

# GREEN BOND PRICING IN THE PRIMARY MARKET:

July-December 2022

H2  
(Q3-Q4)  
2022



## Report highlights

- Sample includes 72 green bonds with a combined face value of USD79bn, priced between July and December 2022
- Green bonds in both EUR and USD performed well on all metrics in the primary market, on average
- Issuers said the green label supported deals
- Green bond ETF assets achieved net growth of 11% on the prior period
- Spotlight: Relative values: where the greenium persists

## 1. Introduction

This is the 15th report in our pricing series, in which we observe how green bonds perform in the primary market. This report includes green bonds priced in the last six months of 2022 (H2 2022).

Our methodology is designed to capture the most liquid portion of the green bond market and is thus limited to USD and EUR bonds with a minimum original issue size of USD475m (lowered in H2 2022 to catch EUR500m deals). Developed market (DM), emerging market (EM) and supranational issuers (SNAT) are included.<sup>1</sup> The full methodology is explained on page 17.

By mid-January 2023, USD204.5bn worth of green bonds priced in H2 2022 had been added to the Climate Bonds Green Bond Database (GBDB), a 29% decline from H1 2022 (USD287.7bn as of January 2023). This report includes 39% of the amount recorded in the Climate Bonds GBDB for H2, that met the above requirements, i.e., USD79bn split between 72 green bonds from 58 issuers. EUR was the dominant currency with 56 bonds amounting to EUR66.1bn (USD66.7bn), while 16 qualifying USD denominated bonds had a combined issue size of USD12.3bn.

Sovereign green bond performance is assessed separately in the Sovereign Green Bonds Club section of this report. Sovereigns are subject to different pricing dynamics than bonds from other issuer types and we address their performance on an absolute basis.

### Description of sample H2 2022

Category	EUR	USD
SSA	10	1
Covered	6	N/A
A	10	10
BBB	24	5
Sovereign + EU	6	N/A
<b>Total</b>	<b>56</b>	<b>16</b>

**Hungary 2027** was priced in EUR as opposed to its local currency (HUF) but we include it in the same section because there were no comparable bonds priced during the observation period. The European Union (EU) a supranational issuer, is also subject to peculiar pricing dynamics and is again discussed separately.

### Report highlights:

- **Green bonds achieved higher book cover and spread compression than vanilla equivalents, on average.**  
**See more on page 4**
- **Overall, 67% of green bonds were allocated to investors describing themselves as having green or responsible investment mandates.**  
**See more on page 7**

- **Yield curves could be built for 50 bonds in our non-sovereign sample. Ten priced inside their issuer's yield curves, achieving a greenium.**  
**See more on page 9**
- **After 7 and 28 days, green bonds had tightened by more than comparable vanilla baskets and corresponding indices, on average.**  
**See more on page 9**
- **Green bond ETFs: total fund assets in EUR and USD green bond ETFs ended the period at USD1.9bn, a net increase of 11.2% on the prior period.**  
**See more on page 12**
- **Sovereign Green Bond Club: Austria, Belgium, Germany, Hungary, Italy, and the EU priced green bonds together worth USD23.7bn.**  
**See more on page 13**
- **Spotlight: Relative values: where the greenium persists — we compare bonds bearing thematic labels with vanilla equivalents and note that on average, thematic bonds price closer to their yield curves.**  
**See more on page 15**

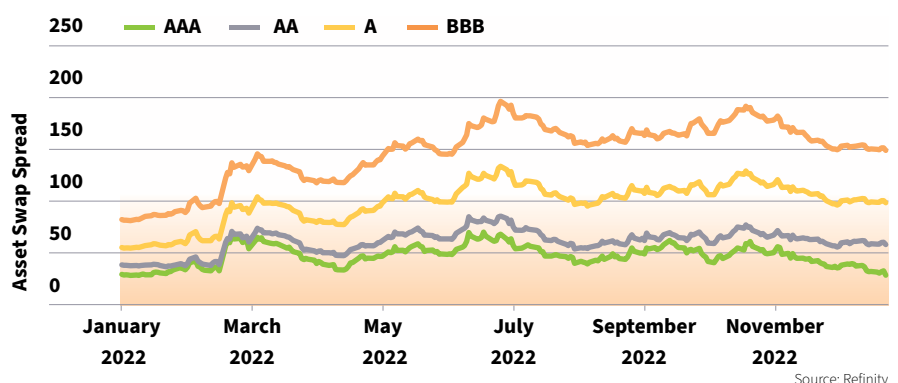
## Market developments

Macroeconomic conditions posed challenges for debt issuers in H2 2022. At the beginning of July, European growth forecasts were downgraded, inflation forecasts were revised upwards as energy costs continued to rise, and the EUR currency headed towards parity with the USD. That level was eventually breached in August, and by October, a Europe wide recession was looking more likely. EUR corporate bond spreads reached their 2022 highs in early July and while spreads had retraced somewhat by year end, all categories except AAA (-4%) ended the year significantly wider: AA by 65%, A by 92%, and BBB by 91%. In the USD market, the highs came in October as prospects of a US recession increased, and corporate spreads ended the year wider in all categories, albeit more subdued than EUR: AAA widened by 6%, AA by 15%, A by 40%, and BBB by 37%.

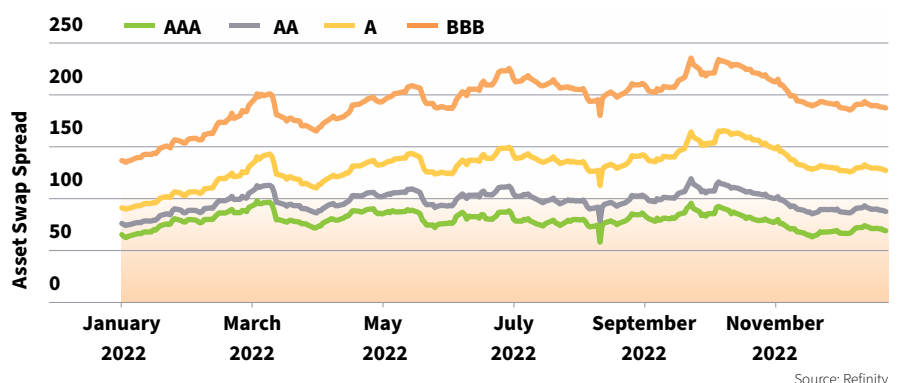
Against this backdrop, issuers continued to visit the bond market, but with caution illustrated by multi-day periods with no new issuance, and reports of deals being pulled at the last minute.

**Numerous green bond issuers emphasised that the green label supported deal placement in volatile markets.**

### EUR Corporate Credit Spreads



### USD Corporate Credit Spreads



Green bond volumes recorded in the Climate Bonds GBDB in 2022 declined slightly by 7% compared to 2021 but maintained a steady contribution of around 3% to total market volumes. H2 green issuance reached USD293.6bn, compared to USD355.4bn in H1, with September being the most prolific month of the year at USD75.9bn. November came a close second with volumes of USD72.8bn, an increase of 8.6% on the year. None of the bonds contributing to the USD26.9bn priced in December were eligible for inclusion in this report.

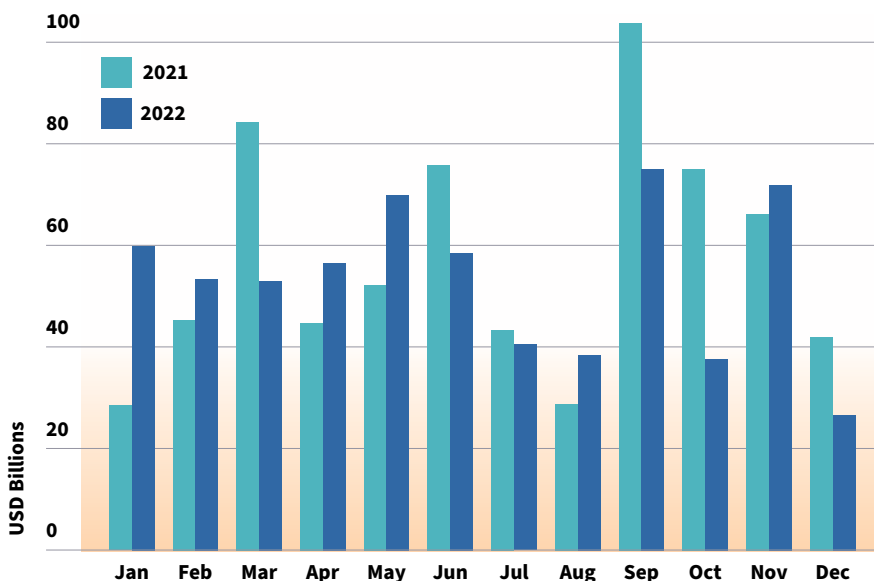
## Auto manufacturers pile into the green lane

Auto manufacturers are now using the green label more frequently to support the development of green technologies and in 2022 Climate Bonds recorded green deals from Chinese auto company BAIC Motors, Ford, Kia Corp, General Motors, GMAC, Honda, Hyundai, Renault, Volvo, and Volkswagen. As noted in the H2 2020 iteration of this paper, auto-makers are now entirely focused on clean solutions hence there is huge potential to relabel existing debt as green as it rolls off. We also expect the affordability of low carbon vehicles to facilitate a deluge of green auto loan ABS deals over the next few years.

Historically, the green corporate bond market has lacked diversification potential, being dominated by bonds from issuers operating in the finance, utility, and real estate sectors. Seasoned debt issuers with strong sustainability strategies operating in other areas can magnetise investor interest for green bonds, and this extends to the auto sector.

This report includes six bonds from three auto manufacturers: In EUR **Renault 2027**, **VW 2025**, **VW 2028**, **VW 2030**, plus one deal, **ALD 2027** from French car leasing company ALD Automotive, and in USD **GM 2029**, and **GM 2032**. All of these deals were strongly supported by investors describing themselves as green with eventual allocations for ALD, Renault, and VW reaching at least 80% (see page 7). ALD Automotive priced its first green deal at the end

## Green issuance volumes declined by 7% in 2022



Source: Climate Bonds GBDB

of June 2022 following the publication of its *Green and Positive Impact Bond Framework*.<sup>3</sup> The Framework was aligned with best practice in compliance with the EU Green Bond Standard and proceeds of the deal were reserved for battery electric vehicles (BEV). The issuer reported that investors were attracted to the deal by the strong sustainability strategy and the diversification play would have contributed too. Renault also priced its first green bond at the end of June with proceeds earmarked to finance or refinance BEV and charging infrastructure. The issuer acknowledged that the green label contributed to the successful execution of the deal during a particularly volatile period. Volkswagen priced its three tranche EUR2.5bn (USD2.6bn) deal in early November bringing its total green liabilities to EUR7.4bn (USD6.8bn), the largest of any auto manufacturer. Around 80% of each tranche was placed with green investors underscoring the appetite for this sort of paper. Volkswagen's Green Finance Framework, revised in October 2022, highlighted BEVs as the only category of eligible expenditures, consistent with the Group's long-term target of carbon neutrality by 2050.<sup>4</sup>

### Remarks:

- Three bonds priced in late Q2 were included in this analysis because they were not added to the Climate Bonds GBDB in time for inclusion in the prior iteration of this paper. They are **ALD 2027**, **KFW 2029**, and **Renault 2027**. The bonds are compared with vanilla equivalents also priced in Q2.
- Seniority rankings of financial corporate bonds are denoted using the following abbreviations: Senior Preferred (SP), Senior Non-Preferred (SNP) and Covered (CO). As per our standard methodology, the payment rank of the green bond is matched when selecting vanilla bonds with which to compare the performance.
- The methodology for the selection of the bonds used as comparators is given on page 17.

## 2. Spread compression and book size: green bonds in both EUR and USD attracted larger book cover and exhibited larger spread compression than vanilla equivalents, on average

• **EUR:** Average oversubscription was 3.6 times for green bonds versus 3.0 times for vanilla equivalents. Spread compression averaged 21bps for green bonds and 19bps for vanilla bonds.

• **USD:** Average oversubscription was 5 times for green bonds and 3 times for vanilla equivalents. Spread compression averaged 25bps for green bonds and 18bps for vanilla bonds.

EUR Book cover				
Category	Green bond sample	Number of green bonds beating vanilla basket	Green average book cover	Vanilla basket average book cover
SSA	10	7	2.9	2.5
Covered	6	5	3.2	1.7
A	10	5	2.8	2.3
BBB	24	12	4.3	3.9
<b>Total</b>	<b>50</b>	<b>29.0</b>	<b>3.6</b>	<b>3.0</b>

USD Book cover				
Category	Green bond sample	Number of green bonds beating vanilla basket	Green average book cover	Vanilla basket average book cover
SSA	1	1	3.8	1.6
A	10	8	6.1	3.3
BBB	5	2	2.8	3.2
<b>Total</b>	<b>16</b>	<b>11.0</b>	<b>4.9</b>	<b>3.0</b>

Five EUR green bonds achieving largest book cover					
Category	Short Name	Deal size EURbn	Reported order book EURbn	Book cover	Vanilla basket book cover
BBB	EDP 2030	0.50	6.5	13.0	3.6
A	Statkraft 2029	0.50	4.9	9.8	4.0
BBB	Eurogrid 2031	0.75	6.5	8.7	7.1
BBB	SSE Plc 2029	0.65	5.6	8.6	4.0
SSA	EIB 2030	4.00	33	8.3	3.8

Five USD green bonds achieving largest book cover					
Category	Short Name	Deal size USDbn	Reported order book USDbn	Book cover	Vanilla basket book cover
A	NTT 2027	0.5	4.4	8.8	2
A	NTT 2024	0.5	4.3	8.6	2
A	NTT 2025	0.5	3.9	7.8	5
A	Gaci 2027	1.3	10.3	6.8	2
A	Gaci 2032	1.3	8.5	6.8	2

Green bonds are oversubscribed and experience spread tightening during the pricing process, just like vanilla bonds. To help determine whether investors attach any value to the green label, green bonds are compared to carefully selected vanilla equivalents (baskets).

### EUR green bond pricing

EUR green bonds accumulated larger order book cover in H2 2022 (3.6 times) compared to H1 (3.1 times). This increased appetite extended to vanilla bonds which recorded average book cover of three times in H2 against 2.4 times in H1, undoubtedly exacerbated by the market volatility and relative scarcity of new bonds in the second half of the year. Spread compression during book building also rose to an average of 21bps in H2 against 18bps in H1 for green bonds, and 19bps compared to 16.bps in H1 for vanilla bonds.

While the book cover attained by green bonds was greater in H2 compared to H1, individually, 58% of green bonds (28 out of 50) experienced

greater oversubscription compared to vanilla equivalents, which is similar to the prior two observation periods.

59% of green bonds (27 out of 46) achieved larger spread compression than their vanilla equivalents, a higher share than H1 2022 (53%).

*Bonds in the sample excluded from this analysis:*

*VW 2030 achieved book cover of 3.1 times but its vanilla basket did not have data for that point.*

*Four bonds achieved the same amount of tightening as their respective vanilla counterparts: SNCF 2027 (0bps), Caixa Bank 2029 (SP) (20bps), TenneT 2042 (20bps), and Amprion 2027 (40bps).*

### Book cover

Four utility companies were among the EUR deals achieving the largest book cover in H2. The fifth spot was taken by EIB.

France's **EDP 2030** attracted an order book of EUR6.5bn, covering the EUR500m (USD490m) deal 13 times. According to the issuer, this was the largest reported book cover for an investment

grade deal since June 2020 and is the second largest recorded by Climate Bonds for a green corporate bond (the high remains **Prologis 2032** with a book cover of 14 times the EUR deal size in June 2020). The proceeds of the deal were earmarked for renewable energy projects, consistent with EDP's objective of becoming 100% green by 2030.

Norwegian hydropower company **Statkraft 2029** built an order book for its EUR500m (USD510m) deal of 9.8 times its size, only beaten by four historical green bond deals recorded by Climate Bonds. Statkraft will mobilise the proceeds for renewable energy and clean transportation. Its *Green Bond Financing Framework* states an intention to be among the top-three most climate-friendly European-based power generators, and to be carbon neutral by 2040 for scope 1 and 2 emissions, (but makes no mention of scope 3).<sup>5</sup>

German electric utility **Eurogrid 2031** covered its EUR750m (USD750m) 8.7 times. It was the second green bond from the company, indirectly

owned by Belgium's Elia and KfW, with proceeds earmarked for improvements to offshore and onshore grid transmission of renewable energy.

**SEE plc 2029** returned to the EUR green bond market for the third time and obtained an order book 8.6 times the EUR650m (USD667m) final deal size. The July deal was boosted by the timing, following an eight-day run of no new issues in the EUR market, plus the company's first quarter trading update which slightly exceeded expectations. The issuer mentioned that the deal attracted very high participation from green investors which helped to squeeze the spread, and Climate Bonds calculated that the deal came with a normal new issue premium.

The order book of **EIB 2030**, an EUR4bn offering priced in mid-September, reached EUR33bn, 8.3 times the deal size. This is joint fourth largest book cover recorded by Climate Bonds for a deal from an SSA issuer, the largest being the European Union, which managed to cover the book of its EU 2043 deal by 13 times in April 2022. SSA green bonds achieving book cover of this magnitude demonstrate how far the market has developed, as in the initial stages, strong pricing dynamics were often attributed to the smaller or capped deal sizes rather than the green label.

#### Spread compression

The bonds delivering the largest spread compressions in EUR all originated from the private sector, with **EDP 2030** taking the top spot obtaining 55bps. **Prologis 2032** (priced June 2020) and **Daimler 2030** (priced September 2020) are the only EUR green deals on Climate Bonds record to have exceeded this level of price revision with 65bps and 57bps respectively. **Iberdrola 2025** also managed 55bps in April 2020. The EDP 2030 deal demonstrated strong pricing dynamics across the board, achieving the largest book cover and spread compression of the observation period, and tightening in the secondary market. Climate Bonds could not build a yield curve for this deal, so cannot remark on whether this strong demand translated into cheaper funding.

European multi-national real estate company Vonovia priced a two-part ESG deal in mid-November which included a social bond and an EUR750m (USD777m) green deal (**Vonovia 2030**). The latter achieved spread tightening of 50bp, having attracted book cover of 6.5 times.

A debut green bond transaction from one of the four German transmission system operators comprised **Amprion 2027** and **Amprion 2032**. The bonds underwent spread compression of 40bps and 45bps respectively. The issuer was very happy with the timing of the transaction, and remarked that strong participation from the ESG investment community (85%) contributed to the success of the deal. Climate Bonds could not build a yield curve but the issuer described the new issue premium as negligible. Investors are evidently willing to support the transformation and upgrade of the grid system, a critical component of a climate neutral energy future.

Dutch financial services company **Achmea 2025** also obtained 45bps of spread compression, leveraging a book cover of 4.8 times. The proceeds from the deal will support its lending activities for commercial and residential real estate.

Volkswagen (VW) priced a trio of bonds in early November following the publication of its updated green finance framework in October referenced above. Green deals from VW have a history of aggressive spread revision in primary, and **VW 2025** and **VW 2030** each tightened by 42bps, while **VW 2028** deal managed 39.5bps. The deals did not achieve a greenium, but Climate Bonds calculated that the 2028 and 2030 tranches each priced fewer than 5bps outside the yield curve, while the 2025 priced slightly wider.

#### USD green bond pricing

USD green bonds achieved higher book cover and more aggressive tightening than vanilla bonds, on average. The H2 2022 sample achieved an average book cover of five times, more than the 3.8 times observed in H1, while vanilla bonds increased their book cover to 3 times from 2.7 times in the prior period.

Spread compression was also more aggressive for green bonds at 25bps against 18bps for the vanilla sample. These numbers were both smaller than the H1 sample, which exhibited 29bps and 22.5bps of tightening for the green and vanilla samples respectively.

Eleven out of 14 green bonds (79%) achieved larger book cover than vanilla counterparts. Eleven out of 13 green bonds (85%) experienced more spread compression compared to equivalents.

*Bonds in the sample excluded from this analysis:*

*There was no comparable bond for GACI 2122, so neither book size nor spread compression could be compared to anything.*

*Two bonds in the USD sample achieved the same spread compression as their vanilla baskets: NTT 2025 (30bps), and PepsiCo 2032 (25bps).*

#### Book cover

In July 2022, Japan's Nippon Telegraph and Telephone (NTT) priced a USD1.5bn deal spread equally over three tranches. NTT has already issued green with two EUR and four JPY deals outstanding, but this was its first time dialing into green USD. The trio of **NTT 2024**, **NTT 2025**, and **NTT 2027** picked up exceptional interest from investors, with the tranches achieving book cover of 8.6, 7.8, and 8.8 times respectively. This deal came in the busiest USD new issue week since April, and the green label certainly bolstered the appeal. Proceeds were earmarked for 5-G related investments, research and development of telecom infrastructure Innovative Optical and Wireless Network (IOWN), and renewable energy projects including wind and solar. More than three quarters of the deal was allocated to US domestic investors, suggesting plenty of appetite for corporate paper with robust green credentials.

Saudi Arabia's sovereign wealth fund, the Public Investment Fund (PIF) also priced a three-tranche deal in its green debut in late September. The longest dated tranche, **GACI 2122**, was the first century bond to hit the green bond market, and attracted a book of 6.4 times its size. The shorter

EUR Spread compression (swap spreads)

Category	Green bond sample	Number of green bonds beating vanilla equivalent	Green average spread compression	Vanilla basket average spread compression
SSA	10	5	-2.5	-4.3
Covered	6	4	-4.0	-3.6
A	10	4	-21.2	-23.5
BBB	24	14	-32.7	-27.1
<b>Total</b>	<b>50</b>	<b>27</b>	<b>-20.9</b>	<b>-19.0</b>

USD spread compression (treasury spreads)

Category	Green bond sample	Number of green bonds beating vanilla equivalent	Green average spread compression	Vanilla basket average spread compression
SSA	1	1	-30.0	-28.5
A	10	6	-23.7	-21.6
BBB	5	4	-25.0	-9.4
<b>Total</b>	<b>16</b>	<b>11</b>	<b>-24.8</b>	<b>-15.4</b>

dated **GACI 2027** and **GACI 2032** each gathered enough interest to cover their USD1.25m deal sizes by 6.8 times. Eligible investment categories included renewable energy, energy efficiency, sustainable water management, pollution prevention and control, green buildings, and clean transportation. The PIF will be responsible for developing 70% of Saudi Arabia's renewable energy and has stated it will make up to USD10bn of investment in green projects by 2026, so Climate Bonds expects more green bonds from this issuer.

#### Spread compression

Spread compression data was available for all bonds in the USD sample and five of them achieved 30bps. These included all three of the deals from NTT addressed above. Climate Bonds

could only put the NTT 2027 onto a yield curve (the other tranches being too short), and the deal was priced with a small new issue premium.

**KEPCO 2026** and **EDP 2027** also obtained spread revisions of 30bps. The KEPCO 2026 was priced in late September during the short tenure of UK Prime Minister Liz Truss. Efforts to reassure markets included an intervention to buy long-dated paper which was eventually extended to Asian dollar bonds. Climate Bonds acknowledges that the knock-on effects of this could have influenced the pricing dynamics of the KEPCO deal, but notes that a green deal from the same issuer priced in H1 2022 achieved spread tightening of 40bps, hence the name is attractive to dollar investors more broadly. The AA rating, state ownership, short tenor, and green

label collectively contributed to that. The bond was the longest on its USD yield curve so Climate Bonds could not determine whether it had priced with a greenium.

Seasoned green bond issuer EDP brought its USD500m 2027 bond in early October following a very quiet week in the new issuance market. The book was four times covered allowing for 30bps of tightening with very low attrition.

**Methodology notes:** Baskets comprise bonds that most closely match the green bonds and are issued during the same quarter. The baskets in this publication include between one and seven bonds. For an explanation of the methodology, see page 17.

#### Five EUR green bonds achieving largest spread compression (swap spreads)

Category	Bond	Pricing date	IPT	Primary Spread	Compression green bond	Compression vanilla basket
BBB	EDP 2030	04/10/2022	175	120	-55	-30
BBB	Vonovia 2030	15/11/2022	280	230	-50	-25
BBB	Amprion 2032	14/09/2022	190	145	-45	-40
BBB	Achmea 2025	22/11/2022	135	90	-45	0
BBB	VW 2025	07/11/2022	150	108	-42	-30

#### Five USD green bonds achieving largest spread compression (treasury spreads)

Category	Bond	Pricing date	IPT	Primary Spread	Compression green bond	Compression vanilla basket
A	NTT 2024	20/07/2022	120	90	-30	-15
A	NTT 2025	20/07/2022	130	100	-30	-30
A	NTT 2027	20/07/2022	150	120	-30	-11
SSA	KEPCO 2026	29/09/2022	150	120	-30	-29
BBB	EDP 2027	03/10/2022	275	245	-30	-25

### 3. Green allocations: 67% allocated to investors describing themselves as green

Climate Bonds invited the 51 non-sovereign issuers included in this analysis to disclose what percentage of their deal was allocated to investors describing themselves as green or socially responsible (green investors). The results of this outreach were as follows:

- 28 issuers representing 40 bonds shared the data
- Eight issuers representing eight bonds replied without disclosing the data
- 16 issuers representing 19 bonds did not reply

**Based on these responses, the average allocation to investors describing themselves as green was found to be 67%.**

This appears to have stabilised over the past few observation periods, as the number has remained within 2% of that throughout 2021 and in H1 2022.

Allocations ranged from 30% (**Wisconsin P&L 2032**) to 92% (**ALD 2027**).

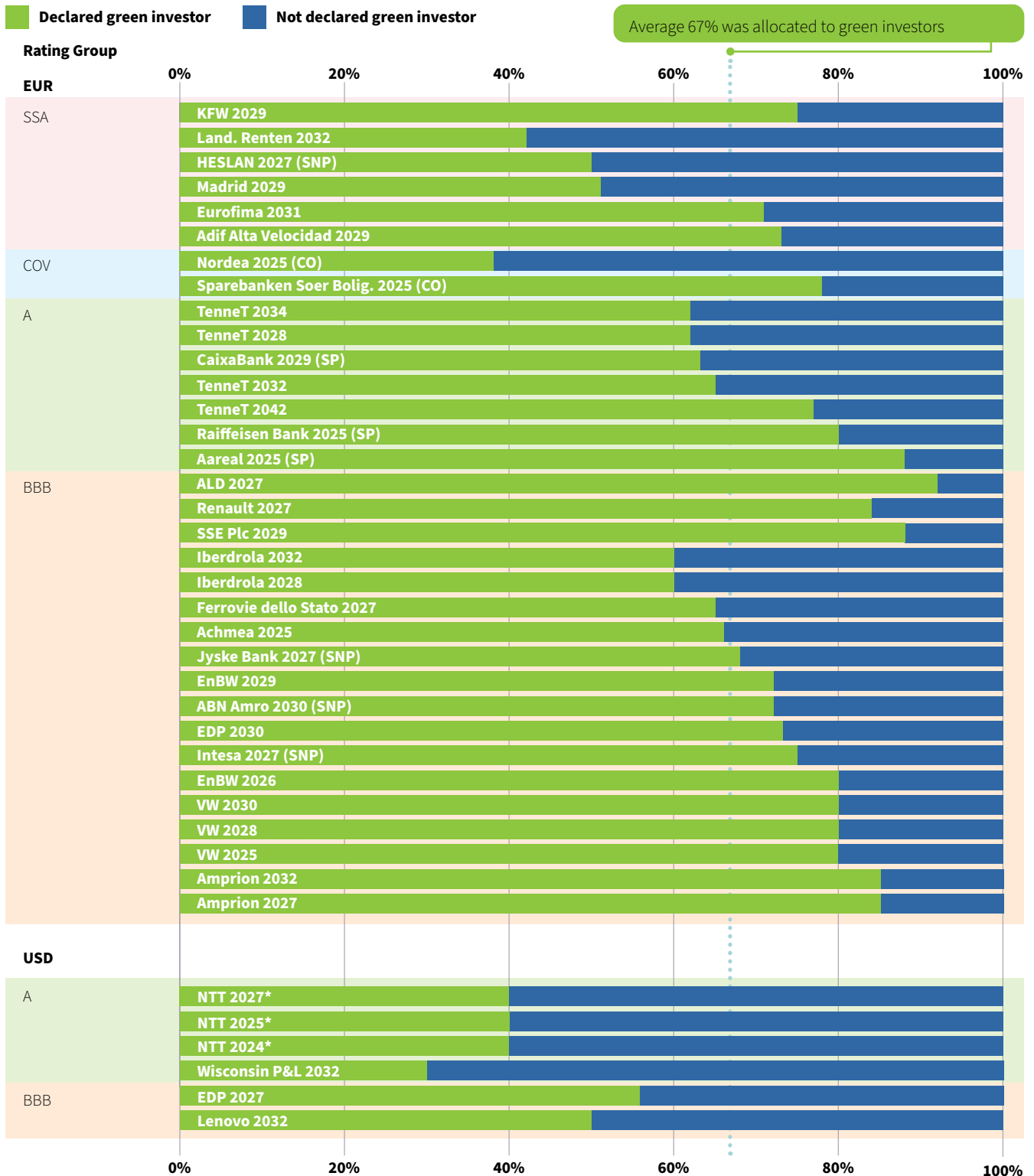
Four issuers representing seven USD bonds disclosed distribution numbers, while a further two replied that they could not share the data. This is an improvement on H1, when just three issuers acknowledged the request. However, the consistently small USD sample does make it difficult to monitor changes in investor demand in this market. Among those who did respond, the tone was positive suggesting that the green label helped to attract the participation of a broader range of investors.

From the European issuers there was, as usual, a general acknowledgement that the green label added value to the transaction and attracted additional investors into the order book. This was borne out by the numbers that we observed for book coverage in the primary market, which are consistently higher than those observed for vanilla equivalents. Several repeat issuers remarked that the interest from green investors increases with each transaction, possibly because genuine commitment is consolidated. But during the volatile market conditions of 2022 the green label has offered another dimension to issuers: it has often helped to get deals over the line during periods of volatility, simply because of its ability to capture a unique investor base.

One issuer remarked that SFDR implementation for EU financial market participants has pushed the green bond market towards stronger integrity and accountability. Post issuance reporting and second party opinions are the starting points.

**Methodology notes:** Green investor participation is provided by issuers. Where the allocation is split between dark, medium, and light green investors, percentages for dark and medium green are included in this analysis. There is no standard methodology for defining a green investor and we acknowledge that this is subject to interpretation. There is no way to monitor how investors split their allocations of green bonds among their different portfolios.

## 67% of green bonds were allocated to green investors



\*Over 40% of the NTT deal was allocated to high-profile investment managers with an ESG focus, according to one of the banks involved in the transaction.



## 4. Performance in the immediate secondary market

• **Seven days after pricing**, 59% of green bonds had tightened more than comparable vanilla baskets; 70% had tightened more than their corresponding index.

• **28 days after pricing**, 55% of green bonds had tightened more than comparable vanilla baskets; 64% had tightened more than their corresponding index.

In H2 2022, 67% of individual green bonds in our sample had tightened seven days after pricing; this increased to 73% after 28 days. In H1 2022, 64% had tightened after seven days, and 49% after 28 days so both observations increased in H2.

### After seven days

- 59% of green bonds had tightened by more than their vanilla baskets: 60% of EUR and 60% of USD green bonds.
- 70% of green bonds had tightened by more than their corresponding index: 70% of EUR and 75% of USD green bonds.

A higher percentage of bonds tightened more than their vanilla baskets in H2 (59%) compared to H1 (51%). A larger percentage of bonds tightened on the break in H2 (67%) compared to H1 (64%). Notwithstanding the volatility seen in 2022, fewer green bonds were added to the Climate Bonds GBDB in H2, and the relative scarcity of benchmark sized green deals with adequate credentials could have also contributed to the greater magnitude of tightening. In H1, 88 non-sovereign green bonds qualified for inclusion in this research, while 66 qualified in H2.

More than half (62%) of EUR green bonds had tightened against both their vanilla basket and corresponding index after a week. Among these, four deals in the SSA category tightened by more than 20% each. **NRW Bank 2032** (22%), **SNCF 2027** (25%), **EUROFIMA 2031** (26%), and **Ned Water 2027** (24%). A general preference for higher quality paper as a safe haven could have contributed to the demand for these bonds, all of which have composite credit ratings of at least AA.

German Local Authority NRW Bank 2032 priced its EUR1bn (USD1.2bn) deal in late July. As the only EUR deal of the day, the bond achieved book cover of 3.8 times, and spread compression of 2bps beating its vanilla basket on both metrics. The bond was one of four in our sample to have priced with a greenium in H2.

Eurofima, the Swiss based supranational supporting the development of rail transport in Europe, came to the market with its EUR500m (USD495m) EUROFIMA 2031 in early November. On the same day, the Dutch Local Government Funding Agency priced its EUR500m (USD500m) Ned Water 2027. Both achieved larger book cover than vanilla equivalents, and EUROFIMA

Bonds generally often deliver price tightening in the immediate secondary market since investors may want to increase their position or open a position in a bond they did not get allocated. Timing is an important factor, because bond indices rebalance at each month end. Therefore, if bonds are issued early in the month, there could be an opportunity for managers to add some off-benchmark performance before bonds are added to benchmark indices. Once bonds enter indices, except for credit events, liquidity can quickly evaporate, and accurate spreads are quoted on a bilateral basis. Our consideration of the secondary market consequently only extends to one month after the pricing date of each bond.

To contextualise spread movements, we compare each green bond to two alternatives.

Firstly, we match each green bond to a vanilla bond or if possible, a basket of vanilla bonds sharing similar characteristics, issued in the same quarter as the green bond. This comparison is a proxy for the opportunity cost to the investor. Secondly, we compare each green bond to a corresponding index to monitor their performance against the market.

Since it is unlikely that the vanilla bonds are priced on the same day as the green bond, this could be expected to impact performance in the secondary market particularly when markets are volatile. This exercise is designed to illustrate what an investor could have otherwise done with their money in the vanilla bond market during the same period. Volatility sometimes benefits green bonds, other times, not.

2031 tightened more than its basket too. Ned Water 2027 priced with a greenium.

On the corporate side, German energy company ENBW priced a pair of green bonds in mid-November. The transaction, which was fixed at EUR1bn (USD1bn) from the outset (no-grow), was split evenly between **ENBW 2026** and **ENBW 2029** attracting book cover of 5.2 and 5.7 times and tightening in primary by 35 and 40bps respectively. Both tranches priced with a normal new issue premium but went on to tighten dramatically in the secondary market. Proceeds from ENBW green bonds are earmarked for renewable energy, energy efficiency, and low carbon transport (charging infrastructure). Diversification into renewables is crucial for German utilities which have been hurt by their reliance on Russian gas. In early December, ENBW announced that its subsidiary VNG had resolved residual risks of gas procurement and had withdrawn its application for stabilisation measures from the German government which may have contributed to the price tightening after 28-days noted below.

In USD, 56% of green bonds had tightened against both their vanilla basket and corresponding index after a week. Among these, **GACI 2027** and **GACI 2032**, addressed above, had tightened by 22% and 18%. **KEPCO 2026** (again, addressed above) was another stand out, tightening by 19%.

### After 28 days

- 55% of green bonds had tightened by more than their vanilla baskets: 56% of EUR and 53% of USD green bonds.
- 64% of green bonds had tightened by more than corresponding indices: 58% of EUR and 81% of USD green bonds

A higher percentage of green bonds had tightened against their vanilla baskets after 28-days in H2 (55%) compared to H1 (48%). However, a lower percentage had tightened against indices: 64% in H2 against 77% in H1. 25 out of 66 bonds had tightened more than corresponding bonds and indices after 28 days.

In EUR, some of the bonds mentioned above continued to demonstrate strong tightening after 28-days: Eurofima 2031 (50%), NRW Bank 2032 (55%), ENBW 2026 (59%), and ENBW 2029 (27%).

Seasoned green bond issuer Iberdrola announced updated sustainability commitments prior to COP27, including a pledge to reach net zero by 2040, and a commitment to have a positive impact on species and ecosystems by 2030. Following this, the company priced a EUR1.5bn (USD 1.5bn) green deal in mid-November, split evenly between **Iberdrola 2028** and **Iberdrola 2032**. Both tranches achieved higher book cover and spread compression than comparable bonds and priced with a normal new issue premium. The bonds went their separate ways in the secondary market, with the longer deal remaining static, while the shorter deal tightened dramatically, reaching -33% after 28 days.

Swedish SEB priced a EUR1bn (USD1bn) green deal in early November. The **SEB 2026 (SNP)** achieved greater book cover and spread compression than its vanilla match, but Climate Bonds could not construct a yield curve so cannot say whether this translated into a pricing

benefit. The bond had tightened by 6% after seven days, extending to 27% after 28 days.

In USD, six out of 16 green bonds achieved greater spread tightening compared to equivalents in the first month. Among them, the pair of NTT bonds addressed above achieved the

most dramatic tightening. All three of the bonds tightened after 7 days, but after 28-days NTT 2024 had extended that to 23%, while NTT 2027 had tightened by 34%. The NTT 2025 did not beat its match but had still tightened by 22% a month after pricing.

Rating Group	Bond	1 week change			28 day change			
		Green Bond	Vanilla Basket	Corresponding iBoxx index	Green Bond	Vanilla Basket	Corresponding iBoxx index	
EUR	SSA	KFW 2029	3%	-18%	9%	25%	23%	53%
	SSA	NRW Bank 2032	-22%	-55%	-7%	6%	-11%	-21%
	SSA	HESLAN 2027 (SNP)	2%	-1%	-1%	3%	-6%	-40%
	SSA	EIB 2030	-9%	5%	121%	-9%	1%	-6%
	SSA	Madrid 2029	95%	103%	33%	47%	-16%	27%
	SSA	Adif Alta Velocidad 2029	29%	62%	33%	47%	45%	39%
	SSA	SNCF 2027	-25%	22%	-1%	-7%	-11%	-20%
	SSA	Eurofima 2031	-26%	-50%	121%	82%	2%	0%
	SSA	Ned. Water. 2027	-24%	14%	30%	-2%	-2%	-20%
	Covered	LBBW 2028 (CO)	-163%	-185%	-7%	29%	4%	3%
	Covered	ING-DiBa 2030 (CO)	424%	153%	499%	820%	-4%	-9%
	Covered	UniCredit 2028 (CO)	433%	158%	-7%	29%	-1%	-2%
	Covered	Slovenska Sport. 2028 (CO)	19%	15%	-7%	29%	-3%	6%
	Covered	Sparebanken Soer Bolig. 2025 (CO)	31%	12%	35%	-14%	0%	5%
	Covered	Nordea 2025 (CO)	-8%	-173%	35%	-14%	15%	11%
	AAA	Land. Renten 2032	28%	17%	-56%	-46%	13%	7%
	A	Aareal 2025 (SP)	-19%	-28%	17%	20%	-10%	-29%
	A	CaixaBank 2029 (SP)	-4%	-9%	-5%	-1%	-3%	-3%
	A	Raiffeisen Bank 2025 (SP)	-12%	-15%	17%	20%	-5%	32%
	A	Statkraft 2029	-8%	-20%	0%	-11%	-6%	2%
	A	SR Bank 2025 (SP)	6%	2%	17%	20%	7%	33%
	A	TenneT 2028	3%	10%	12%	20%	3%	-5%
	A	TenneT 2032	-7%	-12%	-2%	-16%	2%	30%
	A	TenneT 2034	-7%	-21%	-23%	-14%	1%	-7%
	A	TenneT 2042	-5%	-17%	-7%	-13%	1%	-7%
	A	SEB 2026 (SNP)	-6%	-27%	-6%	-13%	3%	-13%
	BBB	ALD 2027	-1%	-17%	-3%	-20%	10%	-2%
	BBB	Renault 2027	3%	-12%	-3%	-20%	13%	-3%
	BBB	SSE Plc 2029	-19%	-22%	0%	-11%	-1%	-4%
	BBB	Eurogrid 2031	-15%	-18%	-7%	-20%	4%	5%
	BBB	Intesa 2027 (SNP)	-2%	-7%	-1%	3%	6%	4%
	BBB	Orsted 2031	-5%	-5%	-7%	-20%	-3%	0%
	BBB	Ferrovie dello Stato 2027	-5%	-2%	-46%	-7%	5%	36%
	BBB	Amprion 2027	3%	-12%	-4%	-15%	3%	16%
	BBB	Amprion 2032	-10%	-26%	-7%	-20%	2%	1%
	BBB	EDP 2030	-15%	-6%	-2%	-16%	-4%	4%
	BBB	Ceske Drah 2027	-5%	-3%	2%	-7%	2%	7%
	BBB	EDF 2034	-3%	-1%	3%	2%	2%	4%
	BBB	VW 2025	-9%	-21%	-12%	-23%	-3%	-21%
	BBB	VW 2028	10%	4%	2%	12%	-3%	-15%
	BBB	VW 2030	1%	1%	-12%	-14%	-5%	-16%

Continued		1 week change			28 day change			
Rating Group	Bond	Green Bond	Vanilla Basket	Corresponding iBoxx index	Green Bond	Vanilla Basket	Corresponding iBoxx index	
EUR	BBB	Covestro 2028	4%	-14%	2%	12%	-7%	-15%
	BBB	Jyske Bank 2027 (SNP)	-5%	-18%	-6%	-13%	-7%	-19%
	BBB	ABN Amro 2030 (SNP)	1%	-8%	0%	-6%	-2%	-10%
	BBB	Vonovia 2030	-6%	-13%	4%	7%	0%	-8%
	BBB	EnBW 2026	-27%	-59%	8%	16%	-3%	-13%
	BBB	EnBW 2029	-13%	-27%	-7%	-3%	-1%	-8%
	BBB	Iberdrola 2028	-12%	-33%	12%	20%	-1%	-8%
	BBB	Iberdrola 2032	1%	0%	-2%	-16%	0%	-8%
	BBB	Achmea 2025	-14%	-23%	-4%	-41%	-5%	-13%
USD	A	PepsiCo 2032	-14%	-5%	1%	-1%	-5%	-9%
	A	NTT 2024	-11%	-23%	-4%	1%	-3%	-8%
	A	NTT 2025	-8%	-22%	-24%	-24%	1%	-8%
	A	NTT 2027	-12%	-34%	-1%	1%	0%	-20%
	A	Wisconsin P&L 2032	-7%	4%	-6%	-6%	-6%	5%
	A	Wisconsin EP 2032	-3%	3%	-3%	4%	1%	21%
	A	Gaci 2027	-22%	-1%	8%	4%	9%	6%
	A	Gaci 2032	-18%	-4%	5%	0%	8%	0%
	A	Gaci 2122	-11%	-19%	N/A	N/A	7%	-4%
	A	Pacificorp 2053	-2%	-8%	-8%	-13%	-1%	-2%
	BBB	Lenovo 2032	13%	10%	-5%	-8%	2%	-19%
	BBB	GM 2029	2%	-9%	-9%	1%	-1%	-9%
	BBB	GM 2032	-1%	-4%	-4%	14%	-2%	-8%
	BBB	Niagara Mohawk 2052	0%	5%	-6%	3%	3%	9%
	BBB	EDP 2027	-3%	-6%	-2%	-16%	-2%	7%
	SSA	KEPCO 2026	-19%	12%	2%	5%	0%	23%

## 5. Green bond ETFs

At the end of H2 2022, Climate Bonds was aware of 14 EUR or USD green bond ETFs with combined fund assets of USD1.9bn, a net increase of 11.2% on the prior period. The preceding two periods had accumulated small contractions, the first net outflows experienced

by green bond ETFs. During H2, six funds increased in size, while seven contracted, and one did not have data available. The Franklin Liberty Euro Green Bond ETF grew its net assets by the largest amount (132%), while the Lyxor Green Bond DR UCITS ETF (-46.5%) experienced

the largest contraction. The Lyxor EuroGov Green Bond DR almost double in size in H2. While the fund had the longest duration, it was able to satisfy investor demand for quality, and the diversity of available sovereign green bonds has significantly improved.

ETF name	Currency	Index	Launch date	Size at launch	Local 30 June 2022	USD 30 June 2021	Local 30 Dec 2022	USD 30 Dec 2022	Change on period
Lyxor Green Bond DR UCITS ETF*	EUR	Solactive Green Bond Index	01/02/2017	EUR5m	533.9	559.7	587.2	628.9	12.4%
Van Eck Vectors Green Bond ETF	USD	S&P Green Bond Select Index	01/03/2017	USD5m	82.6	82.6	73.5	73.5	-11.0%
iShares Global Green Bond ETF	USD	Bloomberg Barclays MSCI Global Green Bond Select Index	01/11/2018	USD25m	269.1	269.1	291.1	291.1	8.2%
UC MSCI European Green Bond ETF	EUR	Bloomberg Barclays MSCI European GB Issuer Capped EUR Index	01/11/2018	EUR20m	17.3	18.1	Unavailable	Unavailable	N/A
Franklin Liberty Euro Green Bond ETF	EUR	Bloomberg Barclays MSCI Euro Green Bond Index	01/04/2019	EUR10m	81.2	85.2	184.9	198.1	132.6%
Lyxor Green Bond ESG Screened*	EUR	Solactive Green ESG Bond EUR USD IG TR Index	01/10/2019	EUR4m	158.6	166.3	154.8	165.8	-0.3%
L&G ESG Green Bond UCITS ETF	EUR	JP Morgan ESG Green Bond Focus Index	01/02/2021	EUR22.9	8.1	8.5	6.2	6.7	-22.1%
iShares EUR Green Bond UCITS ETF	EUR	Bloomberg MSCI Euro Green Bond SRI including Nuclear Power Index	25/03/2021	EUR30m	48.4	50.7	59.4	63.6	25.4%
Horizons S&P Green Bond Index ETF	CAD	S&P Green Bond U.S. Dollar Select Index	01/06/2021	CAD6.2m	5.5	4.3	5.4	4.0	-7.0%
Xtrackers EUR Corporate Green Bond UCITS ETF	EUR	Bloomberg MSCI EUR Corporate and Agency Green Bond Index	24/06/2021	EUR20m	148.1	155.3	211.6	226.7	46.0%
Xtrackers USD Corporate Green Bond UCITS ETF	USD	Bloomberg MSCI USD Corporate and Agency Green Bond Index	24/06/2021	USD16.8	233.4	233.4	126.6	126.6	-45.8%
Lyxor EuroGov Green Bond DR*	EUR	Solactive Euro Government Green Bond Index	01/07/2021	EUR48m	63.9	66.9	124.2	133.0	98.7%
Lyxor Corporate Green Bond DR UCITS ETF*	EUR	Solactive EUR USD IG Corporate Green Bond TR Index	24/08/2021	EUR50m	46.2	48.4	24.2	25.9	-46.5%
Franklin Municipal Green Bond ETF	USD	Bloomberg Municipal Bond Index	02/05/2022		111.5	111.5	107.9	107.9	-3.2%
<b>Total Green bond ETF</b>						<b>1748.6</b>		<b>1943.7</b>	<b>11.2%</b>

\* Amundi ETF

## 6. Spotlight: Sovereign Green Bond Club

By the end of 2022, the Climate Bonds GBDB included sovereign green bonds from 29 issuers with a combined volume of USD268.7bn. Of this USD19.8bn had been priced in US dollars, while almost ten times that amount had been issued in EUR (USD197.1bn). This figure includes EUR23bn (USD23.7bn) added in H2 2022.

- Five sovereign green bond reopenings amounted to EUR5.5bn (USD5.6bn)
- Five repeat sovereign issuers priced new bonds with cumulative volumes of EUR19.5bn (USD18.4bn)

- Austria priced the first sovereign green money market instrument in October 2022
- Hungary has priced green bonds in four currencies, the most diverse among the sovereign issuers
- France remains the largest single issuer of sovereign green bonds with EUR52.1bn (USD58.8bn) outstanding at the end of 2022.

### Reopenings

Five sovereign green bonds were reopened in H2 2022.






Five green bonds were reopened in H1 2022

Issuer	Maturity	Date of tap	Size of tap (local)	Size of tap (USD)	Size as of 31/12/2022 (EUR)	Size as of 30/06/2022 (USD)
Republic of France	25/06/2044	07/07/2022	EUR2.3bn	USD2.3	EUR16.5bn	USD15.3bn
	25/07/2028 (IL)	15/09/2022	EUR549m	USD548m	EUR4.5bn	USD4.8bn
Federal Republic of Germany	15/08/2030	20/07/2022	EUR1.5bn	USD1.6bn	EUR9.5bn	USD10.8bn
	22/04/2023	04/08/2022	EUR201m	USD204m	EUR10.6bn	USD12.6bn
Kingdom of Spain	30/07/2022	03/11/2022	EUR971m	USD947m	EUR8.2bn	USD9.3bn
<b>Total</b>			<b>EUR5.5bn</b>	<b>USD5.6bn</b>		

### New bonds

Five sovereign issuers priced new green bonds in H2 2022. All were repeat issuers, and all the deals were EUR denominated. No USD denominated green sovereign bonds were priced during the period.

Sovereign Scorecard H2 2022

	Germany 	Belgium 	Italy 	Austria 	Hungary 
Coupon & Maturity	1.3% 15/10/2027	2.75% 22/04/2039	4% 30/04/2035	Zero 23/03//2023	5% 22/02/2027
Pricing Date	31/08/2022	14/09/2022	06/09/2022	18/10/2022	14/11/2022
Tenor	5	17	13	0.5	5
Amount issued	EUR5bn/USD5bn	EUR4.5bn/USD4.5bn	EUR6bn/USD6bn + EUR2bn/USD2bn	EUR1bn/USD1bn	EUR1bn/USD1bn
<b>Total green bonds at 31/12/2022</b>					
Number of bonds	5	2	2	3	9
Total size of green bonds	EUR37.5bn/USD42.7bn	EUR15.1bn/USD17bn	EUR21.5bn/USD24bn	EUR6bn/USD6.3bn	USD4.8bn
% of sovereign debt (market data from Bloomberg as of 31/12/2022)	2.2%	3.3%	0.9%	1.6%	3.6%

## Germany

Germany uses a twin structure to price its green bonds, issuing a vanilla bond, and later a green version, sharing similar characteristics.



Germany's fifth green bond, a second 5-year deal (Bobl), was priced in August 2022 via syndicate. The target size of the deal was EUR6bn (USD6bn) and the book closed at EUR14bn. The spread was revised down by 2bps, and the deal size was set at EUR5bn (USD5bn). The twin curve was slightly outside the green curve as of 31 August 2022 and the new Bobl priced inside its twin with a greenium of 1.25bps. The German DMO does not share data on green investor participation but noted that there was high allocation to real-money accounts including central banks and official institutions (24%).

The vanilla twin had been issued through an auction at the end of June, with an original size of EUR4bn (USD4bn). The book covered the transaction size once. The bond was subsequently reopened six times, and by the end of 2022 had reached EUR27bn (USD27bn).

## Belgium

Belgium was the second DM sovereign (after France) to bring a green bond when it priced its 2033 deal in 2018. The sequel green bond came in September 2022, a EUR4.5bn (USD4.5bn) 17-year tenor, priced via syndicate. This attracted an order book of EUR32bn and achieved 2bps price tightening pricing with a small new issue premium (6bps over the June 2032 deal). More than 60% of the deal was allocated to investors describing themselves as green and the book included high participation from real-money accounts.



The size was the largest possible based on identified green expenditures in the state budget.

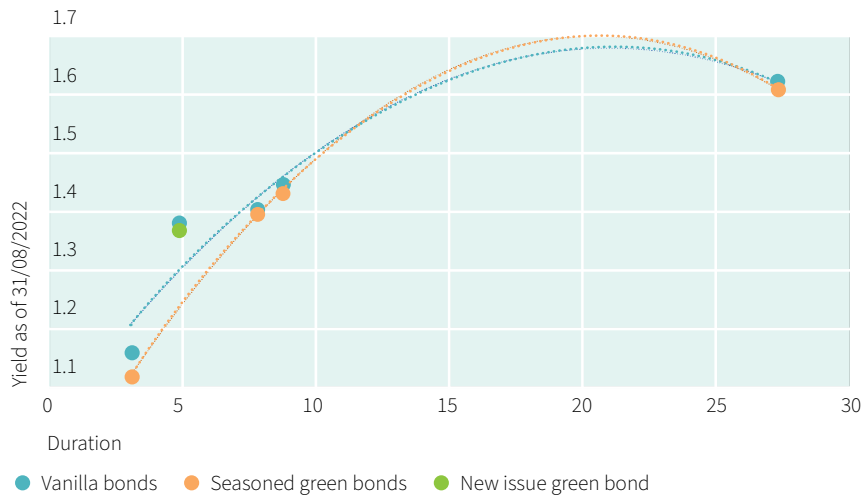
Belgium published its updated green finance framework in June 2022. Five eligible project categories were identified, corresponding with the six environmental objectives of the EU Taxonomy: Energy Efficiency (including Green Buildings); Clean Transportation; Renewable Energy; Circular Economy; and Living Resources and Land Use.

## Italy

Italy priced its second green sovereign in September, an EUR6bn (USD6bn) 13-year bond. Orders of EUR40bn were accumulated, covering the original transaction size by 6.6 times and enabling 2bps of spread tightening. The order book included high participation from investors describing themselves as green to whom



## Germany's green curve sits inside vanilla



Source: Bloomberg

55% of the deal was allocated. The bond priced with a small new issue premium and was tapped for a further EUR2bn (USD2bn) in November.

## Austria

Austria priced its first green sovereign in May 2022, a EUR4.5bn 2049 deal. Later in the year, it became the first country to issue a green Treasury Bill when it priced a 126-day maturity deal via auction in October 2022. The EUR1bn transaction attracted a bid/cover ratio of 2.69 times, which is more than the 2.12 times average for other Austrian T-bills priced in 2022. Green investors comprised 85% of the book and were mainly central banks and money market funds. The deal obtained a greenium of 2bps according to the Austrian Treasury. The instrument is expected to be rolled over when it matures in February 2023.



According to Bloomberg, at the beginning of 2023, the short-term debt market, comprising

instruments with a residual maturity of one year or less at issuance, stood at USD13tn. Climate Bonds published *A Discussion Paper: Certification of Short-Term Debt* in June 2022 describing how whole entity Certification could increase the variety and scope of green instruments available to investors while maintaining the integrity of the green label.<sup>5</sup>

## Hungary

Hungary has issued seven green bonds in a mixture of JPY, CNY, HUF, and EUR. In November 2022, it added an eighth deal, its second in EUR, a EUR1bn 2027 maturity priced through a syndicate. The bond obtained interest of four times its size, and the spread was revised down by 35bps during book building. The bond priced with a small new issue premium, and after 28 days had tightened by ten percent, rising to 20 percent by year end. The combined volume of Hungary's green liabilities had reached USD4.8bn by the end of 2022.



## European Union

In November 2022, the European Union (EU) priced its fourth green bond, by syndicate. Despite the ongoing market volatility, the EUR5bn transaction attracted a book of EUR41.9bn, covering the deal seven times which enabled spread revision of 2bps. Investors describing themselves as green received 46% of the allocations. On the same day, the EU priced a smaller (EUR2.5bn) 30-year vanilla deal which covered its book by 11.8 times. Each tranche priced with a small new issue premium.



Since June 2021, Climate Bonds has monitored the book size of 16 EU transactions.

The average book cover was 9.1 times, with a high of 16.1 times (achieved on a EUR3bn 30-year social deal priced in March 2022) and a low of 3.8 times (for a EUR3bn 15-year social bond priced in December 2022).

The EU is expected to become the largest issuer of green bonds globally, and by the end of 2022 had issued EUR36.5bn (USD39.9bn) under the green label. The EU seeks to provide a regular supply of green bonds to the market, while also taking into consideration the prevailing market conditions and the green expenditures as reported by Member States. To ensure predictability and as part of its open and transparent communication to markets, the European Commission regularly publishes the timing of the expected syndicated transactions.



## 7. Spotlight: Relative values: where the greenium persists

Prepared by Caroline Harrison (Climate Bonds), and María Gonzalez-Ramirez (University of Texas at San Antonio)

Climate Bonds partnered with the University of Texas at San Antonio (UTSA) to determine whether green bonds priced tighter than vanilla equivalents in H2 2022. The results of this work suggest that green and bonds bearing other thematic labels—including sustainability, social, and sustainability-linked bonds (SLBs)—did price tighter than vanilla equivalents during the observation period.

Climate Bonds developed and uses the term *greenium* which describes a green bond that has priced inside its own yield curve in the primary market (new issue discount), and has been monitoring its presence since 2017. The existence of a *greenium* implies that the issuer has obtained cheaper funding for its new bond compared to prevailing rates.

The Russian invasion of Ukraine in 2021 and subsequent energy price shocks led to interest rate increases pushing up yields on all categories of bonds. In H1 2022, Climate Bonds built yield curves for 50 bonds, of which ten (20%) priced inside their yield curves. This was the lowest incidence since the 19% observed in H1 2019 and way off the high of 61% which occurred in H2 2020. However, green bond pricing dynamics in the primary market remained strong with green bonds continuing to achieve higher book cover, and greater spread compression, and green bonds tightening by a larger magnitude than vanilla equivalents 7- and 28-days after pricing, on average. Climate Bonds suspected that this translated into relatively tighter pricing so that where a new issue premium was present, its magnitude was smaller for green bonds than vanilla equivalents.

To make this determination, Climate Bonds and UTSA analysed bonds priced in H2 2022. From a universe of 407 EUR and 503 USD denominated bonds priced between 01 July and 31 December, Climate Bonds constructed yield curves for 259 EUR bonds (63%), and 289 USD bonds (57%). Climate Bonds then calculated a theoretical yield for each subject bond using linear interpolation. The difference between the theoretical yield and the observed yield was the new issue premium if positive, or *greenium* if negative.

The incidence of *greenium* in the sample is described above for bonds plotted against vanilla curves.

The UTSA team then applied a matched pair analysis to compare the new issue premium/greenium of green and other types of labelled bonds with their nearest-neighbour vanilla equivalents. The matching process was performed using Mahalanobis distance to find an environmentally labelled bond's closest vanilla counterpart in terms of currency, maturity bucket, credit rating bucket, and ultimate parent country of risk.<sup>7</sup> This procedure yielded a total of seven SLB pairs, 49 green bond pairs, two social

Against vanilla curves	EUR			USD		
	Sample size	Number of bonds pricing through vanilla curve	%	Sample size	Number of bonds pricing through vanilla curve	%
Green	28	4	14%	5	0	N/A
Social	8	2	25%	1	0	N/A
Sustainability	7	1	1%	7	2	29%
SLB	4	0	N/A	3	0	N/A
Vanilla	174	20	11%	258	5	2%
Green not aligned	15	1	8%	7	0	N/A
	<b>233</b>	<b>28</b>	<b>12%</b>	<b>281</b>	<b>9</b>	<b>3%</b>

bond pairs, and 12 sustainability bond pairs. Typical pair matching exercises compare bonds from the same issuer, but this usually means that recency is compromised. **Climate Bonds and UTSA compared bonds priced in the same six-month period ensuring similar market conditions, which is particularly relevant given the recent volatility.**

The pairs were then used to compute average treatment effects—or the differential mean spread between environmental and vanilla bonds. Spread in this context means the difference between a bond's actual yield and interpolated yield. This revealed all types of environmentally labelled bonds presented lower average spreads relative to their vanilla comparables. **Spreads, on average, were lower by 10 basis points for SLBs, 47 basis points for social bonds, 22 for sustainability bonds, and 48 basis points for green bonds compared to those of nearest neighbour vanilla equivalents.**

While the sample size was small, the results suggest that even though the incidence of the outright *greenium* had diminished under prevailing market conditions, green bonds were still achieving relatively tighter pricing compared to vanilla equivalents. For green bonds, this is consistent with the results of other analysis described in this report, i.e., green bonds achieve larger book cover, and large spread compression in the primary market compared to vanilla equivalents. The higher demand translates into relatively tighter pricing.

The relative scarcity of labelled bonds contributes to this tighter pricing, driven by higher demand in the primary market. As regulation continues to support green bond issuance and underpins the market with the required integrity to maintain credibility, Climate Bonds expects this to persist.

### Yield curve methodology

Subject bonds had an original issue size of at least USD475m, vanilla structure, denominated in either EUR or USD, and priced between 01 July 2022 and 31 December 2022.

Climate Bonds plotted each subject bond on its own yield curve, constructed using existing bonds from the same issuer sharing the same characteristics as the new issue (subject) bond:

- Ticker
- Currency
- Seniority
- Minimum amount outstanding of USD475m
- Parent country of risk
- No other thematic label
- Priced after 01 July 2014
- Bullet Bonds, with vanilla structures

For the subject bond, yield-on-issue-date was used, reflecting the price that the green bond

offered on the pricing date. For comparable bonds, yield-to-convention-mid was used.

For all bonds, modified duration to mid was used, and all the data was as of the pricing date of the green bond. The modified duration is the percentage price change of a security for a given change in yield. The modified duration increases with risk.

Seasoned vanilla bonds were plotted and a 2nd order polynomial yield curve was fitted. Next, labelled bonds were overlaid and finally, the subject bonds. Other bonds priced on the same day as the subject bonds were also plotted separately. Only yield curves of bonds in our sample with a minimum of two comparable bonds were included (one with a shorter duration, and one with a longer duration than the subject).

### Reference

Gary King and Richard Nielsen. 2019. "[Why Propensity Scores Should Not Be Used for Matching](#)." *Political Analysis*, 27, 4, Pp. 435-454

## 8. Outlook

The market volatility, which started in H1 2022 with the Russian invasion of Ukraine, continued into the second half of the year as high energy prices, and rising inflation extended into warnings of a global recession. During the final six months of 2022, USD204bn of green bonds were added to the Climate Bonds GBDB denominated in 25 currencies. Two thirds of the volumes (66%) were priced in EUR (USD96.2bn) and USD (USD38.6bn).

While prevailing market conditions did not favour bond markets, our analysis demonstrated that green bonds continued to experience relatively strong pricing dynamics. Green bonds in both EUR and USD attracted higher book cover on average compared to vanilla equivalents, they also experienced larger spread compressions in the primary market. Further, on average, green bonds tended to tighten more aggressively than vanilla equivalents and indices in the immediate secondary market. Bonds pricing inside their yield curves became much less common than in prior periods. This is as one would expect given the broader context, and in some cases, issuers reported that the green label helped to get their deal over the line, in itself an achievement in a

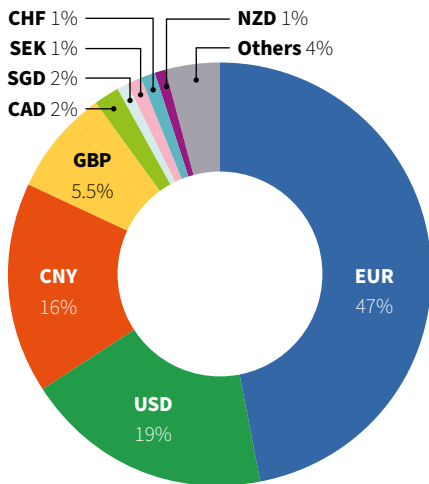
period when scheduled deals were being taken off the table at the last minute, and during which there were several stretches in both the USD and EUR markets which saw no deals at all. Within our sample of 66 non-sovereign bonds, just four priced inside yield curves in H2. However, Climate Bonds analysis in partnership with UTSA suggests that labelled bonds of all types did price closer to their yield curves than matched vanilla pairs. Climate Bonds analysis finds that participation of investors describing themselves as green reached 67% and has roughly remained similar for the past three observation periods, suggesting that issuers can rely on this strong appetite from dedicated investors.

In 2023 Climate Bonds expects that the green bond market will continue to support the accelerated transition to clean energy kickstarted by the Russian invasion of Ukraine, particularly in Europe. In its recent market blog, Climate Bonds predicted *5 Big Directions for Sustainable Finance in 2023* noting that the US Bipartisan Infrastructure Laws (BILs), which will provide tax cuts and grants for clean energy will facilitate a new raft of investment to green projects.<sup>8</sup>

This analysis is based on a limited number of green bonds, chosen according to the parameters outlined on page 17. Green bonds issued in other currencies, structures, formats, and sizes may perform differently from those discussed in this paper.

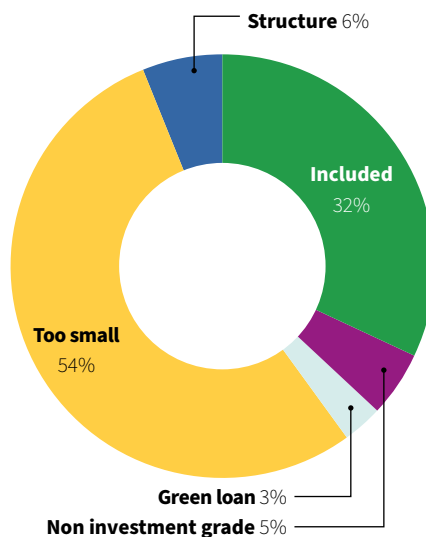
Climate Bonds started monitoring green bond pricing in 2016, and after six years 680 securities had been included in the analysis. As the profile of green bonds has evolved in the intervening period, pricing dynamics have also changed. Observations made five years ago will almost certainly not pertain to the current market which is rapidly developing. Climate Bonds will continue to monitor the behaviour of green bonds in the primary and immediate secondary market.

EUR or USD took two thirds of green bonds priced in H2



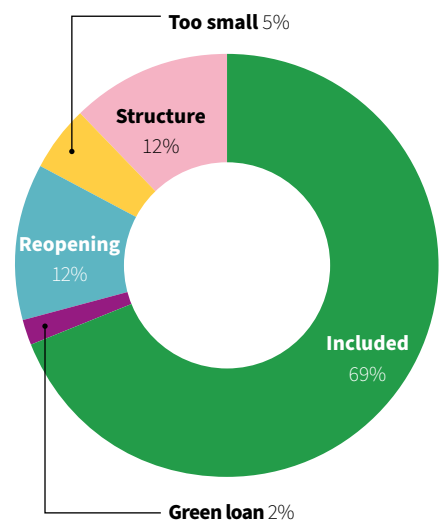
Source: Climate Bonds Initiative

32% of USD volume was eligible for analysis



Source: Climate Bonds Initiative

69% of EUR volume was suitable for analysis



Source: Climate Bonds Initiative



## Methodology

This paper includes labelled green bonds issued during H2 2022. Labelled green bonds meeting the following specifications are included:

Announcement date between 01 July 2022 and 31 December 2022

Currency: EUR or USD

Benchmark size i.e., >= USD500m

Investment grade rated

Minimum term to maturity of three years at issue

Consistent with the Climate Bonds Taxonomy and included in the Climate Bonds GBDB

Amortising, perpetual, floating rate, and other non-vanilla structures were excluded. These parameters are designed to capture the most liquid portion of the market while not limiting the diversity of data.

All historical data is based on asset swap spreads for EUR denominated bonds. USD bonds are compared to a US treasury curve. All historical data is from Refinitiv EIKON.

**Comparable baskets** include bonds issued in the same quarter as the subject green bond. Comparable bonds must fit the parameters described above except that they are not labelled and the UoP is not explicitly green, and they must not have been priced prior to 2014. Baskets comprise the closest possible matches based on the following considerations in order of priority: a) currency, b) market type (EM/DM/SNAT/Sukuk), c) no other thematic label, d) seniority, e) maturity, f) credit rating and g) sector. If corresponding bonds cannot be found, best efforts are made to find suitable alternatives from the available sample. The resulting baskets are a proxy for how the money could have been invested in the same quarter in which the green bond was issued. The number of bonds in each basket ranges from one to seven bonds. We acknowledge that bonds behave differently depending on when they are issued and that geopolitical events can affect bond prices from one day to the next. This proxy was designed to circumvent the fact that vanilla bonds and green bonds with similar characteristics are rarely issued on the same day.

## Endnotes

1. MSCI <https://www.msci.com/market-classification>
2. <https://www.climatebonds.net/resources/reports/green-bond-pricing-primary-market-h2-2020>
3. Ald Automotive Green and Positive Impact Bond Framework, June 2022, [LinkClick.aspx\(aldautomotive.com\)](LinkClick.aspx?aldautomotive.com)
4. Volkswagen Group, Green Finance Framework 2022, October 2022, [Volkswagen Group - Green Finance Framework 2022 \(volkswagenag.com\)](Volkswagen Group - Green Finance Framework 2022 (volkswagenag.com))
5. Statkraft Green Financing Framework, April 2022.
6. Discussion Paper: Certification of Short-Term Debt, Climate Bonds Initiative, June 2022, <Discussion Paper: Certification of Short-Term Debt | Climate Bonds Initiative>
7. Mahalanobis distance is a multivariate distance computation that accounts for correlation between matching variables in quantifying the closeness between two bonds. For more details on this computation and why we use it, refer to King & Nielsen (2019).
8. Climate Bonds, *2022 Market Snapshot and 5 big directions for sustainable finance in 2023*, January 2023 <2022 Market Snapshot: And 5 big directions for sustainable finance in 2023 | Climate Bonds Initiative>

The logo for the Climate Bonds Initiative, featuring the words "Climate Bonds" in a large, white, serif font, with "INITIATIVE" in a smaller, white, sans-serif font above the word "Bonds". The text is set against a dark blue rectangular background.

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