

A Systematic Path to Net Zero: Climate Alignment through a Factor Lens

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ABSTRACT. Climate change presents a systemic risk to global financial markets, prompting institutional investors to align capital with the goal of net zero greenhouse gas (GHG) emissions by 2050. Traditional net zero approaches often rely on exclusionary screens and backward-looking emissions data, resulting in limited effectiveness and suboptimal portfolio outcomes. To address these shortcomings, we study a forward-looking net zero alignment framework motivated by institutional climate objectives. We expand conceptually this framework, combining it with a disciplined multi-factor portfolio construction that targets ex-ante control of systematic risk and return drivers and ex-post transparency of portfolio outcomes. By combining a forward-looking climate-alignment perspective with a systematic approach to targeting established return premia, this conceptual framework may offer an alternative considered by long-horizon asset owners — including national banks and public pension schemes — who are exploring ways to align capital with broader decarbonization objectives while remaining mindful of their fiduciary responsibilities.

1. Introduction

The urgency to achieve net zero greenhouse gas (GHG) emissions by 2050 has become a major challenge for institutional investors. Climate change is now widely recognized as a systemic financial risk, with direct implications for asset valuations, capital allocation, and long-term financial stability (Dietz, Bowen, Dixon, and Gradwell, 2016). International frameworks such as the Paris Agreement, reinforced by the Intergovernmental Panel on Climate Change (IPCC), call for a halving of global emissions by 2030 and a full decarbonization by mid-century. In response, institutional portfolios are facing increasing pressure to conceptually align with these climate targets while maintaining fiduciary discipline.

To meet this dual mandate, many investors have adopted Paris-Aligned Benchmarks (PABs), which impose strict emissions reduction targets and fossil fuel exclusions, often based on static sector- and revenue-based screens. While these frameworks offer regulatory clarity, they exhibit notable limitations. Their backward-looking orientation often penalizes firms in transition — particularly in carbon-intensive sectors like utilities, energy, and materials — that are essential to enabling real-world decarbonization. Excluding these firms can raise their cost of capital and undermine broader system-level efforts to support the transition (Krueger, Sautner, and Starks, 2020).

Moreover, the rigidity of rule-based exclusions introduces structural inefficiencies (Andersson, Bolton, and Samama, 2016). By eliminating entire industries or companies with high current emissions, PAB portfolios tend to exhibit high turnover and elevated tracking error relative to standard benchmarks. These portfolios are often difficult to interpret for investors both ex-ante and ex-post: numerous constraints result in ambiguous design choices, and often introduce unintended exposures to unrewarded risks, such as single-stock, sector, currency, or regional skews. The consequences are twofold: implicit costs (e.g., unnecessary turnover) and loss in transparency in identifying key drivers of performance. As such, these designs often appear achievable on paper but are often misaligned in practice — compromising both financial performance and real-world climate impact. As Le Guenedal and Roncalli (2022) emphasize, achieving net zero alignment requires more sophisticated portfolio construction techniques than exclusionary screening. A promising alternative is to integrate forward-looking climate alignment with systematic factor investing.

Factor-based approaches are grounded in strong economic theory and have demonstrated persistent efficacy across geographies, market cycles, and asset classes (see, for example, Fama and French, 1993, and Harvey, Liu, and Zhu, 2016, among many others). However, combining factor exposures with net zero objectives is not trivial. PAB methodologies often conflict with a factor approach — particularly value, where value-oriented stocks often appear unattractive from a backward-looking emissions perspective and are disproportionately penalized in PAB frameworks. This creates trade-offs for investors seeking both climate alignment and performance.

We analyze a conceptual alternative that combines a forward-looking climate framework with a systematic multi-factor investing.

To address these challenges, one conceptual alternative is to combine a forward-looking climate framework — designed to identify credible transition leaders — with systematic multi-factor investing. Such a conceptual design enables pursuing net zero objectives while maintaining transparency, minimizing unintended risks, and preserving exposures to well-documented sources of returns. Crucially, as designed, this conceptual design maintains tight ex-ante control of portfolio characteristics and facilitates clear ex-post decomposition of both risk and return drivers. By preserving transparency, reducing turnover, and avoiding unintended structural skews, such a framework may offer a potential viable solution for achieving net zero goals.

The remainder of this paper presents the logic, design, and empirical properties of such a conceptual design. Section 2 details a forward-looking net zero framework, which draws heavily on forward-looking alignment criteria and shows several strategic advantages over exclusion-based approaches. Section 3 describes how this net zero framework can be integrated into a factor-based approach. Lastly, Section 4 evaluates the historical performance, risk characteristics, and sheds light on practical implementation considerations for institutional investors.

2. A Forward-Looking Net Zero Framework

Recognizing the urgency of achieving net zero emissions by 2050 and the limitations of existing climate investment methodologies, we consider a forward-looking net zero framework designed to identify companies credibly aligned with the long-term decarbonization objectives. Drawing on guidelines from the Institutional Investors Group on Climate Change (IIGCC), the framework employs a forward-looking, company level assessment tailored for systematic portfolio construction.

At its core, the forward-looking net zero framework evaluates firms across six alignment dimensions that collectively define their transition readiness (see Exhibit 1 below). Companies are classified into five tiers, from “Not Aligned” to “Achieving Net Zero”, based on their stated ambitions, interim targets, emissions performance, disclosure quality, strategic plans, and capital allocation. For instance, to reach the Aligned status, firms must demonstrate not only a 2050 net zero commitment but also science-based short- and medium-term emissions targets across Scope 1, 2, and material Scope 3 emissions. In line with the academic literature, performance is assessed against these targets to ensure credibility (Grewal, Hauptmann, and Serafeim, 2021).

Beyond these core metrics, transparency is a central requirement. Firms must disclose emissions comprehensively and consistently, enabling data driven portfolio decisions. Equally important is a credible decarbonization strategy, which must articulate specific operational and capital measures aimed at reducing GHG emissions and increasing the share of green revenues. This includes quantified action plans, not just aspirational statements. Capital allocation is also scrutinized as investments must reflect a genuine shift towards low-carbon technologies and associated infrastructure.

Exhibit 1: Net Zero Framework Overview – A Forward-Looking Alignment Approach

Alignment criteria	Not aligned including no data	Committed to aligning		Aligning towards a net zero pathway		Aligned to net zero pathway		Achieving net zero
		Material emitting	Low emitting	Material emitting	Low emitting	Material emitting	Low emitting	
1 Ambition: 2050 net zero goal	No criteria met	●	●	●	●	●	●	Companies with current emissions intensity at, or close to, net zero emissions and a business model or investment plan expected to continue to achieve this goal over time
2 Targets: Short- and medium-term emissions reduction target (scope 1, 2 and material scope 3)				●	●	●	●	
3 Emissions performance: Current emissions intensity performance (scope 1, 2 and material scope 3) relative to targets ¹						●	●	
4 Disclosure: scope 1, 2 and material scope 3 emissions				●	●	●	●	
5 Decarbonisation Strategy: A quantified plan setting out measures deployed to meet GHG targets, increasing green revenues.				●		●		
6 Capital Allocation Alignment: Demonstration that capex is consistent with achieving net zero						●		

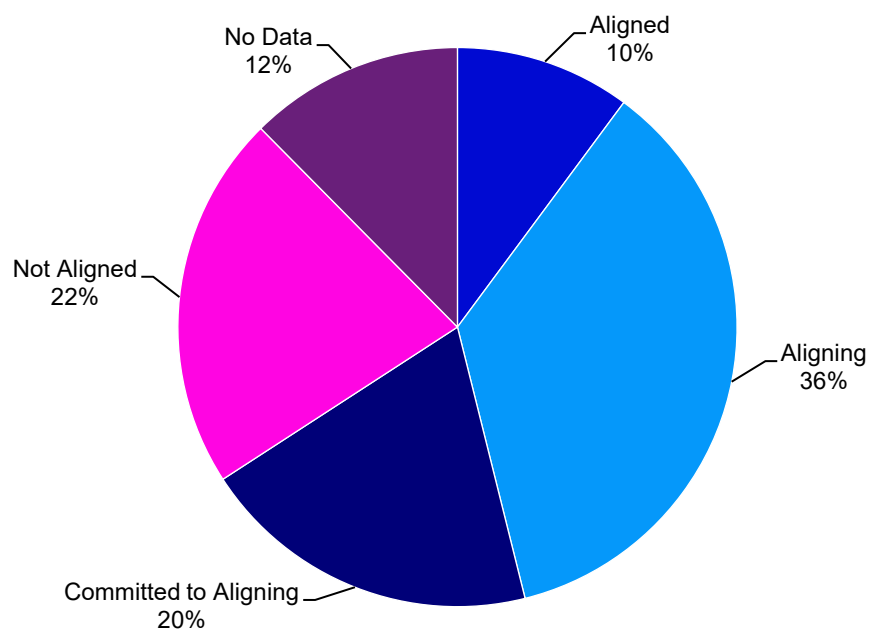
Source: IIGCC, Invesco. ¹Targets are set in-line with science-based net zero pathways. ● = meet in full ◐ = partial. For illustrative purposes only.

Rigid rules can disqualify transition leaders with credible plans and substantial capital commitments inadvertently raising their cost of capital and limiting investor engagement.

A key innovation of this framework is its emphasis on trajectory, identifying not only current low emitters but also firms with operational, strategic, and financial capacity to decarbonize. This is particularly relevant in sectors such as utilities, energy, and materials, which are critical to the transition but often excluded by conventional approaches due to high current emissions. Indeed, as shown in Exhibit 2, a substantial share of the MSCI ACWI universe fall into intermediate categories such as “Aligning” or “Committed” – segments often overlooked by rigid exclusion frameworks despite their strategic importance in climate progress. Such granularity is crucial for large public asset owners, who must demonstrate accountability to multiple stakeholders and ensure their investments support systemic transition rather than short-term divestment optics. By systematically classifying companies along this transition spectrum, this framework also enables a quantitative approach to portfolio construction and monitoring, allowing investors to capture the full breadth of transition opportunities and measure progress over time.

This bottom-up approach contrasts sharply with PAB methodologies, which apply top-down exclusions based on sector affiliation (e.g., fossil fuels) or revenue thresholds, irrespective of decarbonization potential. Such rigid rules can disqualify transition leaders with credible plans and substantial capital commitments inadvertently raising their cost of capital and limiting investor engagement. Moreover, PAB portfolios often suffer from unintended exposures: excessive skews in region, sector, currency, or factor characteristics, which arise from strict exclusions and high turnover required to meet emissions reduction constraints. These hidden biases not only compromise diversification but also make it difficult for investors to understand or manage ex-ante design choices and ex-post risk-return attribution.

Exhibit 2: Distribution of Companies by Alignment Tier for MSCI ACWI universe



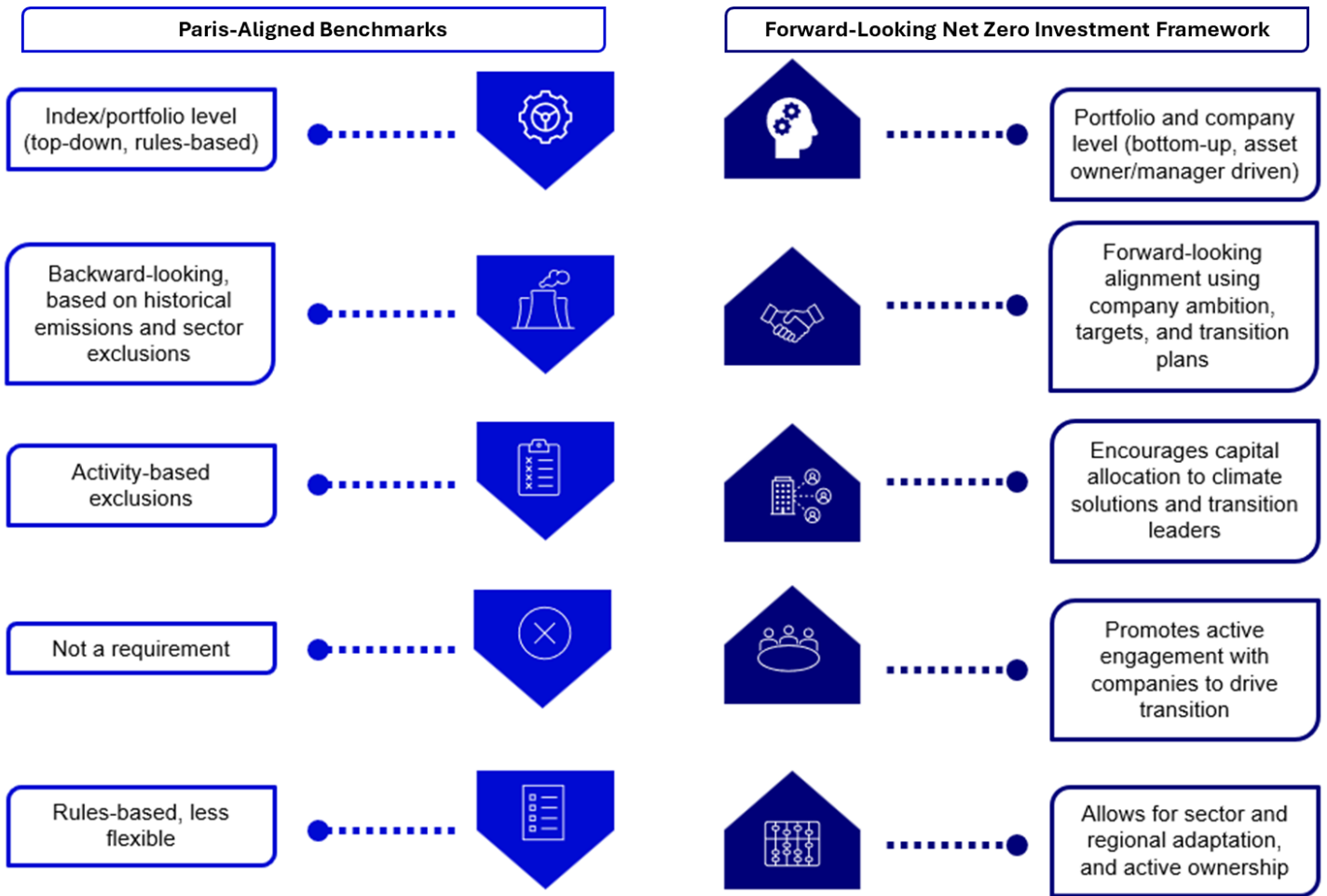
Source: Invesco and MSCI, as of July 31, 2025.

The forward-looking net zero framework is designed to evolve with improvements in disclosure quality and the availability of climate-related data.

By contrast, the forward-looking net zero framework retains a broad investable universe while applying structured, forward-looking alignment criteria. It facilitates constructive engagement with firms in transition, improving transparency and implementation efficiency. Exhibit 3 illustrates how this approach differs from conventional benchmarks, offering a more nuanced and adaptable methodology.

The forward-looking net zero framework is designed to evolve with improvements in disclosure quality and the availability of climate-related data. Over time, it supports a gradual reallocation of capital toward firms demonstrating measurable progress. As illustrated in Exhibit 4, the intended trajectory involves reducing exposure to “Not Aligned” companies over the next three years, with increasing allocations to firms classified as Aligned or Achieving Net Zero. By 2030, investments are expected to be directed exclusively towards companies that are either aligning, fully aligned, or have achieved net zero. By 2040, the target is for 100% of capital to be allocated to companies that have reached net zero or are demonstrably on track. These targets are indicative and subject to revision as market conditions and regulatory standards evolve.

Exhibit 3: Paris-Aligned Benchmarks vs. Forward-Looking Net Zero Framework



Source: Invesco. For illustrative purposes only.

Importantly, this framework also allows for customization across regions, sectors, and regulatory contexts, rather than imposing rigid constraints that may introduce unrewarded risks. This flexibility is paired with robust, forward-looking reporting that offers clear insight into progress and alignment – contrasting with the standardized, emissions-based disclosures common in passive products. Ultimately, this approach is not only more granular and pragmatic but also better aligned with the dual objectives of real-world impact and disciplined investment management.

Exhibit 4: From Emissions to Alignment – An example of a Forward-Looking Decarbonization Map

		Net Zero Alignment				
		Unaligned	Committed	Aligning	Aligned	Achieving
Targets	3yr target	0%	25%	35%	25%	15%
	2030	0%	0%	30%	40%	30%
	2040	0%	0%	0%	45%	55%

Combined “Aligned” + “Achieving” needs to be 100% by 2040

Source: Invesco. For illustrative purposes only.

In short, while exclusion-based models may satisfy regulatory requirements, they often fall short in aligning portfolios with real-world decarbonization. The forward-looking net zero framework offers a differentiated alternative rooted in pragmatism and precision. It offers a rigorous analytical lens on transition dynamics – not just divestment from the problem – and provides a solid foundation for building net zero strategies that are as rigorous in sustainability as they are in systematic investment design.

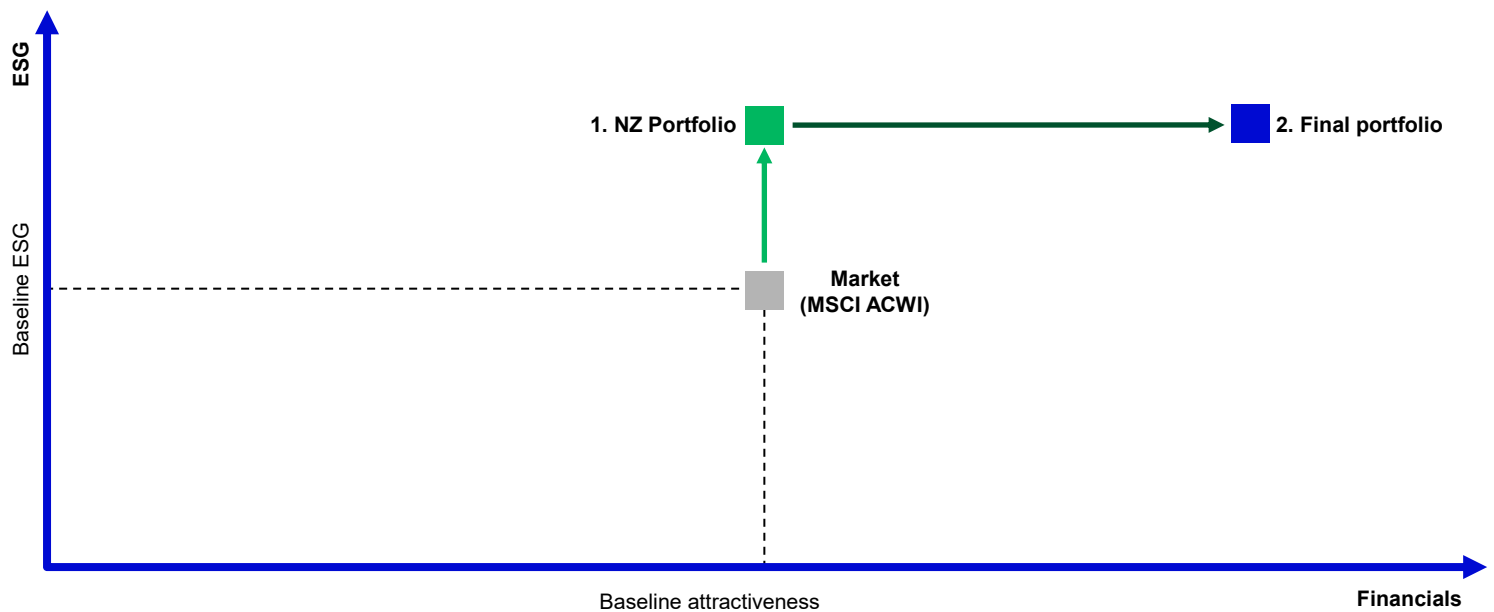
We analyze conceptually a net zero factor approach built on a disciplined two-step process that separates the climate alignment objective from the return-enhancing function of factor investing.

3. Integrating Factor Exposures with Net Zero Goals

Having established a forward-looking framework for climate alignment, the next challenge is to translate this into a systematic investment approach that targets both sustainability and performance. This challenge is particularly relevant for national banks and other large asset owners, who require strategies that are transparent, implementable across multi-billion-dollar portfolios, and consistent with fiduciary mandates.

To meet these requirements, we analyze a net zero factor approach built on a disciplined two-step process – illustrated in Exhibit 5 — that separates the climate alignment objective from the analytical treatment of factor characteristics. This conceptual design improves the interpretability of portfolio decisions and allows ex-ante control and ex-post attribution of both sustainability and performance drivers. Findings from recent academic research further support the importance of this structured approach. For example, Kolle, Lohre, Radatz, and Rother (2022) demonstrate that integrating climate risk considerations into the portfolio construction process while maintaining a clear distinction between sustainability objectives and factor exposures, can enhance both the transparency and effectiveness of climate-aware investment strategies. Their findings reinforce the principles underpinning the conceptual net zero framework analyzed in this paper (see also Pastor, Stambaugh, and Taylor, 2022).

Exhibit 5: Conceptual Two-Step Design Framework – Net Zero Alignment + Factor Overlay



Source: Invesco. For illustrative purposes only. Benchmarks are used as reference universes for comparative analysis only.

In the first step, we construct a hypothetical net zero-adjusted market portfolio that incorporates the forward-looking net zero transition alignment framework while preserving the structure and investability of a standard market benchmark, such as the MSCI ACWI. Unlike rigid exclusion-based approaches or generic PAB benchmarks, which often result in significant deviations from the market portfolio and introduce unrewarded risks such as large sector, region, or individual stock skews, this approach aims to minimize tracking error to the standard market benchmark while incorporating desirable forward-looking sustainability characteristics and net zero objectives. Essentially, the optimization process underweights companies failing to meet minimum transition thresholds (i.e., firms that are classified as ‘Not Aligned’ under our framework), while tightly controlling for country, sector, industry, and currency exposures.

The resulting hypothetical net zero-compliant investment universe reflects three key climate considerations. First, it implements a values-based screen, excluding companies involved in controversial weapons, tobacco, and other activities deemed misaligned with investor preferences. Second, it imposes a 30% carbon intensity reduction relative to the standard market benchmark, ensuring consistency with science-based emissions pathways. Third, and most critically, it under-weights companies with no credible transition plan – those that are ‘Not Aligned’ based on the forward-looking six-pillar net zero assessment. In essence, this first step produces a climate-aware market-like portfolio that maintains the essential structure of the broader market while applying rigorous sustainability filters grounded in forward-looking transition readiness, not just emissions intensity.

In the second step, we can combine a systematic multi-factor overlay to the hypothetical net zero-adjusted universe, ensuring that the climate characteristics achieved in the first step are preserved. This layer introduces intentional tilts toward proven sources of excess return – namely value, momentum, and quality – while maintaining tight constraints on region, sector, and other risk factors to preserve the climate and diversification characteristics of the underlying net zero portfolio. This factor approach has been extensively validated across regions, asset classes and investment horizons (see for example, Gupta, Raol, and Roscovan (2022) on factor existence, Gupta, Sun, and Zhou (2022) on signal weighting, and Feng, Gupta, Roscovan, Sun, and Protchenko (2024) on factor portfolio construction). By separating sustainability alignment from financial performance targeting, this approach allows for precise attribution, reduces unintended financial skews, and enhances transparency.

Exhibit 5 illustrates this architecture: a modular design that integrates climate alignment and factor investing in a transparent and disciplined manner. The result is a systematic approach that avoids the pitfalls of rigid exclusions frameworks while delivering enhanced return potential and maintaining alignment with net zero goals.

4. Empirical Characteristics of the Two-Step Net Zero Conceptual Framework

To evaluate the empirical properties of the net zero two-step framework, we analyze historical performance from January 2014 to July 2025, decomposing results across the two-step construction process: first, the creation of a net zero-integrated market portfolio; and second, the addition of a systematic factor overlay. This decomposition provides transparency into the drivers of return and risk, and allows for a meaningful comparison with alternative approaches, including the MSCI ACWI PAB and generic exclusion-based approaches.

The first step of the strategy constructs a net zero-integrated portfolio that incorporates forward looking climate alignment while preserving the structure of the MSCI ACWI benchmark. In contrast to PABs, which apply rigid exclusions and often result in significant deviations from the benchmark, this approach minimizes tracking error and maintains exposure to sectors critical to the transition, such as energy and utilities. As shown in Exhibit 6, the net zero-adjusted market portfolio displays far smaller sector deviations than both the PAB and generic exclusion portfolios. For example, while the PAB approach results in a complete exclusion of the energy sector and significant underweights in materials, the net zero market portfolio retains exposure to these sectors, reflecting their importance and enabling real-world decarbonization.

Exhibit 6: Average Historical Sector Allocations for Alternative Net Zero Approaches

GICS	MSCI ACWI (%)	MSCI ACWI PAB (%)	Generic Net Zero Universe (%)	Net Zero-Adjusted Market Portfolio (%)
Information Technology	24.41	29.09	23.31	26.50
Real Estate	2.58	6.87	1.62	1.32
Consumer Staples	5.72	1.70	7.04	5.27
Energy	3.59	0.00	4.18	3.23
Financials	17.58	18.78	14.93	17.78
Industrials	11.96	11.45	11.51	12.40
Consumer Discretionary	10.60	9.90	10.47	10.60
Health Care	8.91	9.64	12.90	8.40
Communication Services	8.07	8.11	6.34	8.57
Materials	3.94	2.34	4.76	3.47
Utilities	2.64	2.13	2.94	2.45

Source: Invesco and MSCI, as of July 31, 2025. All results are hypothetical and for academic illustration only.

The historical performance implications of these structural differences are illustrated in Exhibit 7. Both the PAB and generic exclusion portfolios underperform the MSCI ACWI benchmark and exhibit modest Sharpe Ratio deterioration. Similarly, the net zero adjusted market portfolio delivers returns, volatility, and Sharpe Ratio slightly below the MSCI ACWI benchmark but maintains the lowest tracking error at just 0.67%. This demonstrates that although meaningful climate alignment generally comes with some performance drag, it still can be achieved with minimal deviation from the benchmark's financial characteristics, effectively balancing net zero objectives without introducing excessive (absolute or relative) risk.

Exhibit 7: Historical Performance Characteristics for Alternative Net Zero Approaches

	MSCI ACWI	MSCI ACWI PAB	Generic Net Zero universe	Net Zero-Adjusted Market Portfolio (%)
Return, %	10.56	10.16	10.06	9.95
Volatility, %	14.16	14.39	14.05	14.30
Sharpe Ratio	0.75	0.71	0.72	0.70
Outperformance, %		-0.40	-0.50	-0.61
Tracking Error, %		1.30	0.92	0.67
Information Ratio		-0.31	-0.54	-0.91

Source: Invesco and MSCI. Performance from January 2014 to July 2025. Simulated past performance is not a guarantee of future returns. All results are hypothetical and for academic illustration only.

Building on this foundation, the second step introduces a systematic factor overlay that incorporates commonly studied factor characteristics — such as value, momentum and quality — while aiming to maintain broad consistency with the climate profile established in the first step. The resulting strategy maintains moderate sector deviations relative to the benchmark as shown in Exhibit 8. These tilts are intentional and reflect return-seeking exposures driven by factor characteristics rather than structural exclusions. For instance, modest overweights in financials, information technology, and industrials are balanced by underweights in real estate and utilities.

Exhibit 8: Historical Average Sector Allocations for a Two-Step Net Zero Factor Framework vs Alternatives

GICS	MSCI ACWI (%)	MSCI ACWI PAB (%)	Generic Net Zero universe(%)	Two Step Net Zero Factor Framework (%)
Information Technology	24.41	29.09	23.31	26.20
Real Estate	2.58	6.87	1.62	0.32
Consumer Staples	5.72	1.70	7.04	4.27
Energy	3.59	0.00	4.18	4.23
Financials	17.58	18.78	14.93	19.78
Industrials	11.96	11.45	11.51	13.40
Consumer Discretionary	10.60	9.90	10.47	10.40
Health Care	8.91	9.64	12.90	7.40
Communication Services	8.07	8.11	6.34	8.73
Materials	3.94	2.34	4.76	3.55
Utilities	2.64	2.13	2.94	1.71

Source: Invesco and MSCI, as of July 31, 2025. All results are hypothetical and for academic illustration only.

Exhibit 9 presents the historical performance characteristics of the two-step net zero factor framework. The framework achieves a historical return of 10.84%, outperforming both the MSCI ACWI benchmark at 10.56% and the MSCI ACWI PAB, at 10.16%. Volatility remains in line with the benchmark, resulting in a Sharpe ratio of 0.76. The tracking error rises slightly to 1.41%, reflecting the addition of factors, but the information ratio improves to 0.20 — indicating efficient risk-taking and value generation. This confirms that historically systematic factor integration can enhance performance without compromising the net zero profile or introducing unintended risks.

Exhibit 9: Empirical Characteristics for a Two-Step Net Zero Factor Framework vs. Alternatives

	MSCI ACWI	MSCI ACWI PAB	Two Step Net Zero Factor Framework
Return, %	10.56	10.16	10.84
Volatility, %	14.16	14.39	14.21
Sharpe Ratio	0.75	0.71	0.76
Outperformance, %		-0.40	0.28
Tracking Error, %		1.30	1.41
Information Ratio		-0.31	0.20

Source: Invesco and MSCI. Performance from January 2014 to July 2025. Simulated past performance is not a guarantee of future returns. All results are hypothetical and for academic illustration only.

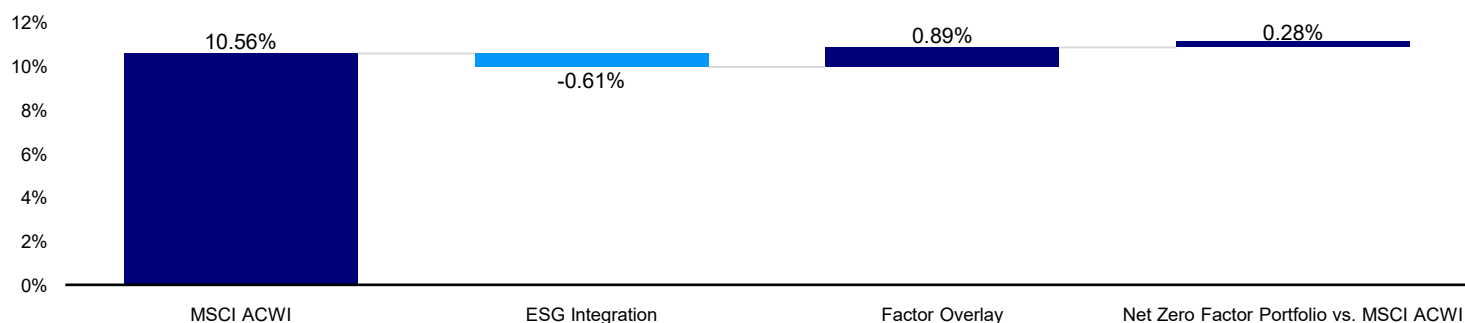
The attribution analysis in Exhibit 10 (shown on the next page) further decomposes the sources of historical return and risk. Approximately -0.61% of the return over MSCI ACWI is attributable to the net zero alignment step, while 0.89% is attributable to the factor overlay.

On the risk side, 0.67% of tracking error is attributable to the ESG integration layer and 1.26% to the factor overlay. However, due to partial diversification between these two components, the resulting overall tracking error is 1.41%, rather than the sum of individual contributions. This highlights the benefit of combining climate and financial objectives within a unified optimization framework.

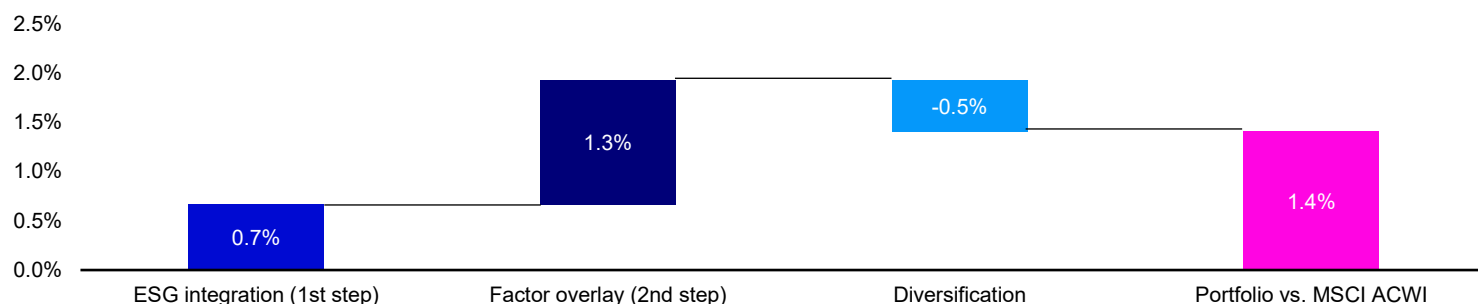
In summary, the historical performance analysis confirms the robustness of the two-step net zero strategy. The minimum tracking error climate alignment process delivers meaningful sustainability alignment without distorting the portfolio's structure, while the factor overlay enhances return potential through disciplined exposure to proven factor premia. Together, these components produce a conceptual approach that is both climate-aware and financially resilient — well-suited to the needs of institutional investors seeking to align capital with the global decarbonization agenda without compromising on performance.

Exhibit 10: Risk and Return Decomposition within the Two-Step Net Zero Factor Framework

(A) Return decomposition



(B) Risk decomposition



Source: Invesco and MSCI. Performance from January 2014 to July 2025. Simulated performance is not a guarantee of future returns. All results are hypothetical and for academic illustration only.

5. Conclusions

The transition to a low-carbon economy presents both an urgent challenge and a strategic opportunity for institutional investors. While many net zero strategies have focused on regulatory compliance, particularly with the adoption of PABs, these approaches often rely on rigid, exclusionary rules that introduce unintended risks, reduce diversification, and disconnect portfolios from the real economy's decarbonization path. By contrast, the framework outlined in this paper is built on a forward-looking, systematic approach that identifies and supports credible transition leaders through detailed company-level assessments and active engagement.

Through its two-step construction process, the framework first creates a hypothetical net zero-integrated market portfolio that minimizes tracking error while excluding firms lacking credible transition plans. This ensures alignment with climate objectives without introducing structural inefficiencies. In the second step, a disciplined factor overlay targets established sources of excess return – value, momentum, and quality – within tight risk constraints while preserving the net zero profile from the first step. This modular architecture enhances transparency, separates sustainability and financial performance drivers, and allows for unambiguous attribution of both return and risk.

Empirical results confirm the robustness of this approach. The net zero integrated market portfolio retains benchmark-like characteristics while improving climate alignment. Overall, the framework shows better historical returns than both the benchmark and conventional net zero alternatives, achieving historically higher Sharpe and Information Ratios with controlled tracking error. The result is a transparent, scalable, and performance-conscious framework that meets institutional investors' dual mandate: credible sustainability integration and systematic exposure to well-documented risk and return drivers.

For national banks and other mission-driven asset owners, this dual mandate is especially critical. It demonstrates global leadership in sustainable finance while ensuring institutional reserves and endowments continue to compound reliably over the long term. The net zero framework presented here offers a differentiated and pragmatic path forward – one that aligns investment portfolios with global decarbonization targets, supports real-economy impact, and preserves the financial integrity demanded by long-term institutional investors.

Overall, the conceptual strategy outperforms both the benchmark and conventional net zero alternatives, achieving higher Sharpe and Information Ratios with controlled tracking error.

References

- Andersson, M., Bolton, P., and Samama, F. (2016). Hedging climate risk. *Financial Analysts Journal*, 72(3), 13–32.
- Dietz, S., Bowen, A., Dixon, C., and Gradwell, P. (2016). 'Climate value at risk' of global financial assets. *Nature Climate Change*, 6(7), 676–679.
- Fama, E. F., and French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3–56.
- Feng, X., Gupta, T., Protchenko, S., Roscovan, V., and Sun, J., (2024). Control and transparency in factor portfolio implementation, *Journal of Beta Investment Strategies* 15(1), 39-52
- Grewal, J., Hauptmann, C., and Serafeim, G. (2021). Material sustainability information and stock price informativeness. *Journal of Accounting and Economics*, 71(2–3), 101420.
- Gupta, T., Raol, J., and Roscovan, V. (2022). Factor investing from theory to practice. *Journal of Beta Investment Strategies*, 13(4), 10-31.
- Gupta, T., Sun, J., and Zhou, H. (2022). Risk-based weighting for better factor investing. *Risk and Reward*, #04, 16-21
- Harvey, C. R., Liu, Y., and Zhu, H. (2016). ...and the cross-section of expected returns. *Review of Financial Studies*, 29(1), 5–68.
- Kolle, J., Lohre, H., Radatz, E., and Rother, C. (2022). Factor investing in Paris: managing climate change risk in portfolio construction. *Journal of Investment Management*, 20(4).
- Krueger, P., Sautner, Z., and Starks, L. T. (2020). The importance of climate risks for institutional investors. *Review of Financial Studies*, 33(3), 1067–1111.
- Le Guenedal, T., and Roncalli, T. (2022). Portfolio Construction with Climate Risk Measures. Available at SSRN: <https://ssrn.com/abstract=3992740>
- Pastor, L., Stambaugh, R. F., and Taylor, L. A. (2022). Dissecting green returns. *Journal of Financial Economics*, 146(2), 403–424.

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