NORTHERN TRUST
ASSET MANAGEMENT

SUSTAINABLE INVESTING INSIGHTS

THE EVOLVING IMPACT OF ESG RATINGS ON PORTFOLIO OUTCOMES

WHY CONTINUOUS REASSESSMENT MATTERS

KUSHAL DINESH CHOURASIA
Quantitative Researcher

IVAN RUMYNIN
Sustainable Investing Specialist

BART VAN VLIET, CFA
Quantitative Researcher

MILAN VIDOJEVIC, PHD
Head of Factor Research and Solutions

Over the past decade, many institutional investors have embedded sustainability objectives into their investment processes. These frameworks are evolving rapidly alongside the markets they aim to influence. Against the backdrop of this fast-moving space, portfolio implications of achieving desired sustainability outcomes are changing.

At Northern Trust Asset Management, we specialize in helping asset owners quantify these trade-offs, assess their evolving sustainability targets, and implement portfolios that achieve measurable ESG and climate outcomes efficiently and adaptively over time.

Based on our research, we present here four key takeaways for investors integrating ESG objectives into long-term investment frameworks:

1. **Reassess targets regularly**. As benchmarks, corporate data, and sustainability disclosure standards evolve, periodic reviews are essential to ensure that targets remain both ambitious and attainable within acceptable risk budgets.
2. **Differentiate between objectives**. Improving ESG ratings and cutting carbon intensity may have some overlap, but ultimately are not interchangeable. Each has distinct implications for portfolio composition and tracking error, and should be managed as separate, but sometimes complementary, objectives.
3. **Pursue risk-efficient implementation**. Achieving sustainability goals in core portfolios should not require excessive deviation from the benchmark. Advanced portfolio construction techniques can help investors reach desired outcomes while maintaining tight risk control.
4. **No single metric can capture all aspects of sustainability**. An investor cannot rely solely on one measure (such ESG score alone or carbon intensity alone) to achieve multiple objectives. If investors want to improve multiple dimensions they need to explicitly incorporate different objectives and understand the trade-offs.

SUSTAINABILITY TARGETS OVER TIME

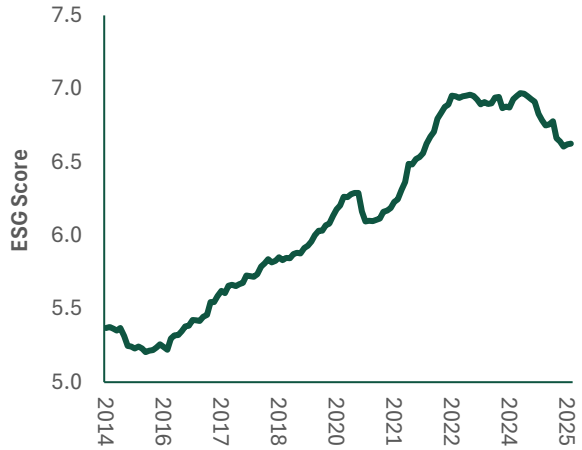
Our analysis shows that while the overall ESG profile of global equity markets improved, with average ESG scores rising and carbon intensities falling, the marginal cost of further improvement for some metrics also increased markedly. For example, raising a portfolio's weighted-average ESG score today by the same proportion requires significantly more active risk (tracking error) than a decade ago, whereas achieving large carbon-intensity reductions can still be done with relatively little tracking error.

Exhibit 1 illustrates this trend using the MSCI World Index from December 2014 through September 2025. At the index level, we observe substantial improvements in both the ESG score and carbon intensity over time. We explore these dynamics in more detail later in the article.

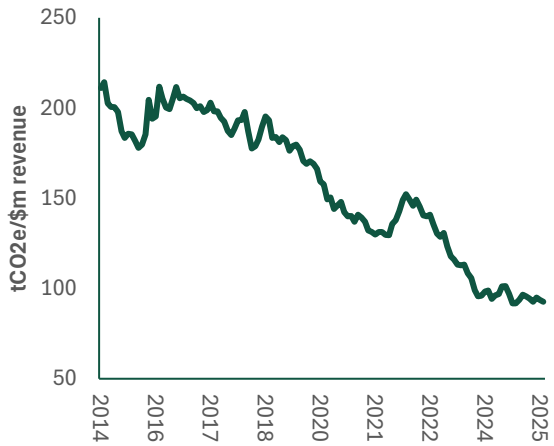
EXHIBIT 1: MSCI ESG SCORE AND CARBON INTENSITY OVER TIME

MSCI World universe exhibits substantial improvements in both the ESG score and carbon intensity over the past decade.

MSCI ESG Score Trend
December 2014 – September 2025



Carbon Intensity Trend
December 2014 – September 2025



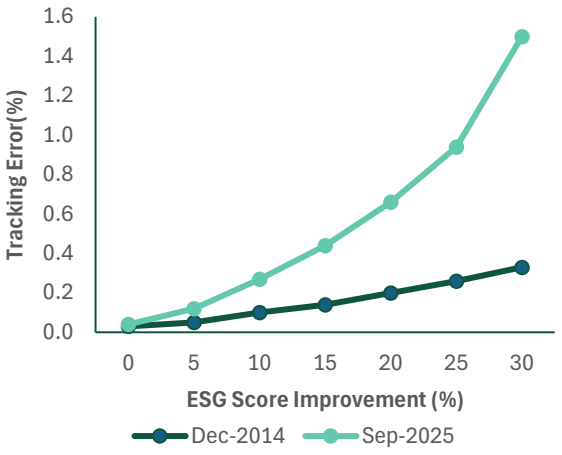
Source: Northern Trust Asset Management, MSCI. Data from December 2014 through September 2025.
Note: ESG Score represents the portfolio weighted average MSCI ESG Score, with the final score on a scale of 0-10. Carbon Intensity represents the portfolio weighted average Scope 1 and Scope 2 carbon intensity (with revenue in USD as the denominator).

Exhibit 2 compares the tracking error required to (1) improve the portfolio's ESG score and (2) carbon intensity by varying magnitudes, both at the beginning of our sample in December 2014, and in September 2025.

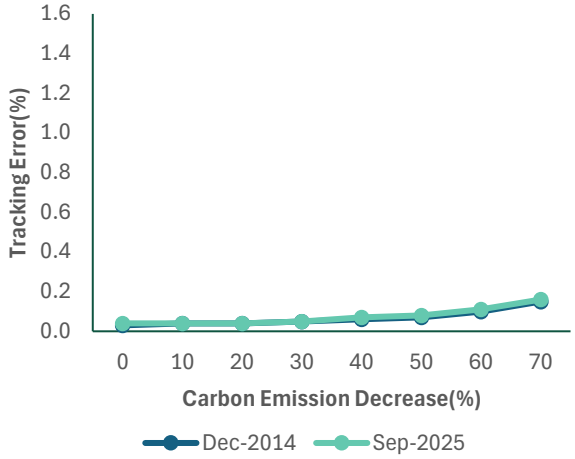
EXHIBIT 2: THE IMPACT OF SUSTAINABILITY SCORE IMPROVEMENT ON TRACKING ERROR

Comparing the tracking error impact in December 2014 and September 2025

ESG Score & Ex-ante TE Frontier
End of month date, Dec 2014 and Sep 2025



Carbon Intensity & Ex-ante TE Frontier
End of month date, Dec 2014 and Sep 2025



Source: Northern Trust Asset Management, MSCI. End of month date from December 2014 and September 2025.
Note: ESG Score represents the portfolio weighted average MSCI ESG Score, with the final score on a scale of 0-10. Carbon Intensity represents the portfolio weighted average Scope 1 and Scope 2 carbon intensity (with revenue in USD as the denominator). The graphs show the extra tracking error (y-axis) to achieve incremental portfolio improvements on the specified metrics (x-axis). (Ex-ante) Tracking error is computed via a minimum variance optimization using the BARRA GEMLTL Model.

The results reveal that, as of September 2025, incremental ESG score improvements exhibit a steep, nonlinear increase in tracking error, particularly beyond a 20–30% uplift versus the benchmark. At any given level of improvement, the required tracking error is noticeably higher in 2025 than in 2014, indicating that the deviation from the benchmark needed to achieve constant ESG score gains is rising over time. In contrast, the tracking error associated with carbon intensity reductions remains modest even for substantial cuts, both at the start and the end of the sample. That said, investors pursuing dynamic decarbonization targets, such as a 7% year-on-year emissions-intensity reduction consistent with Net Zero commitments, should remain cautious. If benchmark companies do not decarbonize quickly enough, portfolios must meet these targets through ongoing rebalancing into lower-carbon names. This can gradually increase benchmark deviation and, consequently, tracking error[1]. For a deeper discussion of the impact of backward- and forward-looking climate metrics on portfolio outcomes, see our publication Carbon Misconceptions[2].

[1] NTAM Research: Staying on Track: Paris-Aligned Benchmark Decarbonisation
[2] NTAM Research: Carbon Misconceptions

ESG TRENDS IN THE INVESTMENT UNIVERSE

Before diving into portfolio construction implications, it is useful to understand how the overall universe of investable companies has changed on ESG metrics in recent years. As shown in **Exhibit 1**, over roughly the last decade, the broad market shows clear improvements. Aggregate ESG scores generally rose, and average carbon intensities fell in major equity indices.

For example, the MSCI World Index's average ESG score steadily improved over the past ten years. According to MSCI's scoring (a 0–10 scale corresponding to letter ratings), the index average was 5.4 in 2014 and increased to 6.6 by September 2025 — improving from a BBB rating to an A. This reflects companies in developed markets enhancing ESG policies and practices and thus lifting their scores.

It is also worth noting that ESG ratings tend to be persistent over time. Companies rarely change their ESG profile overnight. Our analysis confirms that firms with top-tier ESG ratings often remain leaders the following year, and the lowest-rated tend to lag unless they undergo major changes. We found that 70% of companies in the top ESG decile of our dataset remained in the top 20% of ESG scores in the next year. Mid-range companies showed moderate consistency as well. In practical terms, this justifies using prior ESG scores as one input for forecasting future ESG performance (and many quantitative ESG investors do just that). It also implies that dramatically improve a portfolio's ESG score, holdings must be swapped for fundamentally different companies, because companies seldom leap from bad to great on ESG in short order. This underscores the importance of active engagement and long-term efforts to improve a company's ESG profile, since improvements take time.

At the same time, the carbon footprint of the index dramatically decreased. The weighted-average carbon intensity of the MSCI World Index was over 210 tCO_2e/$m revenue in December 2014; by September 2025 it dropped by more than half to 93 tCO_2e/$m revenue. This indicates that the universe of large-cap companies became much less carbon-intensive on average. Part of this decline is due to companies genuinely reducing emissions (for instance, utilities shifting toward renewables and manufacturers becoming more efficient), and part is due to changes in the index composition and growth in less carbon-intensive sectors (such as technology). It is worth noting that carbon "intensity" can fall simply because revenues grow (the denominator), even if absolute emissions do not fall as much - so some of the improvement is due to the global economy growing and some firms increasing output without increasing emissions at the

WHAT ARE ESG RATINGS AND DECARBONIZATION TARGETS?

ESG ratings are used by investors to quantify financially material ESG risks, and measure how companies manage these risks relative to sector peers. Providers such as MSCI or Sustainalytics use two components: exposure to ESG risks across material issues (driven by industry, geography, and operations), and management of risks (reflected in policies, performance metrics, and controversies). In essence, ESG ratings measure risk management, not moral virtue.

Decarbonization targets focus on reducing portfolio GHG emissions, often using carbon intensity (emissions per unit of revenue). Investors pursue these targets for two main reasons. The first is risk management: high-emission companies face transition risks from regulation, technology shifts, and changing market preferences. Lower-carbon portfolios are generally more resilient to these risks. The second is regulation and accountability: policies such as the EU's Paris-Aligned Benchmark Regulation require measurable emissions reductions (e.g. 7% per year). Investors using these benchmarks must decarbonize their portfolios by adjusting exposures, or otherwise achieve equivalent outcomes via targeted climate engagement with investee companies.

same rate. Nonetheless, in aggregate the trend is clear: a dollar of revenue generated by a company today results in less carbon emissions that it did a decade ago.

This provides context for setting ESG targets: the baseline is moving, which can make active targets either easier or harder to achieve over time.

The first implication is that the market's ESG metrics improving over time suggests that companies are getting better at managing ESG risks. This can be encouraging for investors - for example, if one's goal is to invest in companies with strong ESG scores, there are more of them now than a decade ago, and even the average company is better managing ESG issues. Similarly, the halving of carbon intensity indicates real economy shifts and opportunities for lower-carbon investment.

The second implication is that a higher baseline makes it more challenging for an active portfolio to achieve a large ESG or carbon advantage over the benchmark. In 2015, an ESG-focused fund could surpass the benchmark's ESG score by a wide margin with simple tilts because the benchmark had many low-rated companies that could be underweighted or excluded. By 2025, obtaining an additional uplift or even equivalent uplift becomes tougher. To beat the now-elevated benchmark by a wide margin, the active portfolio must make more aggressive bets or exclusions, which can increase tracking error. Put simply, the "low-hanging fruit" of ESG gains has been picked. This phenomenon is noted in index analytics: as aggregate ESG ratings of benchmarks rise, the achievable incremental ESG uplift for an active portfolio is shrinking, unless one is willing to take on more active risk. In fact, recent research finds that popular ESG indexes saw their tracking errors climb in the past five years as underlying ESG scores improved and index providers layered on more exclusions.[3] The result is more concentrated portfolios with smaller ESG differentials and higher active risk.

These changes in the investment universe warrant adjustments in how sustainability strategies are approached. Methodologies and expectations that worked in 2015 may need to be recalibrated in 2025. For example, an ESG fund that once targeted a score of 7 when the benchmark was close to 5 might find that achieving such a large improvement is much harder now that the benchmark is at 6.5. Thus, continuous assessments of outcomes are crucial: investors should regularly check whether their sustainability targets are still delivering the intended differentiation and whether the active risk required is still acceptable.

HOW TO APPROACH INTEGRATION OF MULTIPLE TARGETS

Investors often have multiple sustainability objectives - for example to both improve ESG scores and reduce carbon intensity, and perhaps also respect other constraints such as diversity targets or exclusions. Achieving multiple sustainability goals simultaneously can be tricky, because some goals can conflict. It is important to understand the relationships (correlations) between different ESG measures and set targets in a way that balances them.

Exhibit 3 provides insight into the interaction between an ESG score target and a carbon intensity target in a hypothetical portfolio optimization. The left chart shows that as the ESG score target is raised, carbon intensity initially drops. This makes sense: there is a positive correlation between ESG scores and carbon efficiency in many cases. Companies with better ESG scores often have better environmental practices, and very high carbon emitters (e.g. coal-fired utilities) usually have poor ESG scores due to higher exposure to ESG risks, so tilting toward high ESG inherently tilts away from some heavy emitters. Thus, a moderate ESG uplift tends to deliver a side benefit of decarbonization. However, beyond a 30% ESG score

[3] NTAM Research: ESG (In)efficiency

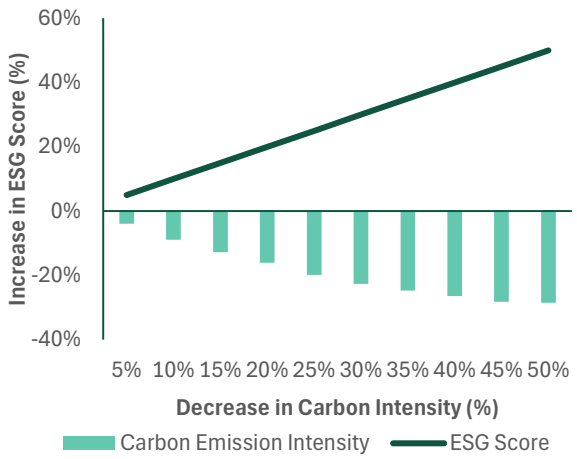
improvement, the carbon intensity reduction flattens and can even reverse slightly. Pushing the ESG score extremely high causes the portfolio to become concentrated in a small subset of companies, essentially the top-rated names only. At that extreme, the relationship with carbon intensity can break down, as the highest ESG scorers might not be the lowest carbon emitters. For example, there could be an overweight to a tech company with an ESG score of 10 but moderate carbon intensity, with an underweight to a utility with an ESG score of 8 but very low carbon intensity because it is 100% renewable-powered.

The right chart in **Exhibit 3** examines the converse scenario. As expected, if the only objective is to cut carbon intensity, the portfolio achieves large carbon reductions, but sees virtually no improvement in ESG score versus the benchmark. In fact, the ESG score could even slightly decline in some cases. The reason is that a pure decarbonization strategy will heavily tilt away from the worst carbon emitters, typically sectors like Energy, Utilities, Materials. While this strategy removes a lot of absolute emissions, it does not necessarily pick stocks for their broader ESG merits.

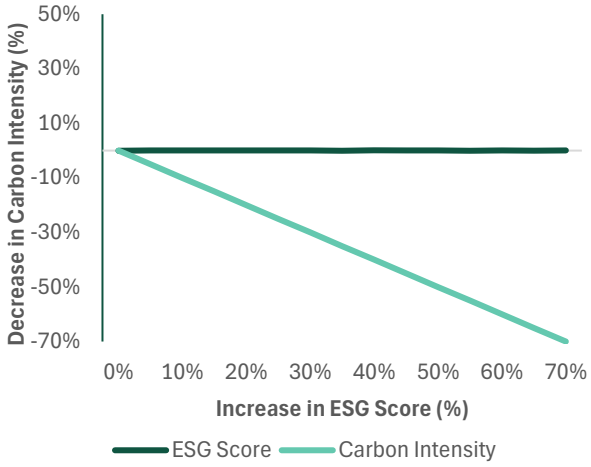
EXHIBIT 3: SECONDARY IMPACT ON NON-TARGETED SCORE FROM IMPROVEMENTS IN TARGETED SCORE

Interaction between an ESG score target and a carbon intensity target in a hypothetical portfolio optimization.

Increase in ESG Score
As at 30 September 2025



Decrease of Carbon Intensity
As at 30 September 2025



Source: Northern Trust Asset Management, MSCI. Data as of end of September 2025.
Note: Left graph shows the resulting carbon intensity reduction (y-axis) from linearly increasing iterations of a portfolio ESG score uplift (x-axis), expressed as percentage reduction compared to the benchmark. Right graph shows the inverse, what happens to the portfolio ESG score when carbon intensity is reduced by linearly increasing amounts, expressed as percentage increase over the benchmark. The results are computed using minimum variance optimizations using the BARRA GEMLTL Model.

The key takeaway is that no single metric can capture all aspects of sustainability, and a single measure such as ESG score cannot achieve multiple objectives. If investors want to improve different dimensions, such as both an ESG score improvement and low carbon intensity, both objectives need to be explicitly considered and the trade-offs understood. Sometimes, certain sustainability objectives are synergistic

(improving one helps the other), and other times they are in tension. In our example, up to moderate levels, ESG and carbon goals are synergistic, but at extremes they conflict. When designing an investment strategy, one should examine the correlations and contributions of each metric. Sophisticated optimization techniques can then be used to find an efficient frontier that balances the goals. In practice, this might involve setting target thresholds for both ESG and carbon (e.g., “achieve at least 20% ESG score improvement and 50% carbon reduction vs benchmark”) and then optimizing for minimum tracking error. Careful analysis can reveal whether those targets are feasible together, or if one objective would significantly undermine the other.

Finally, consider that multiple sustainability objectives might also interact with financial objectives. For instance, a high ESG, low carbon portfolio might inadvertently introduce sector bets (such as overweighting tech or underweighting energy). If those bets are concerning from a financial perspective, additional constraints may be needed (e.g. sector neutrality) or otherwise more tracking error should be allowed to compensate.

CONCLUSION

Sustainability targets should evolve as markets, data, and benchmarks change. What once required little active risk may now demand much more, especially for ESG score improvements, while modest carbon reductions often remain achievable with minimal tracking error.

For asset owners, three actions stand out:

1. **Review targets regularly** to ensure they remain ambitious yet realistic.
2. **Differentiate objectives** - ESG uplift and decarbonization affect portfolios differently and should be managed independently.
3. **Focus on efficiency** by achieving sustainability outcomes with measured, well-managed active risk.

At Northern Trust Asset Management we help investors quantify these trade-offs and implement sustainability strategies that remain effective, risk-aware, and adaptable as the landscape evolves.

IMPORTANT INFORMATION

This material is directed to expert, institutional, professional, wholesale and eligible clients or investors only and should not be relied upon by retail investors.

This document may not be edited, altered, revised, paraphrased, or otherwise modified without the prior written permission of Northern Trust Asset Management (NTAM). The information contained herein is intended for use with current or prospective clients of Northern Trust Asset Management. The information is not intended for distribution or use by any person in any jurisdiction where such distribution would be contrary to local law or regulation. Northern Trust Asset Management's (NTAM) and its affiliates may have positions in and may effect transactions in the markets, contracts and related investments different than described in this information. This information is obtained from sources believed to be reliable, its accuracy and completeness are not guaranteed, and is subject to change. Information does not constitute a recommendation of any investment strategy, is not intended as investment advice and does not take into account all the circumstances of each investor.

This report is provided for informational purposes only and is not intended to be, and should not be construed as, an offer, solicitation or recommendation with respect to any transaction and should not be treated as legal advice, investment advice or tax advice. Recipients should not rely upon this information as a substitute for obtaining specific legal or tax advice from their own professional legal or tax advisors. References to specific securities and their issuers are for illustrative purposes only and are not intended and should not be interpreted as recommendations to purchase or sell such securities. Indices and trademarks are the property of their respective owners. Information is subject to change based on market or other conditions.

All securities investing and trading activities risk the loss of capital. Each portfolio is subject to substantial risks including market risks, strategy risks, advisor risk, and risks with respect to its investment in other structures. There can be no assurance that any portfolio investment objectives will be achieved, or that any investment will achieve profits or avoid incurring substantial losses. No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment. Risk controls and models do not promise any level of performance or guarantee against loss of principal. Any discussion of risk management is intended to describe NTAM's efforts to monitor and manage risk but does not imply low risk.

Past performance is not a guarantee of future results. Performance returns and the principal value of an investment will fluctuate. Performance returns contained herein are subject to revision by NTAM. Comparative indices shown are provided as an indication of the performance of a particular segment of the capital markets and/or alternative strategies in general. Index performance returns do not reflect any management fees, transaction costs or expenses. It is not possible to invest directly in any index. Net performance returns are reduced by investment management fees and other expenses relating to the management of the account. Gross performance returns contained herein include reinvestment of dividends and other earnings, transaction costs, and all fees and expenses other than investment management fees, unless indicated otherwise.

Forward-looking statements and assumptions are NTAM's current estimates or expectations of future events or future results based upon proprietary research and should not be construed as an estimate or promise of results that a portfolio may achieve. Actual results could differ materially from the results indicated by this information.

Hypothetical portfolio information provided does not represent results of an actual investment portfolio but reflects representative historical performance of the strategies, funds or accounts listed herein, which were selected with the benefit of hindsight. Hypothetical performance results do not reflect actual trading. No representation is being made that any portfolio will achieve a performance record similar to that shown. A hypothetical investment does not necessarily take into account the fees, risks, economic or market factors/conditions an investor might experience in actual trading. Hypothetical results may have under- or over-compensation for the impact, if any, of certain market factors such as lack of liquidity, economic or market factors/conditions. The investment returns of other clients may differ materially from the portfolio portrayed. There are numerous other factors related to the markets in general or to the implementation of any specific program that cannot be fully accounted for in the preparation of hypothetical performance results. The information is confidential and may not be duplicated in any form or disseminated without the prior consent of NTAM.

Investing involves risk- no investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment.

Northern Trust Asset Management is composed of Northern Trust Investments, Inc. Northern Trust Global Investments Limited, Northern Trust Fund Managers (Ireland) Limited, Northern Trust Global Investments Japan, K.K, NT Global Advisors, Inc., 50 South Capital Advisors, LLC, Northern Trust Asset Management Australia Pty Ltd, and investment personnel of The Northern Trust Company of Hong Kong Limited and The Northern Trust Company.

Issued in the United Kingdom by Northern Trust Global Investments Limited regulated by the Financial Conduct Authority (Licence Number 191916), issued in the European Economic Area ("EEA") by Northern Trust Fund Managers (Ireland) Limited regulated by the Central Bank of Ireland (Licence Number C21810) , issued in Australia by Northern Trust Asset Management (Australia) Limited (ACN 648 476 019) which holds an Australian Financial Services Licence (License Number: 529895) and is regulated by the Australian Securities and Investments Commission (ASIC), and issued in Hong Kong by The Northern Trust Company of Hong Kong Limited which is regulated by the Hong Kong Securities and Futures Commission.

I-120125-5018090-120126