Climate scoring methodology

To determine if a position or the portfolio in total improves or deteriorates climate performance, Co₂liseum applies a scoring methodology. This is partially built upon the ECOBAR system pioneered by the Swedish pension fund AP4, and documented in "Credit alpha and CO2 reduction: A portfolio manager approach." An updated version, Fixed Income Optimisation for Net-zero Alignment (FIONA), was introduced in "Decarbonising iShares' LQD ETF". The Co₂liseum scoring methodology follows the general principles of being data-agnostic, combining multiple climate data sources including forward-looking indicators. This allows the user to weigh each data source themselves and handle missing data in a way applicable to the fixed income portfolio.

This document expands on how the climate scoring signal is constructed. Co₂liseum relies on the following considerations:

- **Practicality**: signals should reduce complexity to aid decision making in a real-time trading environment. They should also be straightforward to apply to traditional credit trading metrics, e.g. duration, CS01, and return attribution exercises.
- **Transparency for decision making:** a signalling approach should be intuitive, so that there is a clear link between the sustainability performance of an issuer/security, the climate score, and the impact that has on the portfolio.
- **Reflects model imprecisions:** a signalling approach should not give credence to overly confident estimates of a certain carbon footprint of a portfolio.
- **Quantitative viability:** Structural models tend to give rise to corner solutions in terms of portfolio optimisation, as the outputs can be distributed according to very fat-tailed and asymmetric distributions. A core can be designed (like ECOBAR) to have a more symmetric, less extreme distribution.

Figure 2 illustrates how the original climate-scored portfolio has generated an excess return of approximately 35bps per annum historically, noting that the scoring is not suggested as alpha generation per se but as a tailwind for strategy.

Figure 1: Excess returns on a capital basis and ECOBAR score, AP4 credit portfolio including CDS, as documented in original ECOBAR paper.

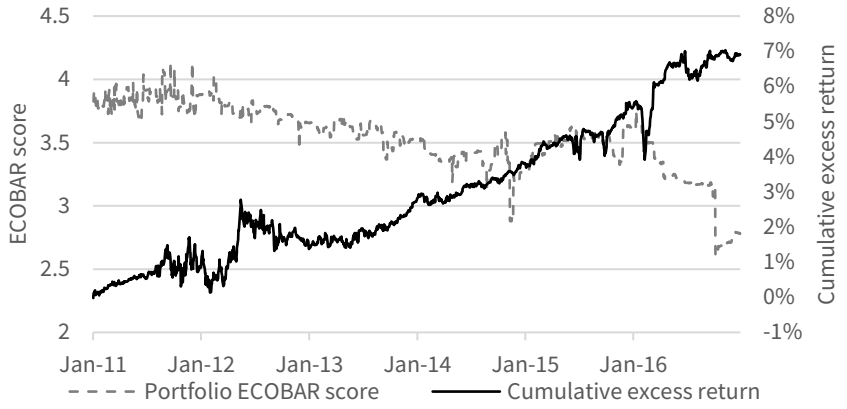


Figure 2: Excess return of ECOBAR weighted passive index of the S&P500 investment grade corporate bond index [TICKERS]. Out-of-sample from mid-2018. See "Back to the grind: Low carbon credit performance".

Co₂liseum is a hypothetical collection of positions for purposes of testing out how to combine various climate- and nature-driven fixed income concepts. It is in no way intended as, or should be construed to be, investment advice.

GHG: greenhouse gas metrics and data

The Co₂liseum system uses carbon emissions over enterprise value as its key historical/spot metric (CO_2/EVIC). This approach is in line with recent IIGCC recommendations ("New derivatives and hedge funds guidance aims to maximise transparency"). Intuitively, we assume that an investor holding all the securities in a particular capital structure would also assume 100% of the associated carbon footprint. Note that this approach does not differentiate between levels in the capital structure, i.e. $1 of equity has the same exposure as $1 of debt.

For all sectors except extractive sectors, Scope 1+2 emissions are used. For extractive sectors (Energy, Materials) Scope 3 emissions are included when calculating CO_2/EVIC.

TPI: Transition Pathway Initiative metrics and data

CO_2/EVIC gives us a historical and, at best, fairly recent, account of an issuer's carbon exposure. We are complementing this backward-looking data with a forward-looking indicator using the Transition Pathway Initiative (TPI) approach. This dataset contains the carbon intensity of sectors and a list of companies with climate transition plans until 2050. At the time of writing, TPI data is available for 324 companies featured in the Co₂liseum database.

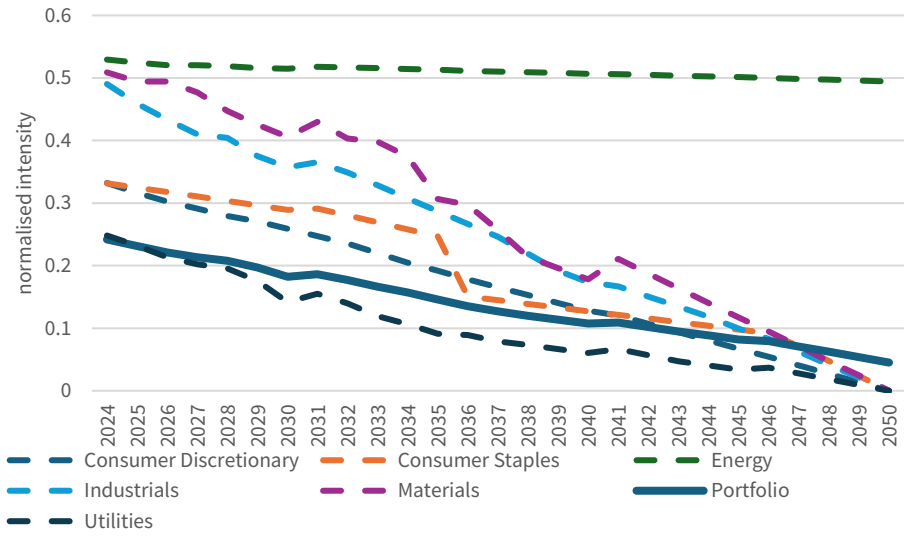
The TPI intensity metrics for each sector are different, e.g., CO2e/MJ for the oil and gas sector, and metric tonnes of CO2 per MWh electricity generation for electric utilities. All companies with the same intensity metric are grouped together. Intensity is rescaled to the 0-1 range. Each sector's standardised intensity is shown in Figure 3 as dashed lines. Other than the Energy sector, all the companies with transition plans have committed to net zero by 2050.

The portfolio of individual companies is mapped to the same sectors, and using the capital allocated to each sector, a composite is created for the portfolio for each year. This is shown in Figure 3.

Table 1: Issuer universe current spot/historical data.

		Scope 1+2(+3*) emissions / EVIC		Emissions intensity		ESG rating	
Sector	Count of issuers	Average	Median	Average	Median	Average	Median
Communications	186	15.5	9.1	32.1	22.4	18.7	18.3
Technology	151	12.1	2.6	30.6	8.7	15.7	15.5
Health Care	173	9.3	4.2	20.9	14.6	20.5	21.1
Financials	644	4.7	0.9	17.7	3.2	19.9	19.5
Consumer Discretionary	320	54.6	21.5	75.4	27.3	19.8	20.2
Consumer Staples	162	83.1	31.3	76.5	42.5	25.3	24.0
Real Estate	189	10.4	5.3	63.5	39.5	13.0	12.6
Government	221	1.9	1.0	22.3	19.8	8.1	7.8
Industrials	342	340.9	18.7	520.8	43.3	21.4	20.9
Materials*	231	1910.1	703.0	716.5	338.7	23.9	23.4
Energy*	240	2889.1	1890.8	584.2	420.3	31.6	31.9
Utilities	329	493.1	225.3	1581.0	669.0	24.4	22.3

Figure 3: TPI transition for sectors and the portfolio. Source: TPI, AFII. Accessed April 2024.



Scoring: best-in-class/ranking approach

Each data source's universe of issuers is ranked within their respective sector and region. Thresholds are created to divide companies based on their climate impact metrics: high (3), intermediate (2), and low (1). Further, as this methodology has been developed for fixed income markets, instrument-level adjustments are used depending on the portfolio positions to arrive at portfolio-level scoring. The same approach is run on the benchmark to provide a comparable benchmark score.

The general principle of the ranking system is provided in Figure 4.

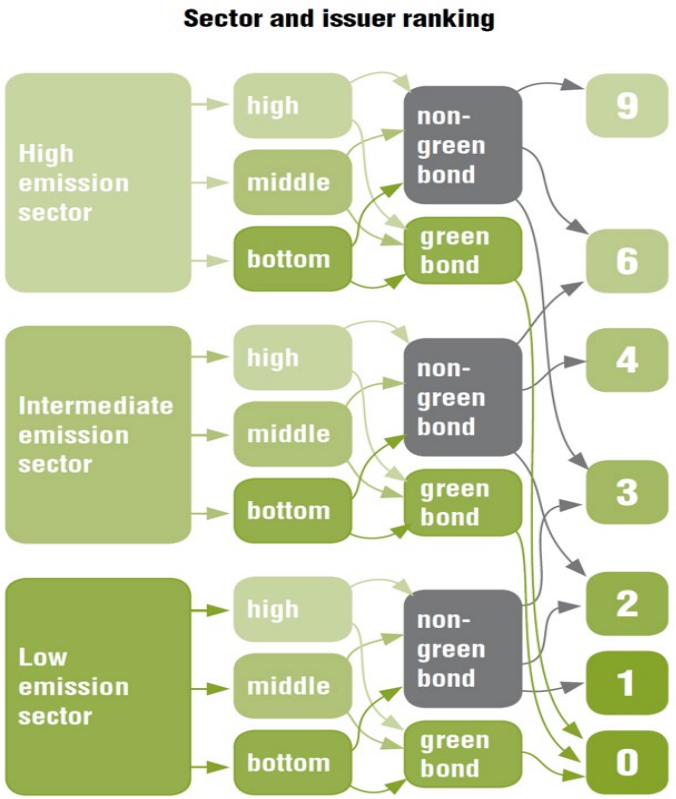
Sector rankings
Sectors are ranked low, medium, and high with corresponding scores (1, 2, 3) based on their emissions. Extractive sectors are designated a sector score of 3 regardless of whether or not we include Scope 3 emissions.

Intra-sector rankings: leaders and laggards within sectors
Issuers obtain an initial score of (1, 2, 3) depending on which third they rank in within their respective sectors, with a regional overlay.

Joint score
The issuer and sector score scores are multiplied, yielding a range of (1-9) for each data source, which is weighted as per the combined score methodology (described below). Each data source creates its own need to classify these rankings, as the sector composition is different for each.

A number of variations on this general framework are described in the following pages. These cover regional issues, corporates vs non-corporates, labelled bonds, long vs short positions and more.

Figure 4: Green bonds and sector ranking adjustments.



GHG sector ranking

The first step is to decide the sector score for the backward-looking GHG dataset. Our system applies BICS sector allocations and aggregates available data, to arrive at the scoring in Table 2.

The sector rankings appear as typical, with substantial differences between the tiers in terms of emissions footprint per unit of capital and/or intensity. Industrials, Materials, Energy, and Utilities score a 3 ranking as the high-emitting sectors.

Table 2: Sector scoring for GHG historical/spot dataset.

		Scope 1+2(+3*) emissions / EVIC		Emissions intensity		ESG rating		
Sector	Count of issuers	Average	Median	Average	Median	Average	Median	AFII sector rank (historical data)
Communications	186	15.5	9.1	32.1	22.4	18.7	18.3	1
Technology	151	12.1	2.6	30.6	8.7	15.7	15.5	1
Health Care	173	9.3	4.2	20.9	14.6	20.5	21.1	1
Financials	644	4.7	0.9	17.7	3.2	19.9	19.5	2
Consumer Discretionary	320	54.6	21.5	75.4	27.3	19.8	20.2	2
Consumer Staples	162	83.1	31.3	76.5	42.5	25.3	24.0	2
Real Estate	189	10.4	5.3	63.5	39.5	13.0	12.6	2
Government	221	1.9	1.0	22.3	19.8	8.1	7.8	2
Industrials	342	340.9	18.7	520.8	43.3	21.4	20.9	3
Materials	231	1910.1	703.0	716.5	338.7	23.9	23.4	3
Energy	240	2889.1	1890.8	584.2	420.3	31.6	31.9	3
Utilities	329	493.1	225.3	1581.0	669.0	24.4	22.3	3

TPI sector ranking

The TPI dataset focuses on high-emitting sectors. This means there are fewer sector scores associated with this dataset. As can be observed in Figure 3 above, the Energy, Materials, and Industrials sectors have slower transition pathways than the Consumer Staples, Consumer Discretionary, and Utilities sectors. This results in the TPI sector ranks laid out in Table 3.

The forward-looking sector scores comes out the same as the spot/historical sector scores except for the Utilities sector, which has a lower pathway compared to others. This means that the companies in this sector are estimated to (on average) have lower emissions intensities in future years than those in other sectors.

We assign Financials to the intermediate (2) tier, as traditional metrics around carbon emissions and some of the forward-looking metrics are relatively meaningless for financials. The same is true for the government sector.

Table 3: Sector scoring for TPI (forward-looking dataset).

Sector	AFII sector rank
Consumer Discretionary	2
Consumer Staples	2
Utilities	2
Materials	3
Industrials	3
Energy	3

Financials intra-sector ranking

Financials (banks and insurance companies) as a sector are designated a 2 (intermediate) score, which seems fair given their traditional role as suppliers of capital and financial services across the economy. Carbon footprinting of the sector has so far been relatively meaningless. However, new datasets are expected to come online in future courtesy of the Partnership for Carbon Accounting Financials (PCAF).

For the intra-sector tiering of commercial and investment banks, the Co2liseum strategy uses AFII's league tables on green vs fossil fuel funding (as laid out in Table 4). A top tier bank in the league table will achieve a 1 intra-sector score, while the banks with the lowest ratios in their peer group will be assigned a 3.[1] Hence, banks will be scored in the range (2, 4, 6). League tables and related climate scorings are updated quarterly, near IMM roll dates. Given that the tables are based on a 2yr rolling window, the scores are not expected to be particularly volatile.

We do not currently apply a similar system for insurance companies and consequently score all insurance companies as intermediate (intra-sector score 2 => full score 4). This is judged to be an appropriately conservative approach.

Table 4: The green/fossil fee league table. A top rank indicates a higher degree of green activities relative to fossil. Source: AFII, Bloomberg, effective date 10 Sep

Rank	Bank	Net green/fossil	3m change		1y change		2y change		Total fees USDmn
1	BNP Paribas	8.1%	0	~	0	~	3	↑	1,779
2	Societe Generale	6.4%	0	~	1	↑	12	↑	939
3	Credit Agricole	5.4%	0	~	-1	↓	-2	↓	1,404
4	HSBC	3.7%	1	↑	1	↑	-2	↓	1,506
5	UBS & Credit Suisse	2.9%	-1	↓	-1	↓	-2	↓	1,115
6	Deutsche Bank	1.9%	0	~	1	↑	-1	↓	1,939
7	SMBC	1.4%	1	↑	6	↑	3	↑	1,026
8	Goldman Sachs	-1.5%	4	↑	7	↑	-2	↓	1,977
9	MUFG	-1.5%	5	↑	-3	↓	7	↑	1,086
10	Morgan Stanley	-1.7%	-3	↓	-1	↓	-3	↓	1,528
11	Citi	-2.2%	0	~	0	~	0	~	2,561
12	Barclays	-2.3%	-3	↓	-4	↓	-4	↓	1,667
13	JP Morgan	-2.4%	0	~	1	↑	-1	↓	3,386
14	Mizuho Financial	-3.7%	-4	↓	-2	↓	-1	↓	1,118
15	BofA Securities	-6.0%	0	~	-5	↓	-6	↓	2,644
16	RBC	-7.5%	0	~	0	~	1	↑	1,116
17	Wells Fargo	-8.6%	0	~	0	~	-2	↓	1,554

Sovereign, supranational, and agency (SSA) sector bonds

The climate scoring framework for Co2liseum is mainly focused on credit but will consider SSA paper as well as some government paper into the portfolio. However, the scoring of these entities is not straightforward.

At the current stage of development, SSA paper will be scored on a case-by-case basis, applying a conservative approach. For example, the Co2liseum portfolio's first SSA position, in the hybrid bonds of the African Development Bank, is assigned a 4 score.

[1] We are currently developing new TPI data on banks to be implemented similarly to the TPI data for other sectors described below.

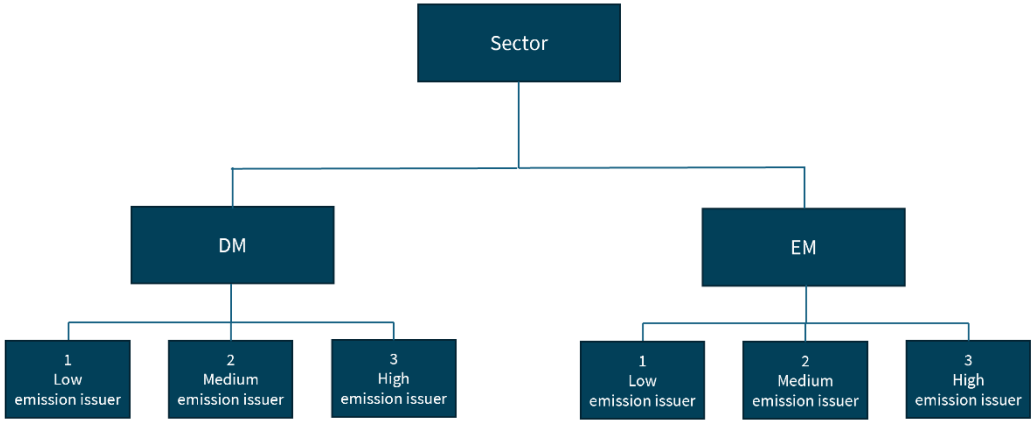
Regional overlays

A commonly recurring critique of climate scoring approaches is how they inadvertently penalise developing versus developed markets. It cannot be expected that a developing market is as efficient in terms of resource usage as a developed one, as technology and regulation cannot be expected to be at the same level. If this goes unaccounted for, EM issuers would tend to be scored lower. This in turn may sap capital from areas where it is most needed and impactful in terms of decarbonisation.

Therefore, for each data source we adjust the peer groups for the rankings based on geography.

Developed (DM: WE, NA) and developing (EM: EEMEA, APAC, LATAM) regions are compared against each other in isolation within each group when calculating the intra-sector scores. With these adjustments, a ranking of all the issuers in the universe can be calculated appropriately, as shown in Figure 5.

Figure 5: Regional adjustments for the best-in-class method intra-sector scores.



TPI adjustment

Due to the nature of the TPI dataset being forward-looking up until 2050, every issuer receives an intra-sector score for each year between now and 2050 (where data exists) to compare them against their peers over time. The scores are then average weighted per issuer to reach a final intra-sector score that ranges between 1-3.

Combined ranking with multiple climate data sources

The scoring system of the Co₂liseum strategy is data-agnostic. This allows the portfolio users to weigh different data sources according to their own confidence in the input data and choose different strategies for handling missing data. This is an evolving area, with more data sources and methods to test the efficacy of each data source still in development.

Currently the two data sources, one historical (based on GHG intensity) and the other forward-looking (TPI) have different coverage universes, which is to be expected. Different data sources cover different companies and sectors. After the initial processing and application of the best-in-class method (outlined above), the various rankings are combined to provide a composite score. Here, there is a trade-off between using all the data or placing more emphasis on high-quality data. Over time the weighting system could be part of the portfolio optimisation process, which could give insights about the impact of each climate data source.

Figure 6: Integrating issuers with different weighing of climate data sources.

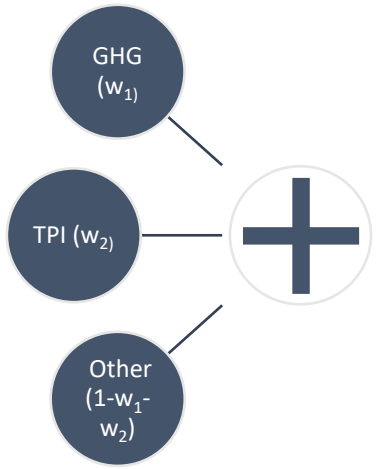


Figure 6 shows different weights (w_1, w_2) adding up to 1, applied to the climate level scores (which ranges between 1-9) such that a combined issuer score can be calculated. There will be issuers that have scores for both backward- and forward-looking data and issuers that only have a score for one. Where both scores are available the current approach in the Co₂liseum strategy is to apply a 50% weight to each of the GHG (spot/historical) and TPI (forward-looking) scores.

This approach would bring companies in all datasets together, but with quite a lot of missing data.

Missing data

The Co₂liseum strategy completes datasets using statistical methods, including penalties for non-disclosure. This is also dependent on the data source. The GHG historical dataset contains over 3,000 issuers and is relatively complete, so we consider extrapolation as a means to fill in the gaps. We want something simple, and so use a median of similar companies, but adjusted to include a penalty for the non-disclosure of data. We must therefore define what counts as a similar company, and how to calibrate our penalty.

To observe only similar companies we need granularity, but to have a meaningful median we need a large dataset. We use a threshold of 10 data points, and consider the following waterfall when deciding the granularity to use:

1. BICS Level 3 Industry & Region
2. BICS Level 1 Sector & Region
3. BICS Level 1 Sector

We use a penalty of 50% of the median to account for missing data. This both penalises issuers who do not disclose, but also estimates the bias present in the decision to disclose. This missing data framework is used to complete four datasets: absolute emissions, emissions intensity compared to sales, emissions per unit of investment, and implied temperature rise.

The TPI dataset contains just over 300 issuers, making it both a more challenging but also less reliable dataset to handle in terms of missing data. For this dataset we do not estimate missing data but rather exclude issuers that have incomplete data over time. If more than 50% of the forward-looking projected yearly data provided by TPI between 2024-2050 is missing, we exclude that issuer from our TPI assessment in the climate scoring methodology.

Handling missing data will be parametric and suitable to each issuer in a portfolio with a choice of degree of penalisation: filling with the sectoral minimum, median or maximum values, or discarding them from the portfolio. This again depends on the quality of the dataset. The GHG data could have all the options available. For TPI data only the last two options are feasible, and even then the sector values could be replaced by minimum or maximum values.

Combined scoring example

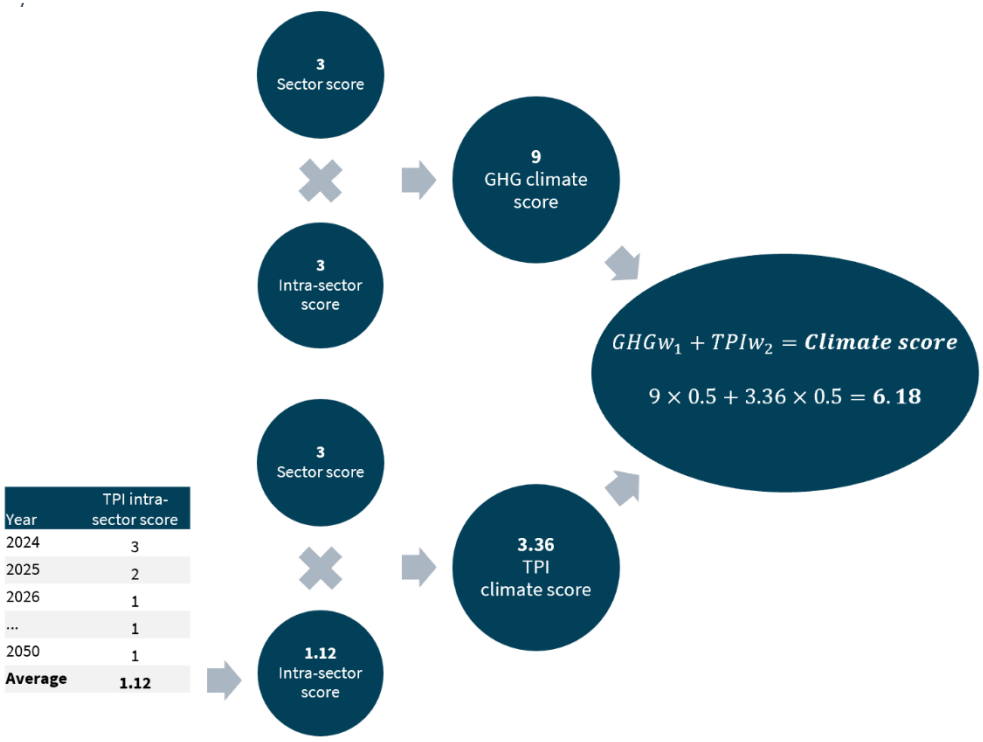
In Figure 7 the combined scoring is exemplified. This shows an issuer in a high-emitting sector (e.g. Energy, Materials, Industrials) that is given a sector score of 3 both from the historical GHG dataset as well as the TPI equivalent, as laid out in Table 2 and Table 3 above.

Since this issuer is a high-carbon emitter, it scores poorly when compared to its peers within the sector (and region) as well, meaning it receives an intra-sector score of 3 for the historical dataset, leading to a total GHG climate score of 9.

However, when compared to its peers in the TPI dataset the issuer's strong transition plan ranks it better over time compared to its peers. The average TPI intra-sector score between now and 2050 comes out at 1.12, leading to a total TPI climate score of 3.36 when multiplied with the sector score.

The combined climate score for this issuer computes to 6.18. The poor performance of the issuer in terms of the historical dataset is partially counterbalanced by its strong transition plan as defined using the forward-looking TPI dataset.

Figure 7: Example of combined scoring for a high-carbon emitting issuer with strong transition



Year	TPI intra-sector score
2024	3
2025	2
2026	1
...	1
2050	1
Average	**1.12**

Instrument-level adjustments to the scoring: green bonds and SLBs

Unlike with equities, issuer-led scoring is not feasible for fixed income bond markets. Instruments such as bonds or derivatives are issued by specific subsidiaries, which refer to entities in a company's organisational structure. The use of proceeds is another differentiator for bonds. A highly polluting company might issue bonds for low-carbon-intensive projects that must be accounted for. We account for these cases by scoring the use of proceeds bonds (green bonds) and sustainability-linked bonds (SLBs) differently from traditional vanilla instruments.

Green bond scoring adjustment

The base case ranking does not account for the specific instrument type. A green bond is scored favourably, irrespective of the sector. The relative ranking of the green and vanilla bonds issued by the same entity might differ based on the sector. A complete mapping is provided in Figure 4.

A subjective analysis is also carried out based on research of greenwashing concerns. If there is enough evidence of greenwashing, the final rank will be adjusted to 9.

Sustainability-linked bond (SLB) scoring adjustment

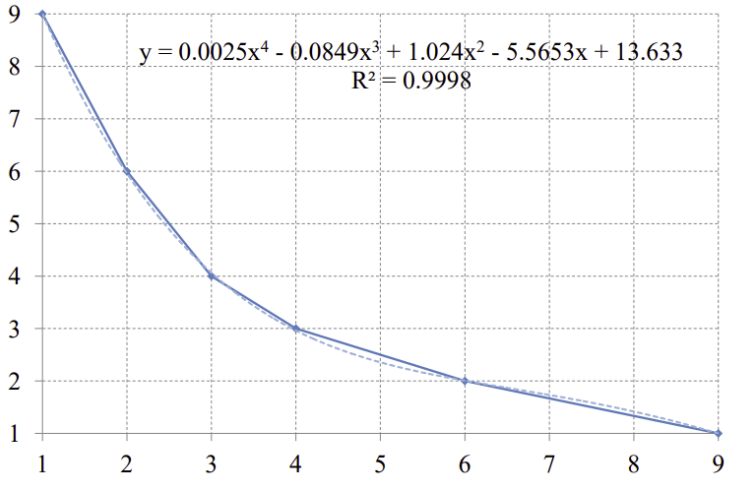
SLBs are likely to play an important role in an impactful transition strategy. However, their expected impact is extremely dependent on the ambitiousness of the embedded sustainability performance targets (SPTs). An SLB incentivising transition in a hard-to-abate sector will do more for decarbonisation on a cumulative emissions basis than a dark-green bond issued from a low-carbon sector. From this perspective, an SLB should be able to score more favourably in our framework. On the other hand, an SLB that represents business-as-usual for an issuer should be penalised for deflating the impact value of the instrument class. Hence, SLB scoring will have to involve some measurement of discretionary inputs. We currently use the following system:

- Decide if the SPTs are relevant at all for the strategy. If not, score the SLB the same as a traditional bond.
- (A): Calculate the total, cumulative possible coupon step payment amount for climate-related KPIs in the SLB structure.
- (B): Decide on the likelihood that the coupon adjustment will occur, with a baseline assumption of 50% (ambitious) and an upper category assumption of 80% ("easy to achieve targets"). SLBs that target SBTi-aligned SPTs use a 50% factor.
- Calculate the product of (A) and (B); (A) x (B) = (C). Adjust the climate score according to the following scaling:
  - (C) < 0.1 => No change in the score
  - 0.1<(C) < 0.25 => Score improves to the highest possible for the sector (e.g. a 6 issuer becomes a 3). If the issuer is already a top performer in the sector, adjust to the next lowest notch (e.g. from 3 to 2).
- (C)>0.25 => Final score of 0
- Greenwashed SLBs are assigned a climate score of 9, same as for green bonds.

Portfolio positioning impact

A fixed income portfolio often also has a mixture of positions, such as longs and shorts, especially around relative value or some sector neutral strategies. To account for this, the climate score for an issuer varies based on the position direction. All short positions receive an inverted score (i.e., a score of 1 becomes a 9) as laid out by the function in Figure 8. This inversion is used to compute portfolio-level aggregate scoring.

Figure 8: Inversion function of the climate score for short positions.



Summary

To summarise, the climate score signal is constructed from issuers mapped to sectors, which in turn are ranked as low, medium, or high emissions. Financials and sovereign sectors receive a different treatment. Issuers within a sector are organised into three tiers based on their percentile thresholds with a regional overlay. The two scores are multiplied, yielding a range of 1-9. Each data source gets weighted together to provide an issuer-level climate score.

To refine this to for the portfolio-wide score, instrument-level and positioning adjustments are made. At an instrument level, green bonds obtain a 0 score in general. SLBs are scored down based on their step-up amount and the probability of step-up. Discretional greenwashing concerns are also studied. Finally, based on the portfolio position direction, short positions receive an inverted score.

IMPORTANT DISCLAIMER:

This report is for information and educational purposes only. The Anthropocene Fixed Income Institute ('AFII') does not provide tax, legal, investment or accounting advice. This report is not intended to provide, and should not be relied on for, tax, legal, investment or accounting advice. Nothing in this report is intended as investment advice, as an offer or solicitation of an offer to buy or sell, or as a recommendation, endorsement, or sponsorship of any security, company, or fund. AFII is not responsible for any investment decision made by you. You are responsible for your own investment research and investment decisions. This report is not meant as a general guide to investing, nor as a source of any specific investment recommendation. Unless attributed to others, any opinions expressed are our current opinions only. Certain information presented may have been provided by third parties. AFII believes that such third-party information is reliable and has checked public records to verify it wherever possible, but does not guarantee its accuracy, timeliness or completeness; and it is subject to change without notice.

Any reference to a company's creditworthiness or likelihood of positive or negative performance in the current or future market is purely observational and should not be taken as a recommendation or endorsement or critique of such company or security. AFII is a non-profit organisation "to monitor, advocate for and influence the impact of the fixed income and bond markets in the age of human induced climate change." For more information about the Institute, please visit www.anthropocenefii.org.

AFII is not in any way associated with, nor are any of its directors, employees or advisors, any of the companies it references in its materials or reports and is not receiving compensation or consideration of any nature for its observations and/or insights.