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Setting Expectations Amid a Bumpy Energy Transition

Applying MSCI's Energy Transition Framework to understand corporate transition risk and opportunity across and within sectors and regions

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Executive summary

The global energy transition is progressing unevenly, shaped by differences in technology readiness and policy strength across sectors and regions. Financing capacity could further determine companies' ability to invest in the transition, while the strength and stability of decarbonization policies may be linked to the quality of institutions in a jurisdiction. This paper explores how these factors may affect companies' decarbonization efforts over the next five to seven years, using the MSCI Energy Transition Framework as the primary framework for the analysis.

Key findings:

- **Technology availability varies widely across sectors**

  Availability, cost and feasibility influence technology adoption by companies. Sectors such as utilities, steel and transport have access to a broader range of decarbonization technologies, while others like chemicals and oil and gas face more limited and costly options. Among technology pathways, process electrification and switching to low-carbon electricity show the broadest decarbonization potential, whereas low-carbon fuels and energy-efficiency measures tend to show more modest potential.

- **Financial strength influences transition readiness**

  Companies with stronger balance sheets may be better positioned to invest in transition technologies, potentially widening gaps in decarbonization progress within industries.

- **Stronger policies were associated with better emissions performance, but not everywhere**

  Stronger decarbonization policies were generally associated with larger reduction in Scope 1 and 2 emissions intensity by companies in recent years, particularly among companies classified in developed EMEA markets and sectors such as utilities, telecommunications and industrials. For companies classified in the Asia-Pacific, which tend to face less mature policy frameworks, voluntary corporate targets were more strongly associated with emissions-intensity reduction than policy strength. Prior MSCI research had found that better emissions performance (controlling for the materiality of the emissions) is associated with better financial and economic performance.

- **Institutional quality underpins policy effectiveness**

  Jurisdictions with stronger institutions, greater fiscal space and a robust rule of law may be better able to support credible, sustained policies that incentivize corporate decarbonization.

For investors, understanding how technology, finance and policy interact across sectors and regions can help identify where transition risks are most material — and where low-carbon growth opportunities are emerging.

Introduction: Setting expectations for the energy transition

For most countries and companies, the energy transition is not unfolding in a straight line. In some markets and product lines, change is happening rapidly; in others, it shows little sign of progress. Although significant investment is flowing toward clean-energy sources, oil and gas profits are rising. The purchase of electric vehicles (EVs) continues to grow, but coal use is also growing. A new technology to decarbonize heavy industry is making headlines, even as major industry players are restating their climate goals amid regulatory pullbacks. Amid these mixed signals, what should investors do?

For institutional investors, understanding the pace of the transition is critical. They increasingly seek to measure where risks are rising — and, just as importantly, where they may not materialize at all.

The energy transition is driven by technology and, at times, supported or constrained by policy. Understanding how these two forces interact can provide context for assessing the pace of transition across sectors and regions — and whether it may shift in ways that creates financial or economic risks, such as unexpected costs or lower returns.

This paper applied MSCI's Energy Transition Framework to consider what might change over the next five to seven years. While investment horizons vary, our discussions with market participants suggest that most think about the future on roughly a five-year timeline. We ask: What is technologically and commercially possible today? What may change in the next five years? And will government policies accelerate or slow the transition?

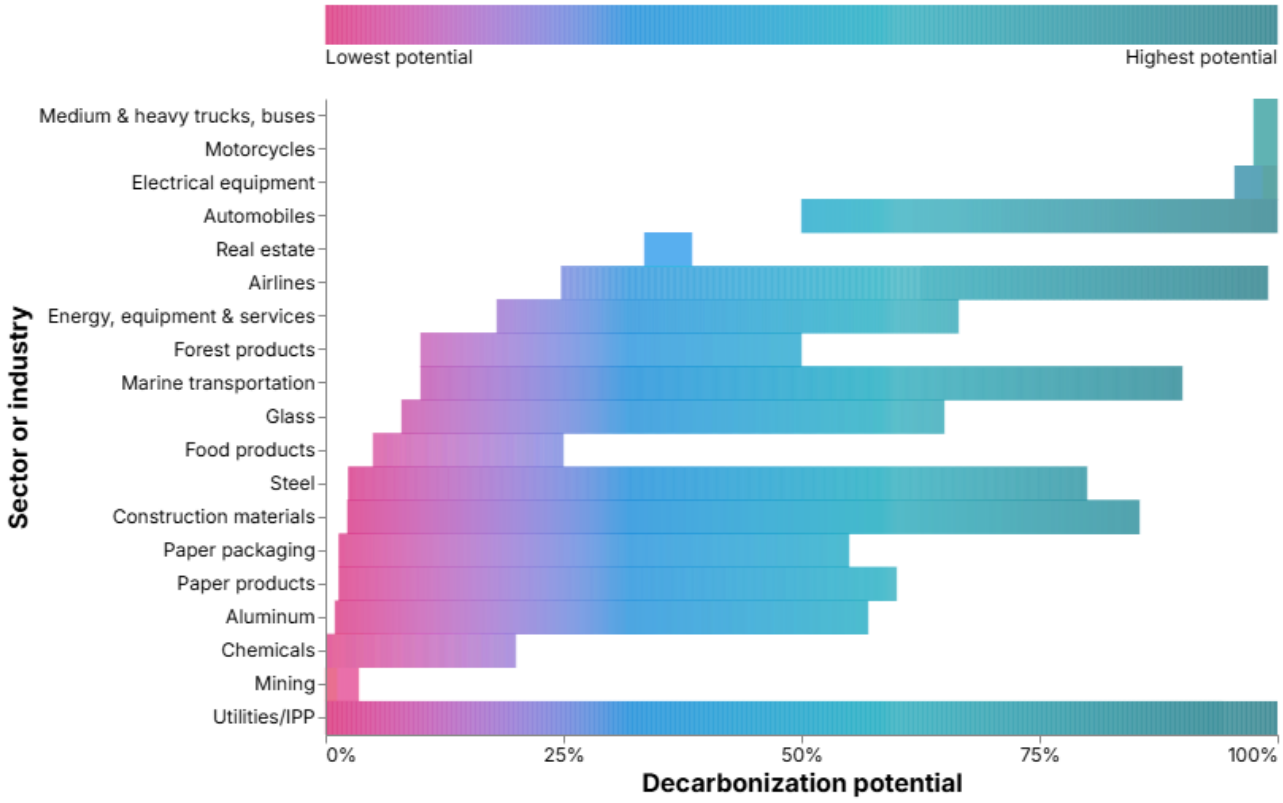
Using our metrics, we assessed the expected pace of transition and show how they can help differentiate between companies.

- First, we analyzed industries by the relevance and availability of decarbonization technologies — what options exist to reduce emissions and which companies are investing in them.
- Second, we studied whether transition-relevant government policies are associated with decarbonization outcomes. These findings build on our recent study that shows that isolating the risks from the financially material portion of a carbon footprint is associated with market performance.

Technological readiness and corporate capital allocation

The availability of technologies to decarbonize industries helps distinguish which firms have viable options to reduce their emissions — and therefore may face economic costs and financial pressures to act — from those that do not. To evaluate this, we used metrics from MSCI's Energy Transition Framework, which assesses more than 20 high-emitting industries based on the technologies available to decrease their material carbon emissions. Material emissions refer to those scopes of emissions within a sub-industry that carry the greatest financial risk for companies in that sub-industry and are most exposed to business and regulatory pressure to decarbonize.

Decarbonization potential of technologies by sector or industry



Data as of Aug. 6, 2025. The bars represent the range of decarbonization potential across technologies within each sector or industry. Longer bars indicate that multiple technologies are available, each with different potential. Shorter bars reflect fewer technology options and narrower potential. For sectors with only one applicable technology (e.g., motorcycles), a buffer is included for visibility. The color gradient highlights potential, shifting from red (lower potential) to green (higher potential). Source: MSCI Sustainability & Climate Research Services. MSCI Sustainability & Climate products and services are provided by MSCI Solutions LLC in the United States and MSCI Solutions (UK) Limited in the United Kingdom and certain other related entities.

Industry groups can broadly be divided between those that have options to decarbonize and those that do not. Industries such as steel, utilities, airlines and construction materials (cement) have access to a wider range of technologies with varying levels of decarbonization. For companies in these sectors, having more technological pathways often means greater capital requirements to support the transition and may invite closer investor scrutiny on how they plan to reshape their operations.

In contrast, industries such as chemicals and oil and gas face more limited technological options for reducing emissions, and the solutions that do exist typically achieve lower levels of decarbonization (see Appendix 1 for details on how technology pressure is assessed for product emissions in oil and gas). For companies in these sectors, the lack of scalable technologies may reduce near-term pressure to adopt new approaches, even as long-term transition risks remain.

Cost and feasibility across technology pathways

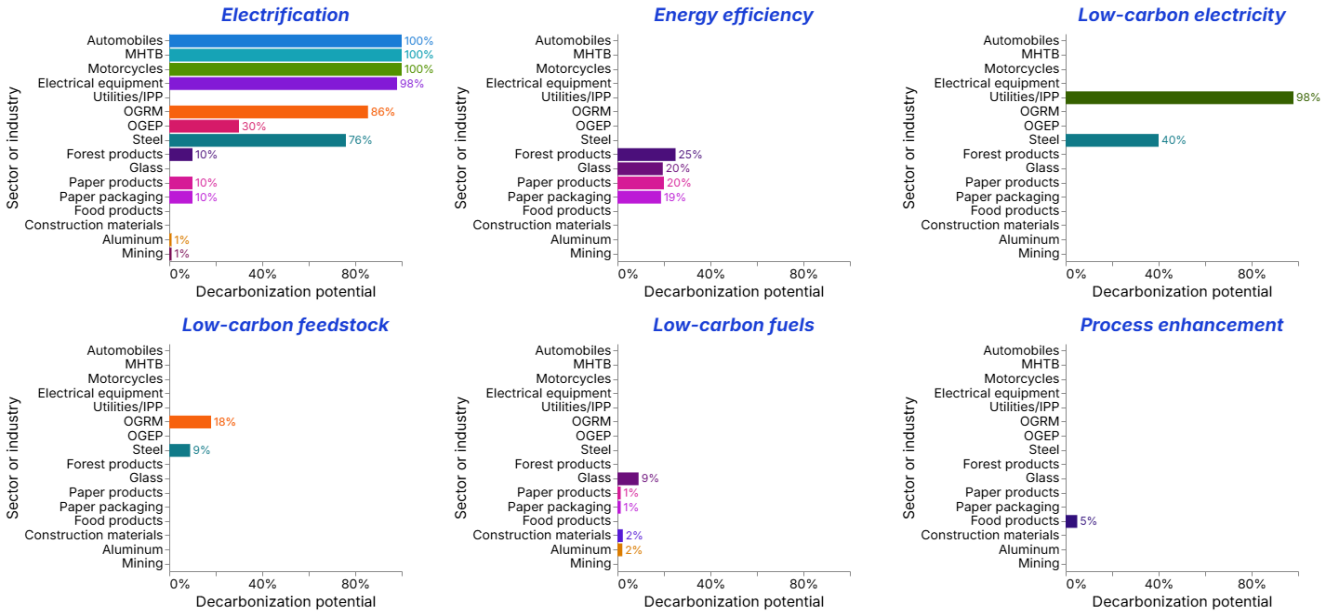
Decarbonization potential does not necessarily translate into near-term decarbonization. Even in sectors with multiple technology options, progress often depends on the cost and feasibility of available solutions.

Among the various pathways, process electrification and switching to low-carbon electricity show the broadest near-term potential. These approaches apply across several industries, including steel, heavy-duty vehicles and manufacturing, where a significant share of emissions stems from processes that can be electrified. Yet, even within the same sector, process-level differences can determine whether electrification is technically viable or economically attractive. For example, battery density limitations constrain electrification for heavy-duty vehicles, while access to sufficient clean electricity for high-temperature production processes in industries such as steel and aluminum poses additional cost and scalability challenges.

Overall, our assessment suggests that in sectors such as steel, paper products and oil and gas, several solutions could become cost-competitive by 2030.

Other pathways, including energy-efficiency improvements and transitional low-carbon fuels (e.g., grey or blue hydrogen), may provide incremental decarbonization potential over the next five to seven years. However, their impact tends to be narrower, either because they address a smaller share of total process emissions or because their achievable reductions are more limited.

Decarbonization potential by process and sector or industry

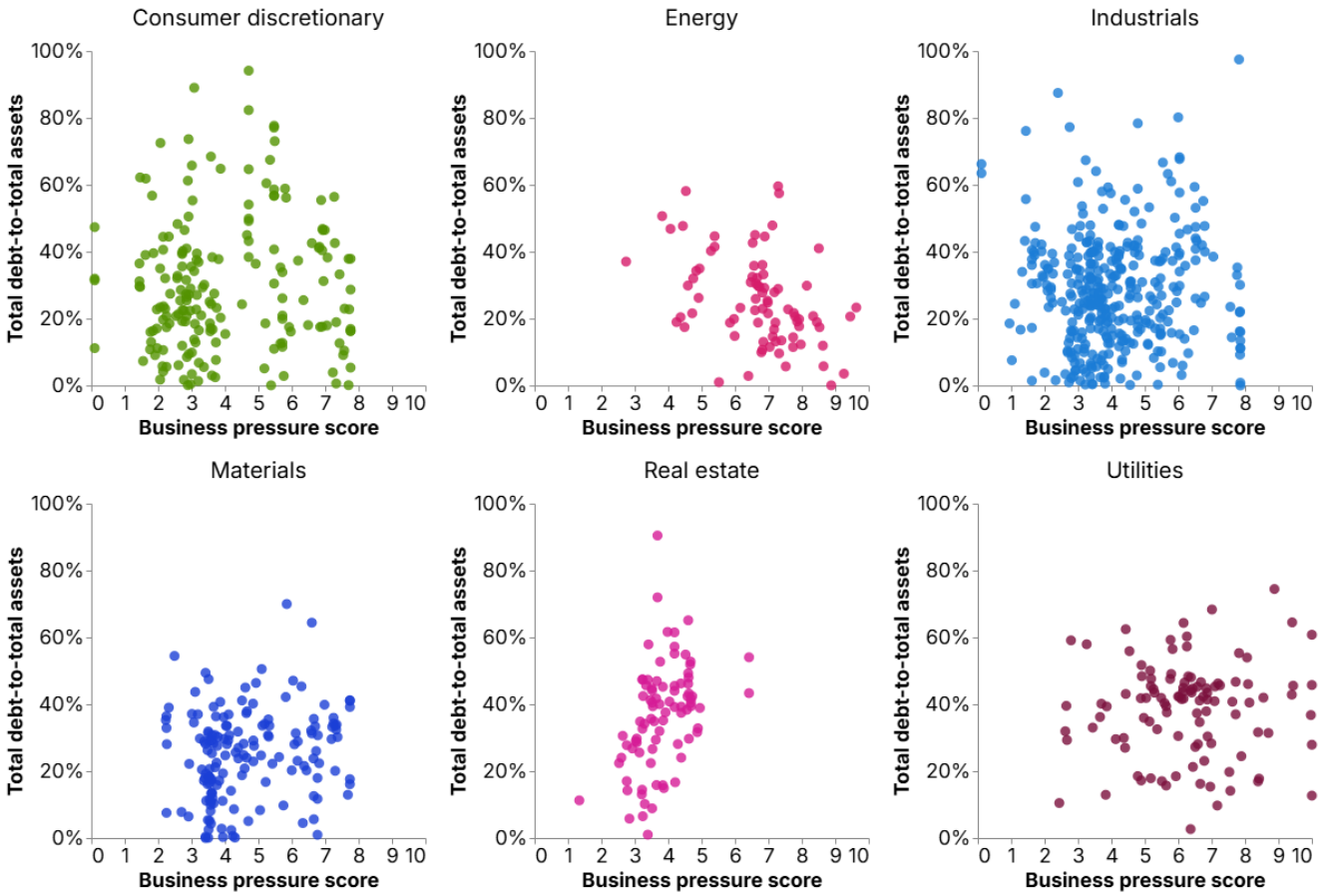


Data as of Aug. 6, 2025. The chart shows technology pathways that are not yet at cost parity but are expected to become so within a five-year timeline, according to MSCI Sustainability & Climate Research Services' assessments. Each chart presents the average decarbonization potential within a sector or industry for a specific technology. MHTB = Medium & heavy trucks and buses; OGEP = Oil & gas exploration & production; OGRM = Oil & gas refining & marketing. Source: MSCI Sustainability & Climate Research Services

Company capacity to finance transition varies

Even where feasible technology pathways exist, companies' ability to adopt them can differ widely. To explore this variation, we examined the differences within sectors based on companies' capacity to finance the transition, measured in the chart below by their total debt-to-total assets (%).

MSCI Energy Transition business pressure score compared with total debt-to-total assets



Data as of Sept. 2, 2025. The chart shows data for companies that are constituents of the MSCI ACWI Index grouped by GICS sectors.[1] Only sectors assessed for technology availability are included. The chart compares, within each sector, the expected transition pressure a company may face, based on the emissions intensity and decarbonization options of its business segments (transition business pressure score) with its leverage (total debt-to-total assets ratio). Source: FactSet and MSCI Sustainability & Climate Research Services

[1] GICS is the global industry classification standard jointly developed by MSCI and S&P Dow Jones Indices.

Across sectors with both a wide range of business pressures, such as materials, and a narrower spread, such as industrials, companies vary widely in their leverage profiles, which affects their ability to invest in new technologies. As a result, the transition may amplify divergence within industries, separating firms with the capacity to invest from those with more constrained balance sheets. Where feasible technologies exist, companies that combine stronger financial profiles with higher business pressure may be better positioned to capture or expand market opportunities in low-emissions products.[2]

Within the materials sector, for example, steel companies such as JSW Steel Ltd., CITIC Pacific Special Steel Holdings, China Steel Corp. and Tata Steel Ltd. exhibit relatively high business pressure scores but also carry elevated debt burdens. This combination of high transition pressure and limited financial flexibility may hinder their ability to fund decarbonization investments, despite the industry's overall high technology readiness.

A similar pattern emerges in the industrial sector, particularly among the electrical components and equipment and heavy electrical equipment sub-industries. These include companies well positioned to benefit from transition-driven product demand, such as energy storage. For instance, LG Energy Solution Ltd., with a relatively low debt-to-assets ratio of 26%, appears better placed to scale energy storage solutions compared with more leveraged peers such as Gotion High-Tech Inc. (50.2%) and EcoPro BM Co. Ltd. (44.9%).

The energy sector presents a distinct case. Most business lines remain misaligned with long-term low-carbon pathways and can at best be viewed as transitional. Among oil and gas companies, however, relatively lower leverage compared with sector peers suggests some firms may still have the financial capacity to pursue transition opportunities or invest in adjacent low-carbon businesses.

Leverage is only one lens, however. A company's ability to finance the transition also depends on its access to capital markets and cost of capital, both of which vary by market structure and jurisdiction. Geography also shapes firms' capacity to innovate and commit to long-term investments in emerging technologies. The next section explores these country-specific dynamics in detail.

Transition pace influenced by policy and institutions

The strength of decarbonization policies, as well as the institutional capacity of governments to implement them effectively, can shape companies' decisions about when and whether to reduce emissions. Companies operating under more stringent regulations and durable policy signals are generally more motivated to invest in emissions-reduction efforts. When the risk of higher operating costs from carbon pricing and loss of market share due to demand shifts align with business planning horizons, policy can act as a powerful catalyst for investment in new technologies and efficiency improvements.

[2] Business pressure score measures the level of financially relevant pressure on a company to decarbonize its business based on the expected emissions intensity and commercial adoptability of relevant emissions-mitigation technologies. The business pressure scores feed into the energy transition score through the transition pressure component of the MSCI Energy Transition Framework.

To assess how decarbonization policies influence corporate emissions-reduction performance across sectors and regions, we used components of the MSCI Energy Transition Framework to regress emissions intensity performance scores against policy pressure scores (see Appendix 2 for more detailed data and methodology definitions). This cross-sectional regression examined whether companies facing stricter policy environments — reflected in higher policy pressure scores across their geographical footprints, such as mature carbon-pricing systems and binding emissions-reduction targets — had better Scope 1 and 2 emissions intensity performance in recent years (i.e., higher performance scores).[3]

The stakes are high: prior MSCI research has found that better emissions performance (controlling for the materiality of the emissions) is associated with better financial and economic performance.

Recognizing that emissions intensity can also be influenced by factors other than policy — such as companies' emissions-reduction targets, business activities and technology availability — we controlled for targets assessment scores and business pressure scores in our regression analysis. (See Appendix 2 for full score definitions and regression specifications.)

Stronger policies led to better outcomes — but not everywhere

We found that policy pressure scores were positively correlated with emissions intensity performance scores across most sectors. To gauge the relative importance of policy versus corporate ambition, we compared the influence of policy pressure with that of company emissions-reduction targets. In sectors where policy pressure played a strong role, targets appeared to have a less material influence on emissions outcomes.

Policy pressure had a stronger influence on emissions intensity performance than targets in the utilities and communication-services sectors, particularly among multi-utilities and telecommunication services. This may reflect direct costs imposed by carbon pricing on power generators and the indirect exposure of telecoms to electricity prices, which heightens their sensitivity to cost pass-throughs.

Positive correlations between policy pressure and emissions intensity performance were also observed in health care (pharmaceuticals), industrials (industrial conglomerates) and financials (banks). While these sectors are not major direct emitters, they may be more responsive to policy incentives and national decarbonization priorities through indirect cost pressures (such as electricity use) or reputational and regulatory expectations.

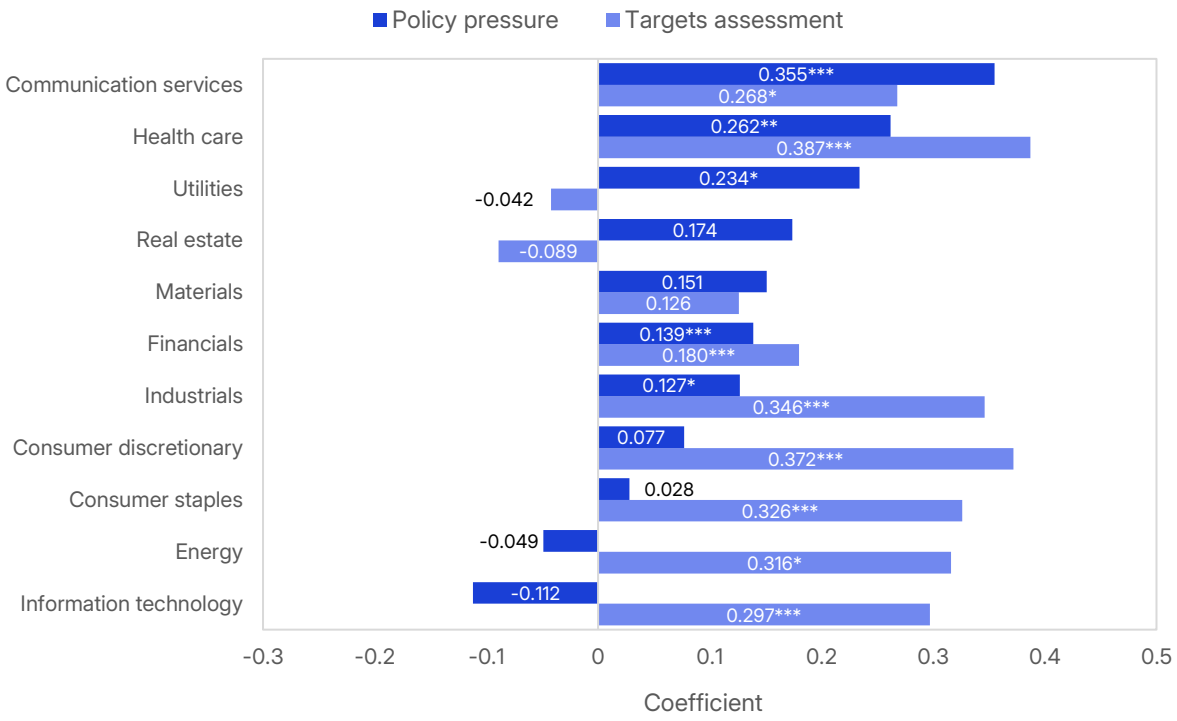
By contrast, emissions-reduction targets showed a significantly stronger association with emissions intensity performance than policy pressure in the consumer-discretionary, consumer-staples, energy and information-technology sectors. The relatively limited influence of policy in these areas may reflect the inherent difficulty of regulating Scope 1 and 2 emissions in industries such as oil and gas, semiconductors and technology hardware — sectors that are strategically significant and where

[3] The emissions intensity performance score measures companies' emissions-reduction track records relative to industry peers, based on Scope 1 and Scope 2 emissions over the three most recent reporting periods. Scope 3 emissions are excluded due to limited and inconsistent reporting across the coverage universe.

imposing direct constraints may be less politically or economically viable. Nevertheless, comprehensive targets and stronger track records of achievement were correlated with better emissions performance, as indicated by the positive coefficients for the targets assessment metrics.

Neither targets nor policy pressure had a significant effect on the materials sector, which includes major energy end-use industries such as construction materials and chemicals). In these industries, the limited availability of viable technologies may constrain the impact of both regulatory measures and voluntary targets.

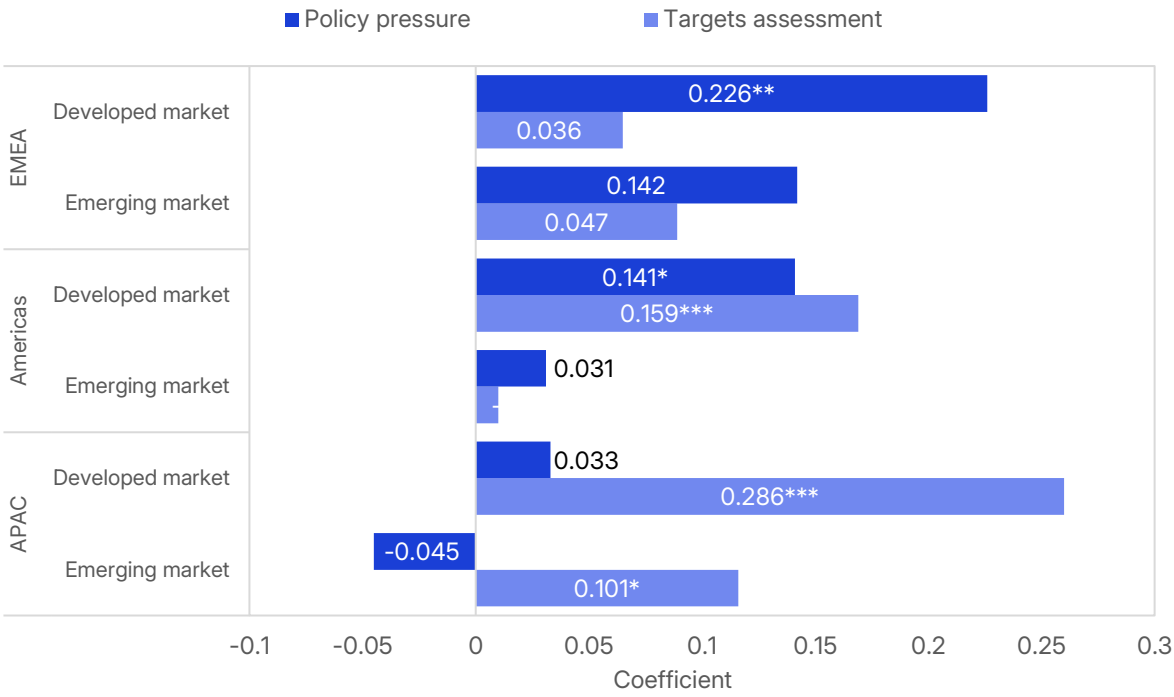
Influence of policy pressure and emissions targets on emissions performance by sector



Data as of Sept. 15, 2025. Bars represent standardized regression coefficients (using Z-scores) for policy pressure scores and targets assessment scores. Each coefficient indicates the expected change (in standard deviations) in emissions intensity performance scores associated with a one-standard-deviation increase in policy pressure or targets assessment scores. ***, ** and * indicate significance at the 99.9%, 99% and 95% levels, respectively. Fixed effects were included at the sub-industry level. R^2 values ranged from 0.171 to 0.353. F-statistics are significant at the 99.9% level for all sectors except consumer discretionary and utilities (95% level), and energy and real estate (not statistically significant). Correlation does not imply causation. Source: MSCI Sustainability & Climate Research Services

When comparing market segments and regions, the strongest positive correlation between policy pressure and emissions intensity performance was observed in companies in developed markets in EMEA, primarily within the EU. This likely reflects the EU's comprehensive decarbonization policy framework, which includes a mature carbon-pricing system and ambitious long-term decarbonization commitments enshrined in law. By contrast, emissions-reduction targets appeared to play a larger role for companies in the Asia-Pacific region, where decarbonization policies are generally less institutionalized.

Influence of policy pressure and emissions targets on emissions performance by region



Data as of Sept. 15, 2025. Bars represent standardized regression coefficients (using Z-scores) for policy pressure scores and targets assessment scores. Each coefficient indicates the expected change (in standard deviations) in emissions intensity performance scores associated with a one-standard-deviation increase in policy pressure or targets assessment scores. ***, ** * indicate significance at the 99.9%, 99% and 95% levels, respectively. Fixed effects were included at the sub-industry level. R^2 values ranged from 0.303 to 0.654. F-statistics are significant at the 99.9% level for all regions except emerging markets in EMEA (99% level) and emerging markets in the Americas (not statistically significant). Correlation does not imply causation. Source: MSCI Sustainability & Climate Research Services

Our findings indicate that the relative influence of decarbonization policies and emissions-reduction targets on past emissions performance varies across sectors and regions. For transition-focused investors, understanding these different drivers of emissions performance can inform investment and engagement strategies.

Where policy frameworks are more mature and exert stronger financial pressure — such as in utilities and developed markets — companies tend to exhibit better emissions performance. Prior MSCI research has shown that firms achieving stronger performance also tend to demonstrate superior financial and economic outcomes.

At the same time, voluntary corporate targets appear to play a role in keeping companies accountable for their emissions, particularly in emerging markets where decarbonization policies are less mature.

Durable policies and signals key to sustaining corporation decarbonization

Regardless of whether policy signals or corporate targets have been the stronger driver to date, past emissions progress offers no assurance of future outcomes. Sustaining decarbonization efforts ultimately depends on risk-reward dynamics: the costs of inaction and the incentives for action must be credible enough to encourage long-term investment. This credibility, in turn, relies on whether policy frameworks and incentive mechanisms are stable and predictable.

Technology barriers underscore this challenge. In industries where low-carbon alternatives are unlikely to reach cost parity in the near term, reliable government support and clear policy roadmaps may help to lower risk and attract capital. Examples include switching from coal- to hydrogen-based steelmaking, retrofitting cement plants with carbon capture and storage, and electrifying petrochemical processes — technologies with high decarbonization potential but low readiness due to high costs and implementation hurdles.[4]

Fiscal capacity, institutional effectiveness and the rule of law are key enablers that determine whether governments can develop and sustain credible decarbonization policies and incentives. Our analysis shows that companies under higher policy pressure often operate in jurisdictions with stronger institutional performance, as reflected in the governance pillar scores of the MSCI ESG Government Ratings.

Developed-market firms, particularly those based in EMEA jurisdictions, face more stringent decarbonization policies but also benefit from more stable and effective institutions. This combination may create more predictable investment environments, helping make transition efforts financially viable. By contrast emerging-market firms in Asia-Pacific jurisdictions often encounter weaker policies and governance. This could result in lower near-term pressure to cut emissions but also greater risks from abrupt policy shifts and ineffective implementation, which can create uncertainty and increase financing costs.

There are, however, some exceptions. Companies in South Korea and China face stronger-than-average transition policy pressure, potentially shaping their investment priorities. While domestic-facing U.S. firms experience relatively low policy pressure following recent regulatory rollbacks, multinational U.S. firms remain exposed to higher pressures from stricter regulations in overseas markets.

Overall, the diverging decarbonization policy paths across regions highlight the need for risk-differentiated approaches that focus on where policy pressures are most financially material. Evaluating companies' geographical operational and revenue footprints can offer investors a more accurate picture of their exposure and transition risk.[5]

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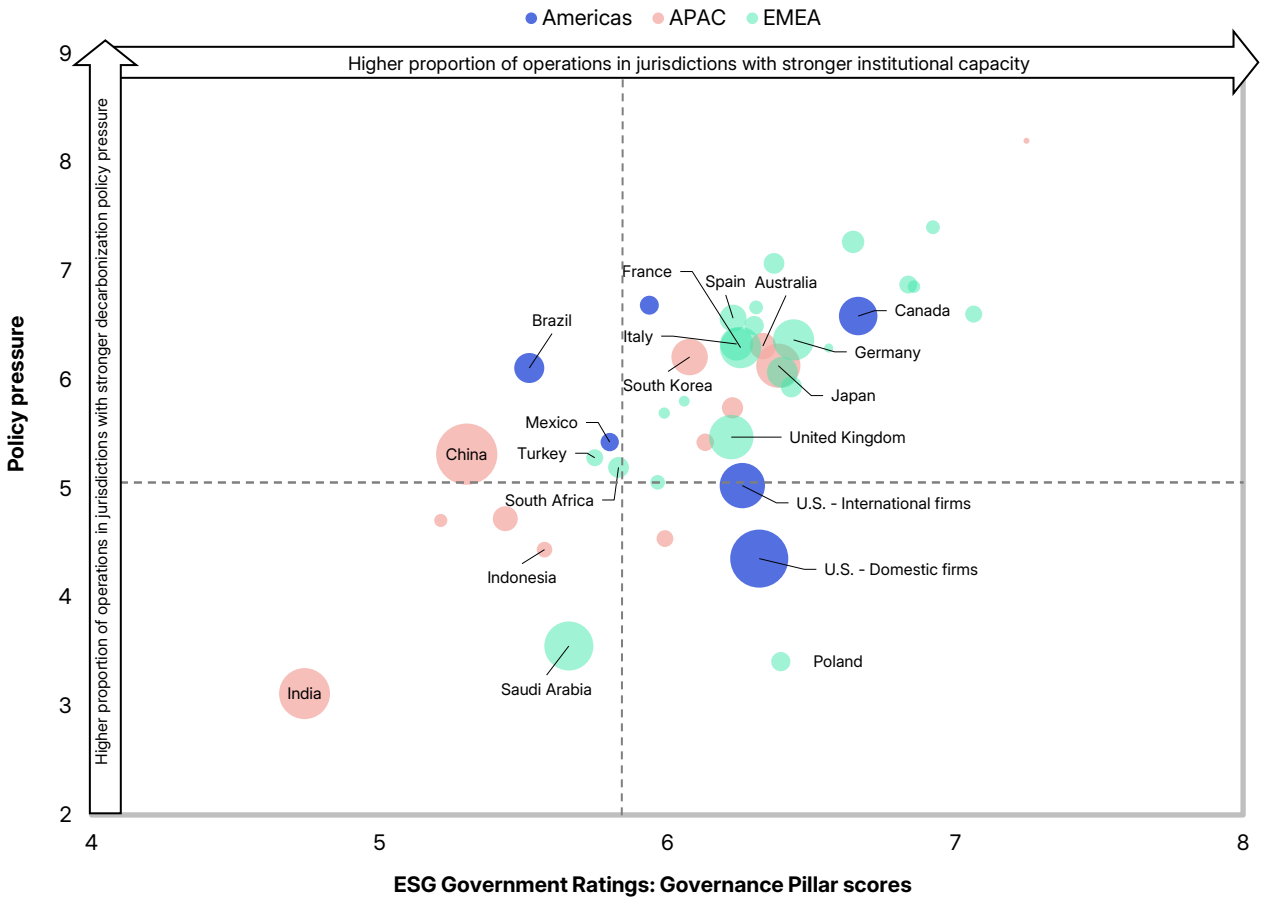
[4] Based on the technology readiness component of the MSCI Energy Transition Framework.

[5] The policy pressure score represents a weighted average of the policy pressure across each of a company's reported geographic segments. Geographic segments are defined by assets or revenue, depending on which metric is financially most relevant based on the business activities of the company.

Relationship between policy pressure and institutional environments



Data as of Sept. 15, 2025. Each bubble represents aggregated data for companies within a jurisdiction, based on their country of classification. The y-axis shows the weighted-average policy pressure score, calculated from companies' geographic revenue or asset segments. The x-axis shows the weighted-average governance pillar score, based on companies' geographic revenue or asset segments. Bubble size reflects the total emissions of companies in the jurisdiction, excluding non-financially material emissions. Policy pressure is a component of the MSCI Energy Transition Framework, which is presented on a 0 (low) to 10 (high) scale. Governance pillar scores are based on MSCI ESG Government Ratings, which are presented on a 0 (weak governance) to 10 (strong governance) scale. Dotted lines mark average values across the universe, which includes constituents of the MSCI ACWI Index (as of June 30, 2025) in the utilities, energy, materials, industrials, real-estate and consumer-discretionary sectors. Labels highlight major economies, including members of the Group of Twenty (G20). U.S. bubbles are split between firms with >50% operations abroad (international) and <50% (domestic). Source: MSCI Sustainability & Climate Research Services

Conclusion

The transition will continue to unfold in unexpected ways, shaped by technological breakthroughs and abrupt policy shifts. Yet investors must make decisions based on the information available today. Using metrics and indicators derived from bottom-up economic exposures, we sought to measure the pace and pressure of the transition on companies across sectors and regions.

We found:

- **Industries differ significantly in the range of decarbonization levers available to them and in the potential emissions reductions those levers can achieve.** Power generation and transport sectors appear positioned for significant progress, while cement and mining face more structural challenges. Companies' ability to capitalize on these shifts may also depend on their financing capacity, illustrated in this paper through leverage ratios.
- **Stronger policy pressure to decarbonize is associated with greater emissions reductions.** But the strength of this relationship varies by industry, and in some cases decarbonization progress is better explained by the quality of emissions-reduction targets.
- **At the country level, the strength of decarbonization policies tends to correlate with broader sovereign governance quality**. However, some countries like Brazil, China, Poland and the U.S. stand out as important exceptions. This relationship may indicate where decarbonization policies are more stable, and therefore where investors may be able to build longer-term expectations.

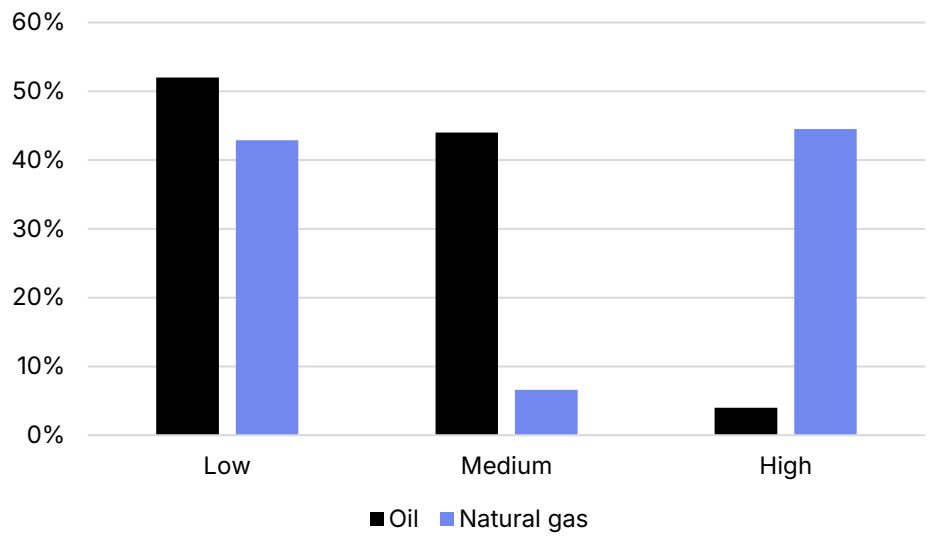
Appendix 1: Treatment of transition technology pressure on the downstream emissions related to oil and gas

MSCI Sustainability & Climate Research has developed a detailed methodology within its Energy Transition Framework for assessing downstream emissions associated with oil and gas. The framework applies a bottom-up approach that evaluates the commercial adoptability of technologies offering alternatives to the consumption of oil and gas. The chart below illustrates where technological developments are — and are not — creating commercially viable substitutes in the short-term.

For example, in the case of gasoline, there is growing pressure from EVs and plug-in hybrids. However, the trend is less convincing globally for other parts of the barrel, such as petrochemicals, jet fuel and middle and heavy distillate for marine transportation, where most solutions remain at the R&D or pilot stage.

Similarly, natural gas used for electricity generation faces pressure from renewables, but many other applications are less likely to be electrified or made dramatically more efficient in the next five years, e.g., industrial heat. Even in commercial uses, where well-known alternatives exist, the trend of adoption has been slow globally because of cost differentials.

Percent of oil and gas consumption by level of technology pressure



Data as of September 2025. A high level of technology pressure indicates that more commercially adoptable technologies exist which provide alternatives to end-use consumption. For this example, we created bands using the downstream business pressure score from the MSCI Energy Transition Framework: Low: 0 – 3.3, Medium: 3.3 – 6.6, High: 6.6 – 10.
Source: US Energy Information Administration and MSCI Sustainability & Climate Research Services

Appendix 2: Analyzing the relationship between emissions intensity performance and policy pressure

Our analysis relies on four component scores of the MSCI Energy Transition Framework, described in the specifications below. These scores are derived from companies' most recent disclosures of business and geographic segments, emissions and emissions-reduction targets, as well as the latest decarbonization policies across jurisdictions.[6]

$$Emissions\ intensity\ performance \sim Policy\ pressure + Targets\ assessment + Business\ pressure$$

- Target variable: **Emissions intensity performance score**, which measures companies' emissions reduction track records relative to industry peers, based on Scope 1 and Scope 2 emissions over the three most recent reporting periods.[7] Scope 3 emissions are excluded due to limited and inconsistent reporting across the coverage universe.
- Primary explanatory variable: **Policy pressure score**, which reflects public policy-driven transition pressures across companies' geographical footprints. Policy instruments include carbon pricing, near- and long-term mitigation targets that raise transition pressure and countervailing measures such as fossil-fuel subsidies, which may lower transition pressure. These external pressures can manifest as financial costs for companies.
- Controls:
    - **Targets assessment score**, which measures the comprehensiveness and track records of companies' emissions-reduction targets. This variable was added to control for the influence of emissions targets.
        - Our recent research paper, "Smoke Signals: Finding Leading Indicators of Corporate Decarbonization," provides an empirical study on the relationship between firm-level factors, including targets, capex and green revenues, and their relationship with emissions outcomes.
    - **Business pressure score**, which indicates the level of financially relevant pressure on the company to decarbonize its business based on the expected emissions intensity and commercial adoptability of relevant emissions mitigation technologies, to account for the effect that these factors may have on emissions-reduction behaviors.

All scores are measured on a 0-10 scale and standardized to Z-scores to allow better comparison of results in relative terms.

[6] This analysis assumes that the most recent policy pressure scores (as of 2024) reflect the policy environment over the three-year period during which emissions intensity performance (2022–2024) was measured. We believe this is reasonable given that the most recent update of Nationally Determined Contributions was in 2020. Similarly, we assume that firms' latest targets reflect their willingness to decarbonize over the same period. As more historical data become available, we can conduct panel regressions and make stronger inferences on the relationship between policy environments, corporate targets and emissions outcomes.

[7] Levels refer to the three-year average Scope 1 and 2 emissions intensity (mtCO2e/million USD revenue) per company. Trend refers to the three-year rolling average percentage change in Scope 1 and 2 emissions intensity.

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