decarbonise include helping customers to address their emissions, such as by electrifying equipment, reducing emissions from drilling, and addressing flaring and fugitive emissions. Oil services companies are also well positioned to capitalise on growth in CCUS by leveraging their technical skills in reservoir characterisation and management.

***The companies above are shown for illustrative purposes only. Their inclusion should not be interpreted as a recommendation to buy or sell.***

*J.P. Morgan Asset Management, "2022 Climate Change Engagement & Voting Report", May 2023.

**Exhibit 4: Share of companies with short-, medium- and long-term targets across sectors**




Source: J.P. Morgan Asset Management. Data from CDP.

## The highest carbon transition risks are in supply chains

For most companies, the majority of their emissions are generated in their supply chain (**Exhibit 5**).[16] Despite being indirect, these Scope 3 emissions can pose material financial risks as climate policies become more stringent. For example, carbon prices can increase the cost of emissions-intensive inputs for construction companies, or regulation around the use of gas boilers or combustion engine cars can change demand for these products. Therefore, emissions reduction targets that aim to adequately reduce transition risks would need to cover all major sources of emissions across business segments of a company, including Scope 3 where material.[17]

However, only the minority of current corporate targets cover Scope 3 emissions (**Exhibit 5**). For example, only 25% (14% weighted by market cap) of energy companies have a target on their downstream emissions, reflecting the challenges they face to decarbonise and transition their business models (**Box 1**).

## Reducing methane emissions is an easy win

Investors can also, where relevant, look at how companies are tackling their methane emissions. Methane emissions are linked to 30% of global warming, with the energy sector contributing 40% of methane emissions overall.[18] At the same time, the cost of eliminating methane emissions is relatively low[19] and in many cases, offers a strong internal rate of return/positive net present value, because the captured natural gas can be sold at a profit in excess of the cost of capturing it.

For companies that are not taking action, methane emissions could result in financial risks. Large methane leakages, for example, can lead to falls in share prices and significant reputational risks. The shares of Diversified Energy fell by 21% in October 2021 after a natural gas leak was reported in the media.[20] The IRA has also introduced a charge on methane emissions – the first time that the US federal government has imposed a direct fee on greenhouse gas emissions.[21]

## Carbon offsets can be useful, but companies cannot offset their way to net zero

Achieving net zero by 2050 does not imply reducing global emissions to zero, but rather reducing the balance of emissions to zero, that is the sum of emissions generated by the global economy and the emissions removed either through technological or nature-based solutions. Therefore, carbon offsets have a place in a decarbonising world.

However, the use of offsets in achieving corporate emissions reduction targets should be kept to a minimum, and should be reserved for neutralising hard-to-abate emissions in the long term. Furthermore, when emissions are offset outside of a company's value chain, this does not lead to the actual decarbonisation of the company's business. Importantly, the market for high-quality carbon removal credits is still in its infancy, accounting for 3% of all projects that issued credits in 2021-2022.[22] Carbon sinks can also absorb only a limited amount of carbon, equivalent to roughly 1.3 times US total emissions in 2021, while the scalability and commercial viability of technology-based emission removals are yet to be proven.[23]

[16] Scope 3 emissions, according to the Greenhouse Gas Protocol, are all indirect emissions (not included in Scope 2) that occur in the value chain of the company, including both upstream and downstream emissions.

[17] Transition risks refer to the risks associated with the shift to a low-carbon economy. They can include the risks from climate policies and regulations, changing consumer preferences, and reputation and litigation risks.

[18] International Energy Agency, Global Methane Tracker 2023, February 2023

[19] International Energy Agency, Global Methane Tracker 2023, February 2023

[20] Bloomberg, "Diversified Energy Plunges After Report on Methane Leaks", 12 October 2021.

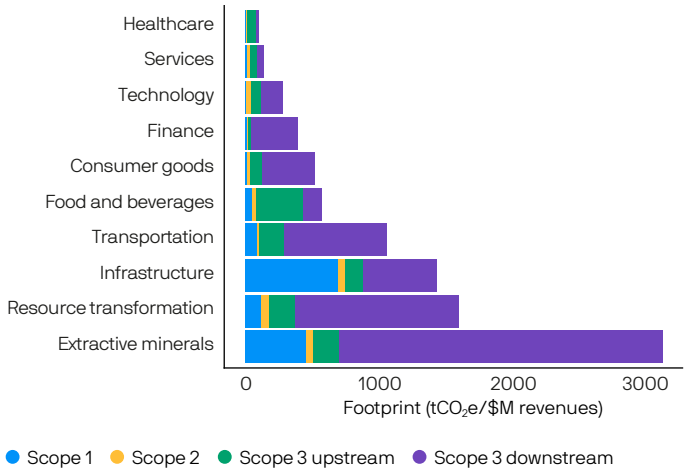
[21] Congressional Research Service, "Inflation Reduction Act Methane Emissions Charge: In Brief", August 2022.

[22] Macfarlane, M., "Assessing the State of the Voluntary Carbon Market in 2022", Carbon Direct, 6 May 2022.

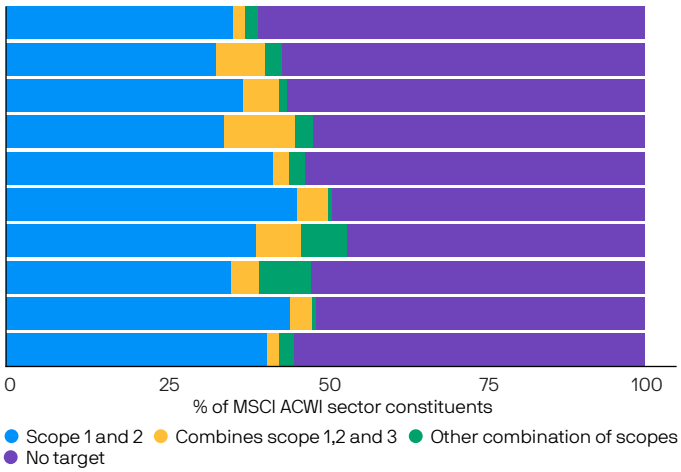
[23] Land-based carbon sinks are estimated to absorb 8.4billion $tCO_2$ annually. Friedlingstein, P. et al. "The Global Carbon Budget 2022", Earth Syst. Sci. Data, 14, 4811–4900, 2022.

**Exhibit 5: Emissions and decarbonisation targets by sectors**

Emission intensity by sector and Scope




Share of companies with emission reduction targets




Source: J.P. Morgan Asset Management. Data from S&P Global, CDP.

## Testing the likelihood of future portfolio decarbonisation

While emissions reduction targets are a signal of a company's intent to decarbonise, additional metrics are needed to measure whether the company is actually transitioning, and whether the targets are achievable (**Exhibit 6**). These various metrics are most effective when used in tandem to capture the nuances of the transition.

**Exhibit 6: Metrics to measure companies' carbon transition**

### Historical emissions trend

- \+ Shows changes in a company's **emissions to date**
- − Past trend is not always a predictor of the future – **decarbonisation is not linear**

### Emission reduction targets

- \+ Proxy for a company's **intent to decarbonise**, being key input in forward-looking climate analytics
- − The existence of a target **does not imply a company's actual decarbonisation,** and the quality of targets varies significantly

### Past targets

- \+ Proxy for a company's track record of **meeting past commitments**
- − Companies tend to **modify unachievable targets**, rather than report that they have been missed

### Revenues

- \+ Signals **realised changes** in companies' business models
- − Can be skewed by **fluctuations in commodity prices**

### Capital expenditure

- \+ Signals **potential changes** in companies' business models
- − Can be skewed by differences and **changes in technology costs**, and is subject to implementation uncertainties

### Real assets

- \+ Indicates past and future **changes in a company's asset base**
- − Asset ownership does not equal their utilisation (for example mothballed coal plants). Planned projects can fail

### Patents

- \+ Captures companies' **green innovation**
- − Companies can **transition without innovation**

Source: J.P. Morgan Asset Management.

For instance, while a high share of green revenues could be a sign that a company is already a leader in the transition, it might also mask other important considerations when used in isolation. Take the example of China Longyuan Power, a Chinese utility that is one of the largest wind power producers in the world. This company generates two thirds of its revenues from the sale of wind energy, but the company's emissions remain high and have not declined in recent years because of its large coal mining and power generation business.

At the same time, companies with a lower share of green revenues might be in the process of transitioning to a low-carbon business model if they allocate a significant share of their capital expenditure (capex) to the energy transition. For example, RWE, with a share of green revenues at 12% in 2022, allocated over 80% of its capex to green activities in the same year.[24]

Data on real assets (for example, power plants, factories, oil fields) can offer additional insights, as changes in revenues and capex are subject to fluctuations in commodity prices and technology costs. Information on new project pipelines and the closure of existing assets is particularly useful, as it indicates where a company is heading in the next few years. For example, the carbon footprint of RWE remains relatively high due to coal power generation, which it has committed to phase out by the end of the decade.

## Assessing policy and economic factors that affect the pace of transition

Besides the transition metrics already discussed that help track companies' decarbonisation potential, there are several policy and economic factors outside the control of most companies that can have a bearing on the speed with which companies may cut their emissions.

- **Policy incentives are a key driver for the early adoption of clean technology**

The early adoption of renewables by European utilities was primarily driven by renewable energy subsidies, which led to a decline in the cost of renewable energy technologies and helped renewables to eventually become competitive without policy support.[25] The IRA could have a similar impact on the decarbonisation of high-emitting sectors, offering tax credits for CCUS and low-carbon hydrogen production, thereby opening new transition options to the energy sector (see **Box 2**).

- **Carbon prices need to be sufficiently high to drive decarbonisation**

Despite the recent record rise in the price of EU carbon permits, historically carbon prices globally have been too low to pose a significant transition risk and drive decarbonisation. The average weighted carbon price, based on carbon taxes and ETS stood at EUR 4.29 per $tCO_2e$ in 2021, falling dramatically short of the mid-range estimate of EUR 120 per $tCO_2e$ required by 2030 to decarbonise the global economy by mid-century.[26]

The magnitude of the transition risk posed by carbon prices also depends on a company's asset mix. In Europe for example, many utilities have had a positive exposure to the EU ETS, given their relatively low-carbon asset mix, comprising nuclear, hydro and efficient gas power plants. As a result, carbon pricing in Europe has resulted in higher prices for consumers, and higher profits for utilities.

Furthermore, higher emissions do not necessarily equal higher exposure to carbon prices if companies are able to hedge the risk of future price hikes by buying carbon permits. As a result, carbon prices have had a relatively smaller effect on the low carbon transition of European utilities compared to subsidies, and most of the effect has been driven by anticipation of higher prices in the future.

[24] Green activities defined as activities aligned to the EU Taxonomy. RWE, Annual Report 2022.

[25] For example, Greece's and Germany's feed-in-tariffs for solar in the early 2010s were among the highest globally and the UK saw some record high tariffs for offshore wind in the same period.

[26] As calculated across 71 countries, which together account for 80% of global emissions. OECD, "Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action", November 2022.

### Box 2: Decarbonisation may lead to return trade-offs in the short-term, but could preserve value in the longer term

The economics of a business will not always align with a company's efforts to decarbonise, especially if decarbonisation involves changing business models. Once a company has exhausted the easy options to reduce emissions (for example, fixing methane leaks, or sourcing renewable power supplies to reduce operational carbon footprints) further abatement efforts can come at higher marginal costs.

For energy companies, investments in renewables offer a different risk-return profile relative to their core business and relatively lower returns compared to traditional fossil fuel projects. At the same time, subsidised hydrogen production and CCUS solutions have the potential to offer more attractive returns compared to renewables and represent a more natural adjacent core competency for many large integrated energy companies, particularly if they have experience with grey hydrogen production and reservoir management.*

Diversified miners with substantial coal operations face a similar dilemma. They can phase down their coal business to reduce emissions, but at the expense of strong cashflows from coal mining, supported by demand, for example, in Asia. There are also cases where cashflows from coal mining may be used to help fund the development of high value copper projects, which are instrumental for electrification and the energy transition.

* Grey hydrogen refers to the production of hydrogen from natural gas without the use of CCUS.

- **Energy security concerns and growing demand for fossil fuels slow the transition**

The 2022-2023 energy crisis and resulting energy security concerns led governments across Europe to reactivate mothballed coal power plants. As a result, utilities have had to come up with solutions to balance higher-than-expected short-term carbon emissions with longer-term emissions reduction targets. RWE, for example, has brought forward its coal power plant phase-out from 2038 to 2030 to keep its decarbonisation trajectory on target.

While global energy projections point to demand for coal, natural gas and oil peaking this decade, demand for fossil fuels, particularly for gas, is unlikely to drop sharply[27]. This will impact the decarbonisation trajectory of energy companies, who will continue to see short-term business opportunities in the conventional energy space, or in closely linked new businesses, such as CCUS and blue hydrogen. Similarly, in the absence of oil and gas demand destruction measures, such as a ban on gas boilers, gas utilities will face a challenge to reduce Scope 3 emissions, which predominantly come from gas used for heating.

- **Permitting issues and supply chain disruptions are a drag on renewables rollout**

The current long wait (up to 10 years) for permits for new renewable energy projects and grid connection in the EU and the UK can significantly hinder the ability of power generation companies to bring more clean power online, and slow the speed of transition at the national level.[28]

Bottlenecks in the issuance of permits are also affecting the rollout of CCUS solutions in the US, where class VI wells required for $CO_2$ sequestration currently need regulated approval by the Environmental Protection Agency (EPA) at the federal level in the majority of states. Allowing more states to issue permits without federal approval from the EPA could alleviate these bottlenecks.[29]

[27] International Energy Agency, "World Energy Outlook 2022", October 2022; IEA, "Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach", 2023 Update, September 2023.

[28] Ofgem, "Ofgem launches policy review on reforming the electricity connections system", 17 May 2023; Tagliapietra, S., "REPowerEU: Will EU countries really make it work?", Bruegel, May 2022.

[29] In May 2023, the EPA announced the intent to approve Louisiana's request for primary responsibility in this permitting.

Meanwhile, disruptions in the supply chains of critical minerals can delay the construction of renewable energy power plants, raising concerns over energy supply and thereby affecting the planned phase out of coal power plants.[30] These issues have recently caused Wisconsin Energy to delay the closure of its 1,112 megawatt (MW) South Oak Creek coal station by up to 18 months, due to energy supply concerns.[31] The company was also forced to delay the opening of its 700MW solar and 500MW battery storage projects by at least a year until 2024. Similarly, Alliant Energy pushed back the closure of its coal-fired units until 2025 and 2026, while facing a significant increase in the cost and delay of its 500MW solar projects.

- **Rising costs of capital and capital costs put upward pressure on returns required from renewables**

The increases in central bank policy rates over 2022 and 2023 to reduce inflation have increased the cost of capital for companies, thereby changing the economics of their transition (as illustrated by the examples in Box 2). For companies to generate the same levels of value creation from new renewable energy projects and maintain favourable economics, they will now require a higher power price. The concurrent increase in capital costs due to commodity price inflation puts an additional upward pressure on the returns required by renewable energy developers.

## Conclusions

The decarbonisation of production and consumption activities is having a transformational impact on the global economy. For investors, it is crucial to adapt–both to mitigate the risks posed by the low-carbon transition and to gain exposure to the beneficiaries of decarbonisation.

A forward-looking transition analysis relies on corporate decarbonisation targets. However, the design and ambition of emissions reduction targets vary significantly by company. As a result, granular assessments of the quality of these targets are required to get a full picture of a company's expected performance.

Such targets represent the ambition of companies to decarbonise. Therefore, additional transition metrics are needed to measure how likely companies are to achieve their targets. These metrics include, for example, green revenues, capital expenditure and real assets. They work best when used in combination, as each metric captures an additional piece of information to the assessment.

Besides analysing transition metrics, it is important to quantify the impact of external factors on the pace of emissions reduction, such as the demand outlook, the policy environment and red tape challenges.

The consideration of transition metrics in combination with external factors can help investors to project the decarbonisation rates of sectors and companies in order to adapt their portfolios in an investment landscape impacted by climate change and low-carbon transition.

[30] Driven, for example, by the COVID-19 pandemic, the Russia-Ukraine war and the investigation by the US Department of Commerce into circumvention of antidumping and countervailing duties.

[31] Wamsted, D., "Delayed U.S. coal plant closures are bumps in the road, not U-turns for energy transition", Institute for Energy Economics and Financial Analysis, July 2022.

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