# Morningstar Sustainability Preferences Portfolio Construction Tool
Methodology

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**Contents**



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## Introduction

As awareness around environmental and social issues has grown, more investors than ever have incorporated sustainability into their investment processes. Due to global initiatives like the United Nations Sustainable Development Goals [1], client demand, and changing regional disclosure requirements [2], investors now face increasing calls for great transparency on the real-world social and environmental impacts of their sustainability-focused strategies. To meet these needs, the Morningstar Quantitative Research team has developed a portfolio construction tool to incorporate sustainability related preference indicated by investors into the portfolio construction process and produce a well-balanced portfolio between matching the asset class policy and sustainability preferences.

The Sustainability Preferences Portfolio Construction Tool constructs fund-level portfolios to facilitate the advisor-led models and lineups. A flexible optimization framework is created that allows for a wide variety of optimization problem formulations. Its most notable features are a rich collection of objective function bases and ease-of-application for specific use cases, such as sustainability preferences optimization.

**Key Takeaways**:

The tool:

- Allows individual-level customization via a preferences utility vector obtained from the Morningstar ESG Preferences Survey.[3]
- Supports targeting investment policy models by way of asset allocation targets.
- Dynamically calibrates internal parameters to produce effective results for a wide variety of lineups.

**Model Highlights**

Several features make the Morningstar Sustainability Preferences Portfolio Construction tool flexible and robust:

- To allow for flexibility of user-specific optimization, minimum constraints are imposed to ensure the constructed portfolio aligns with asset class policy and avoids concentration in one fund. The tradeoffs expressed by users between Sustainability themes and market portfolio are directly used as the importance weighting to balance the two components in the objective function.

- Instead of using one aggregated Sustainability score for each fund, the optimizer considers 15 underlying ESG metrics divided into two main categories:
  - Product involvement. Metrics that represent percentage of revenue earned from negative ESG themes including thermal coal, fossil fuel, palm oil, pesticides, tobacco, gambling, alcohol, small arms, controversial weapons, and military contracting.[4]

  - Impact Metrics: Metrics that represent percentage of revenue devoted to positive ESG themes including climate action, healthy ecosystems, resource security, human development, and basic needs.[5]

**Optimizer Input**

The optimizer minimally requires four sets of inputs—an investment opportunity set, a set of user preferences from one single user, the asset class policy that is pre-determined for the user and a covariance matrix.

**1. User Preferences**

Investor-specific preferences for sustainability and pecuniary topics; generated from an efficacious preference measurement tool.

**2. Asset Class policy**

A set of asset class-based policy portfolio that consistent of six broad asset classes. The asset class policy is decided based on the response from the risk tolerance questionnaire carried out at advisor workstation.

**3. Covariance Matrix**

A covariance matrix is a square symmetric matrix to estimate the extent to which assets move together. The tool takes in the exposures of funds to asset classes and combine with the asset class covariance matrix to construct fund level covariance matrix. This setup ensures the optimizer is agnostic to source of the covariance matrix.

**4. Investment Opportunity Set**

A collection of open-end funds and exchange-traded funds to optimize within. These are provided by the advisor.

### Optimizer Multiple Objective Formula

The objective to maximize in the optimizer is defined as the aggregated impact metrics with user defined preferences with TE penalty:

$$max\ \ P_{Impact\ Metrics}\lambda_{IM}wI - P_{market}\lambda_{TE}(w - w_p)^T\Sigma(w - w_p)\quad (1)$$

Where,

$w$: vector of fund weights

$w_p$: vector of asset class policy weights

$I$: Impact metrics scores vector normalized to [0,1] scale

$P$: user preference(s)

λ: multiplier assigned to each component

Σ: covariance matrix

### Optimizer Constraints

The optimizer is further configured with four areas of constraints to uphold a disciplined optimization process. The constraints ensure final portfolio maintains minimum diversification, fits within investment policy, and no deterioration for sustainability metrics with strong user preference compared with benchmark portfolio.

#### 1. Diversification Constraints

The individual fund weight upper-bound is dynamically defined based on the number of equity and fixed income funds available from the feasible set and the policy asset class allocation.

$$w_{p,i:i\in B(b)} \leq max\left(20\%, \frac{A_b}{|U_{i\in B(b)}|} \times 1.5\right)\quad (2)$$

where $A_b$ is the weight of broad asset class $b$ in the asset allocation policy $A$ and $U_{i\in B(b)}$ is the set of eligible funds in the lineup that belongs to broad asset class $b$. $B$ is the set of all broad asset classes.

#### 2. Benchmark Aware Constraints

A maximum deviation of 5% is enforced for six broad asset classes policy style allocation targets. The six broad asset classes include US stocks, developed market ex-US stocks, emerging market stocks, US bonds, ex-US bonds, and cash.

$$A_b - \ 5\% \leq \sum w_{p,i:i\in B(b)} \leq A_b +\ 5\%\quad (3)$$

#### 3. Sustainability Constraints

► Security-Level Product Involvement Exclusion Constraints

Fund candidates with significant product involvement scores are excluded from final portfolio.

$$w_{p,i:PI_{j,i}>thresh_j} = 0$$

where $PI_{j,i}$ is the product involvement score of fund $i$ in theme $j$ and $thresh_j$ is the product involvement threshold in theme $j$, which targets exclusions on non-zero product involvement scores in theme $j$ of all funds in the investment sample.

For example, all funds with positive product involvement score in theme $j$ will be excluded from final portfolio if its exclusion ratio is set to 100%. Exclusion ratios are defined as preference weights.

► Portfolio-Level Sustainability Constraints

This set of constraints enforces no-deterioration of Product Involvement and Impact Metrics relative to a benchmark such as the average of the investment opportunity set or a tracking error minimized portfolio that doesn't make any sustainability considerations.

$$PI_{p,j} \leq PI_{bmk,j}$$
$$IM_{p,j} \geq IM_{bmk,j}$$

where $PI_{p,j}$ and $\mathrm{PI}_{\mathrm{bmk,j}}$ are product involvement scores in theme j of the final optimal portfolio and benchmark, respectively, and $IM_{p,j}$ and $IM_{\mathrm{bmk,j}}$ are impact metrics scores in theme j of the final optimal portfolio and benchmark, respectively.

This set of constraints is only turned on for themes with high preference level.

### 4. Additional Constraints

Long-only constraints and capital fully invested constraints are applied. Additional constraints such as turnover constraint and cardinality constraint can be activated at investors' request.

$$\sum w_{p,i} = 1$$
$$w_{p,i} \geq 0$$

## Multiplier Derivation

To allow the user's preference to directly control the tradeoff between tracking error improvement and impact metrics improvement in the optimization process, multipliers, specified as lambdas in equation (1). are applied to both terms in the objective function. Since the search ranges for the two components can vary drastically, a multiplier is required to bring both terms to a similar scale before applying the importance weighting.

A collection of methods for defining a multiplier existed. After experimenting with a set of methods, a runtime efficient method that tested empirically well across lineups was adopted.

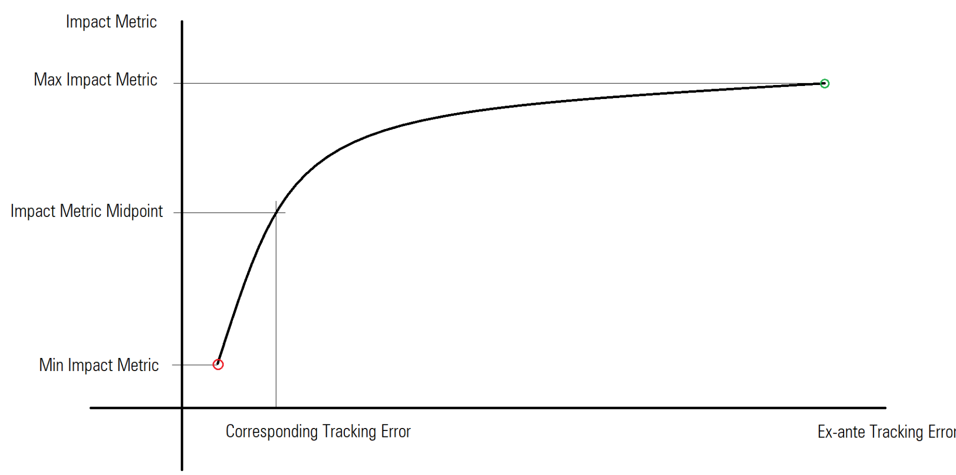
### Impact Metrics Midpoint

First, calculate median metric of impact metrics for two optimized portfolios with single objective, and then take that impact metric as the budget to calculate the corresponding tracking error. The average of impact metrics and the calculated tracking error are the used as the denominator in below formulation, respectively.

$$\lambda_{Impact\ Metric} = \frac{1}{Midpoint\ of\ Impact\ Metric}$$
$$\lambda_{Tracking\ error} = \frac{1}{Calculated\ Correponding\ Tracking\ error}$$

By calculating the midpoint of two optimized portfolio, the process ensures the realized impact metrics and Ex-ante tracking component be at similar scale.

**Exhibit 1** Multiplier Derivation




Source: Morningstar Quantitative Research Team.

## Conclusion

The Sustainability Preferences Portfolio Construction Tool achieves four high level goals that are deemed desirable from both product and user perspectives:

1. The tool can produce an efficient trade-off curve between portfolio sustainability metrics and ex-ante tracking error against an asset class policy.
2. It offers flexible adjustment of importance weighting for portfolio sustainability metrics and ex-ante tracking error based on user preference setting.
3. The tool produces reasonable well-balanced portfolios across investment pools and various user preference inputs.
4. The tool achieves parsimonious parameter setting, and the user inputs are directly used in the optimization process.

**References**

[1] United Nations Sustainable Development Goals https://sdgs.un.org/goals

[2] SEC ESG disclosure guidelines https://www.sec.gov/rules/proposed/2022/33-11042.pdf

[3] Morningstar Investor Preferences Assessment - Determining an investor's non-financial portfolio objectives. 2021.

[4] Morningstar Product Involvement Methodology. 2022. https://direct.morningstar.com/research/doc/812380/Morningstar-Portfolio-Product-Involvement-Methodology

[5] Morningstar Impact Metrics Methodology. 2021. https://www.morningstar.com/api/v1/research/download/1073173?timestamp=1640182980000600&token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJkYXRhIjp7ImRvY3VtZW50SWQiOjEwNzMxNzN9LCJpYXQiOjE2NDk4NzAwNDB9.eKcskSKGQQKIXYX4cM5BbqBIGK3VynQr8BUtZUcJXg0

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Morningstar Quantitative Research is dedicated to developing innovative statistical models and data points, including the Morningstar Quantitative Rating, the Quantitative Equity Ratings and the Global Risk Model.

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