Tracing carbon-intensive debt

IDENTIFYING AND CALIBRATING CLIMATE RISKS IN CORPORATE FIXED INCOME

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Executive summary

This paper investigates the debt financing of carbon-intensive companies, examining approximately 7.8 million securities issued between 2000 and June 2023. Analysing complex corporate structures with the help of graph-based algorithms, we identify over 480,000 carbon-intensive corporate debt instruments – including more than 84,000 'hidden' securities issued by subsidiaries and special purpose vehicles (SPVs) conventionally classified outside of carbon-intensive sectors.

With a total of US$5.5 trillion outstanding as of June 2023, carbon-intensive debt remains an important feature of global fixed income markets, accounting for 29.5% of total non-financial corporate debt, and in aggregate would surpass the size of any other non-financial sector. Compared to listed equities (where the same carbon-intensive sectors accounted for 19.6% of global market capitalisation excluding financials) this also makes corporate fixed income significantly more carbon-intensive as an asset class.

Our analysis also shows that carbon-intensive debt securities tend to be larger with a longer tenor and attract higher credit ratings than other non-financial corporate debt. While approximately US$1.9 trillion carbon-intensive debt is owed by listed companies – whose transition plans are often closely tracked by investors and other stakeholders – almost two-thirds of carbon-intensive debt is owed by privately held companies (US$2.1 trillion) or state-owned enterprises (US$1.5 trillion), both of which are often subject to much less scrutiny.

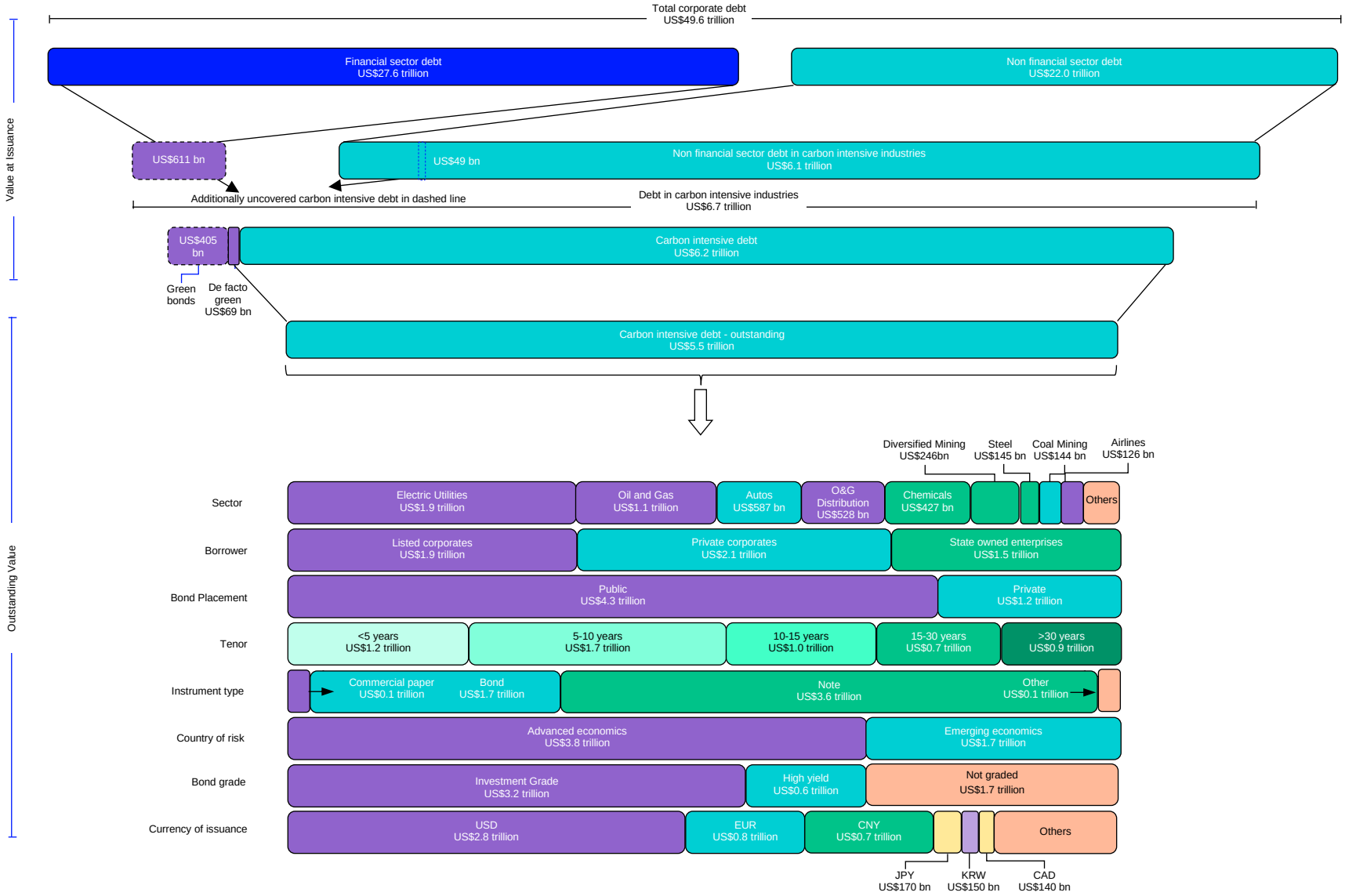
Against the backdrop of an accelerating low-carbon transition, refinancing carbon-intensive debt presents issuers and investors with increasingly urgent and complex challenges. Our data shows that over half of carbon-intensive debt is set to mature before the end of this decade, with global fixed income markets needing to refinance approximately US$600 billion each year. At the same time, carbon-intensive issuers have increasingly relied on shorter-term debt to finance their activities – with the weighted average tenor of annual carbon-intensive debt issuance dropping from 7.4 years in 2010 to 4.2 years in 2022.

Faced with growing regulatory pressure and an uncertain long-term demand outlook, carbon-intensive businesses may choose to pursue varying refinancing strategies. Notably, we find that green debt (including both labelled and de facto green bonds) still plays a limited role in carbon-intensive sectors, accounting for 8.2% of 2022 issuance and 7.7% of the sectors' total outstanding debt. We also find that carbon-intensive sectors' green debt is mainly concentrated in Electric Utilities and Autos – with a combined approximate 85% share by outstanding amount. By contrast, in sectors such as Oil & Gas, Aluminium, and Airlines where the transition is less advanced, green debt plays a much smaller role, making up less than 1% of each sector's total outstanding debt.

Our other key findings include:

- In 2022 alone, US$1.4 trillion of carbon-intensive debt was raised through over 35,000 individual debt securities.
- Energy companies account for roughly two-thirds of carbon-intensive debt, with Electric Utilities at the top (with US$1.9 trillion outstanding), followed by Oil and Gas (US$1.1 trillion).
- The share of emerging markets (EMs) in annual issuance of carbon-intensive debt has increased from 4% in 2000 to 41% in 2022, and EMs now account for a third of the outstanding debt.
- Only 20% of carbon-intensive debt issued in 2022 was US$-denominated (down from 54% in 2000). Meanwhile, CNY-denominated debt now accounts for one-third of the total new issuance in the same year.
- US and Chinese corporates account for approximately US$2.6 trillion of outstanding carbon-intensive debt, but the share of carbon-intensive debt in their respective corporate bond market is below the global average. In contrast, carbon-intensive debt makes up over two-thirds of the non-financial corporate debt in Saudi Arabia, Russia and Indonesia.
- The outstanding carbon-intensive debt is dominated by an investment grade (IG) rating with US$3.2 trillion (or 59%), while the US$0.6 trillion worth of high-yield (HY) debt accounts for 10%, and the remaining US$1.7 trillion (or 31%) is not rated (NG).
- Carbon-intensive sectors have a greater concentration of long-term debt, with 46% of the outstanding carbon-intensive debt issued having a tenor longer than 10 years and 16% exceeding 30 years, compared to 39% and 12%, respectively, in other non-financial corporate debt.

Exhibit 1: Overview of active carbon-intensive debt universe as of June 2023



Measuring carbon-intensive debt in fixed income portfolios

There are many ways investors can address climate risks in fixed income portfolios, including financing issuers that deliver climate solutions, divesting from bonds that are linked to carbon-intensive activities such as coal fired power generation or shifting assets towards labelled bonds that fund issuers' transition plans. While there has been an exponential increase in volumes of labelled green bonds in the last decade and they have been considered a means to hedge against climate change risks,[1] calibrating exposure to carbon-intensive debt and the associated risks is arguably even more important.

However, due to the complexity of fixed income markets – which are composed of millions of securities issued by tens of thousands of issuers and special purpose vehicles (SPVs) whose ownership structure can be opaque – investors often struggle to identify and track exposure to bonds that are associated with carbon-intensive activities.

In this paper, we developed a methodology to systematically track carbon-intensive fixed income holdings – identifying 482,931 carbon-intensive debt securities issued between January 2000 and June 2023 with US$21.5 trillion cumulative issuance and US$5.5 trillion outstanding as of 30 June 2023.

Our starting point is the LSEG fixed income and corporate ownership database, which comprises over 9.3 million corporate debt securities issued since 1900 and associated metadata including issuers' ownership and instruments information.[2] These debt securities include but are not limited to bills, bonds, notes, negotiable certificates of deposit, commercial paper, debentures, money market instruments and similar instruments normally traded in financial markets.[3] Securitisation, loans, and derivatives, such as synthetic collateralised debt obligation, are not included in this research (see Appendix A).

We focus on the approximate 7.76 million debt securities that were issued between January 2000 and June 2023 as our research universe. We then set out to systematically identify carbon-intensive debt securities among them, proceeding in four key steps:

1. We use the Transition Pathway Initiative (TPI)'s definition of Carbon Intensive Sectors that comprises 13 sectors across Energy, Transport, Industrials and Materials, etc, and map these sectors to the TRBC Classification system[4].
2. We then identify issuers that match the respective TRBC codes in carbon-intensive sectors and flag all debt securities issued by them (403,011 debt securities in total) (Appendix B provides the TPI definitions on carbon-intensive sectors and the mapping to TRBC sectors).
3. Further, we identify additional debt securities as carbon-intensive where the issuing entity is not classified in a carbon-intensive sector, but is a subsidiary or a related entity to a parent active in such a sector. This requires systematically analysing intricate (and occasionally concealed) corporate structures. We rely on an innovative graph-based approach for this (see Box 1), identifying 84,238 additional bonds.
4. Finally, we carve out 4,318 bonds in two segments from the results. These include 1) labelled green bonds from carbon-intensive issuers, as their proceeds are usually earmarked for climate mitigation and resilience purposes, and 2) de facto green bonds, which are normal bonds issued by clean technology companies operating within carbon-intensive sectors, e.g. any bond from Wind Electric Utility would not be considered as carbon-intensive debt.

The resulting universe forms the carbon-intensive debt securities in this research (see Exhibit 3), and we use it to analyse the key characteristics and trends around carbon-intensive debt, presenting the results in the following chapters.

[1] The World Bank. (2021) 'What You Need to Know About IFC's Green Bonds'. Available at: https://www.worldbank.org/en/news/feature/2021/12/08/what-you-need-to-know-about-ifc-s-green-bonds (Accessed: 10 Jan 2024)
[2] This research is based on two datasets obtained from the LSEG Workspace. The fixed income dataset provides a comprehensive coverage of historical and global debt securities. The corporate ownership dataset provides the structural details associated with any given entity.
[3] This research uses 'debt securities' or 'debt' to refer to various types of fixed income instruments that have been covered. Appendix A provides details on the scope of issuer types and scope of instrument types. Please note while sometimes loan is considered a type of debt, this research does not include any loan deal in the analysis.
[4] LSEG Business Classification (TRBC). Available at: https://www.lseg.com/en/data-analytics/financial-data/indices/trbc-business-classification

Box 1: Uncovering 'hidden' carbon-intensive debt – an algorithmic-based graph approach

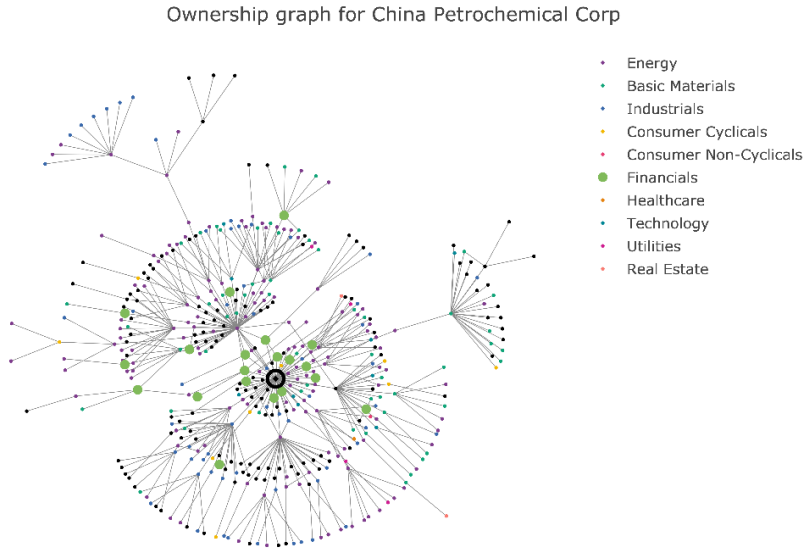
In contrast to equity markets, where a company issues at most a handful of listed equity lines, it can issue large numbers of debt securities. Given the nature of fixed income markets, these debt securities are sometimes issued through subsidiaries and related entities such as special purpose vehicles (SPVs).

Neglecting these complex ownership structures can produce misleading results when analysing climate risks in fixed income portfolios. Indeed, assessing securities purely based on the sector classification of the issuing entity can overlook debt from entities that are commonly classified as 'Financials' or other sectors that are usually not considered as carbon-intensive. In the case of China Petrochemical Corp (or Sinopec) – one of the world's largest integrated energy and chemical companies whose ownership structure is illustrated in Exhibit 2 – only 101 (or 6%) out of the total 1,701 debt securities issued across the company since 2000 were by subsidiaries classified in the Oil and Gas sector. The remaining 1,600 debt securities were issued by subsidiaries that are commonly classified as 'Financials'.

To address this challenge, we used an algorithmic-based graph approach to systematically classify and aggregate debt securities across complex ownership structures. Overall, this approach allows us to identify an additional 84,238 carbon-intensive debt securities with a total cumulative principal value of US$3.3 trillion or about 15% of the total carbon-intensive debt universe (see Exhibit 3), of which US$660 billion remained outstanding as of June 2023.

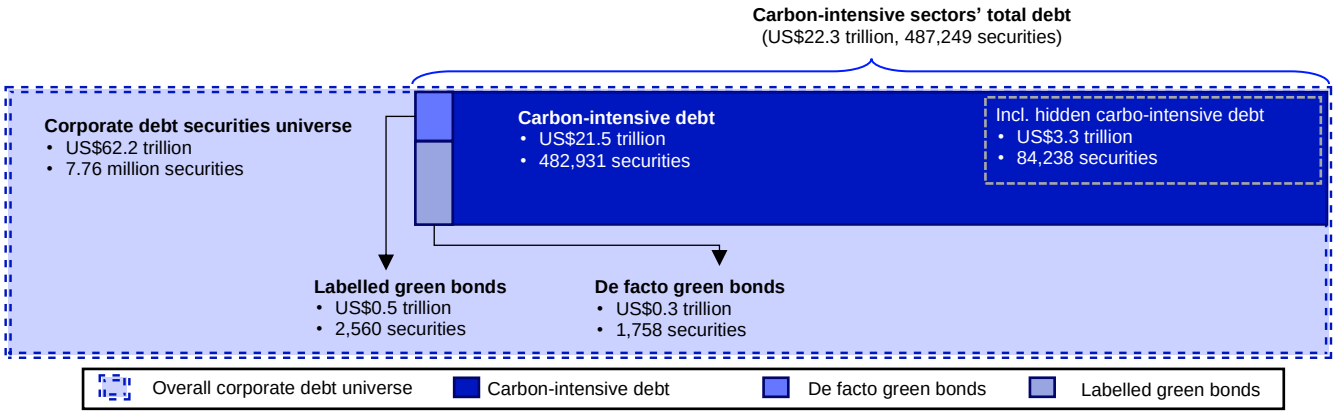
This approach also provides a new perspective of ranking the entities that are involved in carbon-intensive debt financing, by considering carbon-intensive debt securities aggregated across the entire ownership structure. Taking this approach enables investors and other stakeholders to engage more effectively with the largest groups/parent entities rather than each of subsidiary or debt-issuing vehicles.

Exhibit 2: Ownership tree for China Petrochemical Corp



Source LSEG, 2024. Note: China Petrochemical Corp is marked by ⊙ in the centre. Colour of node represents TRBC Economic Sector of organisation. Financial subsidiaries are highlighted by a green dot.

Exhibit 3: Research process and the scope of carbon-intensive debt (historical issuance from January 2000 to June 2023)

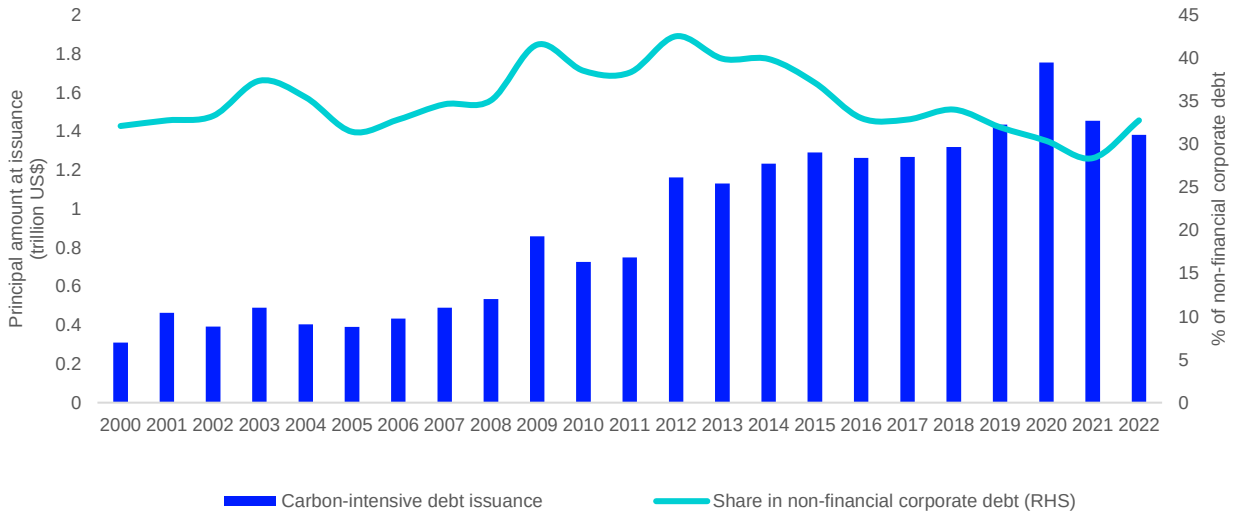


Source: LSEG, 2024. Note: both active and inactive debt issued between January 2000 and June 2023 are included. Size of the areas represents cumulative principal value in US$.

Carbon-intensive debt 101

Despite the accelerating low-carbon transition, debt financing of carbon-intensive economic activities remains an important feature of global fixed income markets. In 2022 alone, 1,950 entities in carbon-intensive sectors issued over 35,000 debt securities with a total volume of US$1.38 trillion at issuance. This amount accounts for approximately one-third of total non-financial corporate debt issuances (see Exhibit 4) and is approximately 2.5 times higher than the total labelled green bonds issuance (including those issued by sovereigns, financial institutions and multilateral lenders) in the same year.[5]

Exhibit 4: Annual issuance of carbon-intensive debt (by principal amount)



Source: LSEG, 2024

Cumulatively, US$21.5 trillion of carbon-intensive debt had been issued between January 2000 to the end of June 2023, with the share of annual carbon-intensive debt issuance in the overall non-financial corporate debt issuance fluctuating between 28% to 43% (see Exhibit 4). Aggregated into a standalone category, the outstanding amount of carbon-intensive debt stood at US$5.5 trillion as of June 2023, and would surpass the value of debt of any other non-financial sector (see Exhibit 5).[6]

This makes corporate fixed income as an asset class significantly more carbon-intensive than equity markets. Indeed, as of June 2023, listed corporates in carbon-intensive sectors accounted for 19.6% of total global equity market capitalisation[7] and just 14% of new IPO volume.[8] In comparison, their debt represented almost a third (29.5%) of the total non-financial corporate debt outstanding and 33% of newly issued debt in 2022.

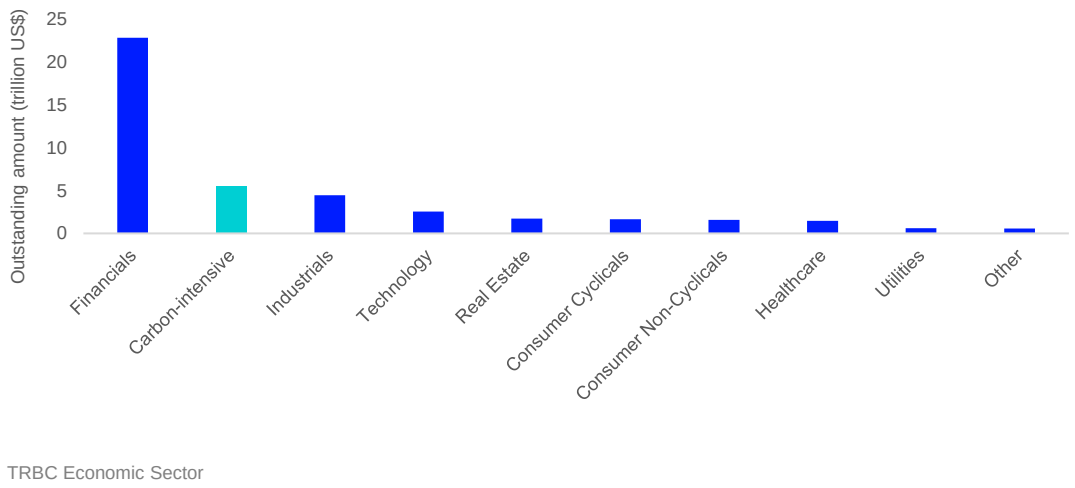
While approximately US$1.9 trillion in outstanding carbon intensive debt is owed by listed companies (including US$1.5 trillion owed by large caps) – whose transition plans are often subject to detailed analysis by investors and other stakeholders – almost two-thirds of carbon-intensive debt is owed by privately held companies (US$2.1 trillion) or state-owned enterprises (US$1.5 trillion), which are often subject to much less scrutiny.

Compared to the overall corporate fixed income market, however, many institutional investors' holdings may have significantly less exposure to carbon-intensive debt, raising questions about potential 'carbon leakage'[9]. For instance, as of June 2023, the FTSE World Broad Investment-Grade Index (WorldBIG) Corp Index[10] includes US$1.97 trillion in carbon-intensive outstanding, with the remaining approximate US$3.5 trillion of carbon-intensive debt failing to meet the index eligibility criteria – due to being non-graded, high-yield or currency denomination. Accordingly, this means that the FTSE WorldBIG Corp Index's exposure to carbon intensive sectors, in terms of the share of outstanding debt (including the 'hidden' carbon-intensive debt that we were able to uncover using

[5] If we remove green bonds issued by sovereigns, multilateral development banks and financials, the 2022 annual issuance of carbon intensive debt is 8.6 times higher of their equivalent non-financial corporate green bonds.
[6] Sectoral categorisations are based on the LSEG Business Classification (TRBC). Available at: https://www.lseg.com/en/data-analytics/financial-data/indices/trbc-business-classification
[7] Calculated by comparing the market capitalisation of the 13 carbon intensive sectors in the FTSE Global Total Cap Index with the index's total market capitalisation excluding Financials.
[8] Calculated by comparing the volume of IPOs from the 13 carbon intensive sectors with the total volume of IPOs from the same period (2000-2023).
[9] Carbon leakage occurs when regulatory pressure causes emissions to be displaced to entities with less stringent standards.
[10] LSEG. (2023) FTSE Fixed Income Guide. Available at: https://www.lseg.com/content/dam/ftse-russell/en_us/documents/ground-rules/ftse-fixed-income-indices-guide.pdf (Accessed: 15 Dec 2023)

the graph-based approach), is at just below 20%. This percentage is very similar to equity markets' in terms of market capitalisation share.

Exhibit 5: Carbon-intensive debt compared to other corporate sectors' debt (by outstanding amount)

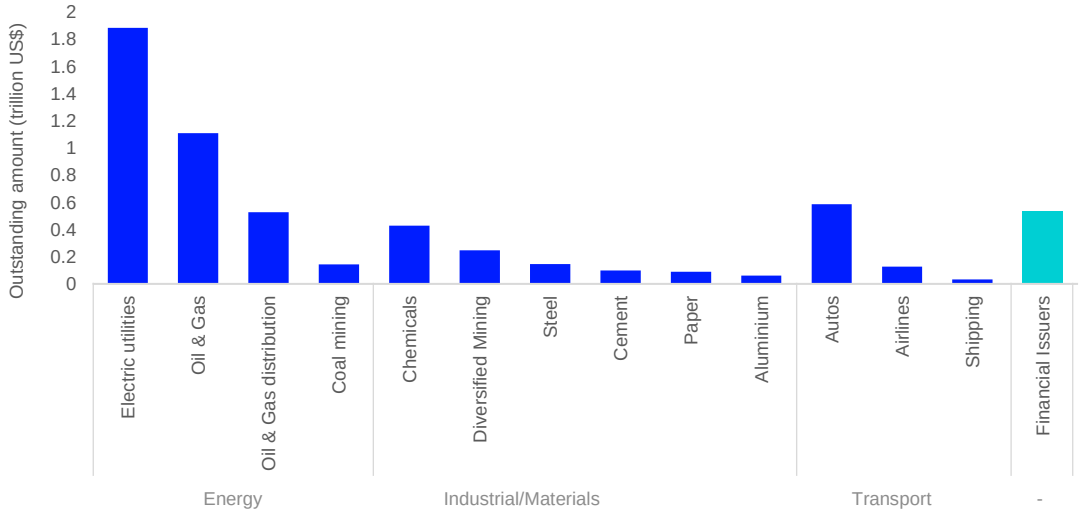


Source: LSEG, 2024

Note: To avoid double counting, carbon-intensive debt securities have been carved out from the conventional sectoral classification. For example, the Utilities sector in the graph above contains only debt securities from companies involved in non-carbon intensive activities (such as renewable energy).

Energy companies account for roughly two thirds of carbon intensive debt, with a total of over US$3.66 trillion outstanding (see Exhibit 6). Within the Energy sectors, Electric Utilities stand out as the biggest issuers, with a total of US$1.88 trillion debt outstanding. The Industrials & Materials sector comprises the next largest group of carbon-intensive debt, with a collective outstanding of US$1.07 trillion. Issuers in the Transport sectors, including Autos, Airlines and Shipping account for US$746 billion in carbon-intensive debt outstanding. Financial entities that are tied to parent companies operating in carbon-intensive sector directly issued an additional US$530 billion worth of debt – which could have been missed by a conventional sectoral-based research approach.

Exhibit 6: Breakdown of carbon-intensive debt across TPI sectors



Source: LSEG, 2024

Note: 'Financial Issuers' are entities classified as 'Financials' in conventional industry classifications but are subsidiaries of those in any of the 13 carbon-intensive sectors.

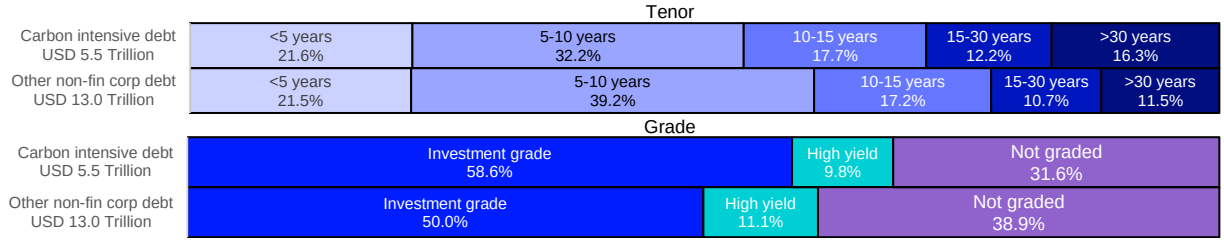
CARBON-INTENSIVE BONDS ARE LARGER, HAVE LONGER MATURITIES AND ATTRACT HIGHER RATINGS

With an average issuance size of US$235 million, carbon-intensive debt is typically larger than other non-financial corporate debt (average size is US$185 million). This includes some of the largest bonds issued by non-financial corporates, including the 15-year US$14.9 billion bond issued by the Aluminium Corporation of China in 2017 (which is the largest non-financial corporate bond with over 10-year tenor), and the US$8 billion 30-year bond issued by Petroleos Mexicanos in 2020.

Carbon-intensive debt also tends to have longer payback periods and attracts higher credit ratings than debt issued by other non-financial corporates. Among the US$5.5 trillion outstanding of carbon-intensive debt, 46% was issued with a maturity of 10 years or longer, and 16% with a 30-year-plus tenor – compared to 39% and 12%, respectively, for other non-financial corporate debt (see Exhibit 7).

Similarly, around 59% of the outstanding carbon-intensive debt is investment grade, compared to 50% in the other type of non-financial corporate debt. For carbon-intensive debt with a 15-year-plus tenor the share of investment grade rises to 78% – not least because issuers of longer-term debt are typically seeking credit ratings to assure investors of their ability to fulfil the financial obligations over a longer horizon.

Exhibit 7: Tenor and grade breakdown of carbon-intensive debt and other non-financial corporate debt



Source: LSEG, 2024

Nonetheless, the greater supply of long-term and investment-grade debt in the carbon-intensive debt universe implies that investors with longer investment horizons – who typically allocate funds to long-term debt securities and hold them until maturity – may face increased exposure to climate transition risk. The energy transition envisioned in the International Energy Agency's (IEA's) Net Zero Scenario, for example, predicts a significant contraction of oil and gas demand, with oil demand falling by 74% and natural gas demand falling by 57% in the period of 2020 to 2050. As a result, this might imply significant risks on the value of long-term debt tied to carbon-intensive activities and issuers.[11]

[11] IEA. (2021) 'Net Zero by 2050 - A Roadmap for the Global Energy Sector'. Available at: https://www.iea.org/reports/net-zero-by-2050 (Accessed: 15 Dec 2023)

Table 1: Top five issuers with the most outstanding debt in each carbon-intensive sectors (by US$ billions outstanding, as of June 2023)

Largest issuing entities of carbon intensive debt					
Electric Utilities		**Oil & Gas**		**Oil & Gas Distribution**	
Korea Electric Power Corp	80	Petroleos Mexicanos	85.7	Enbridge Inc	48.8
Electricite de France SA	76.9	BP PLC	59	TC Energy Corp	39.4
Enel SpA	61	Shell PLC	56.8	Energy Transfer LP	37.4
Duke Energy Corp	59.9	Total Energies SE	46.1	Kinder Morgan Inc	32.8
Nextera Energy Inc	56.1	NK Rosneft' PAO	38.8	Enterprise Products Partners LP	27.8
Coal Mining		**Chemicals**		**Diversified Mining**	
Shaanxi Coal & Chemical Industry Group Co	21.6	Sinochem Holdings Corporation	20.5	Glencore PLC	21.4
Jinneng Hold Coal Industry Group Co	11.5	Linde PLC	14.9	Codelco	17.1
Shandong Energy Group Co	11.5	Dow Inc	14.3	BHP Group	12.8
Shanxi Coking Coal Group Co	6.7	BASF SE	13.1	Anglo American PLC	12.2
Yankuang Energy Group Co	6.1	LyondellBasell Industries NV	13.1	Freeport-McMoRan Inc	9.6
Steel		**Paper**		**Cement**	
Shougang Group Co	11.5	Suzano SA	8.3	Holcim AG	15.4
HBIS Group Co	9.7	Koch Industries Inc	7.2	CRH PLC	9
ArcelorMittal SA	8	Westrock Co	6.7	BBMG Corp	7.7
Posco Holdings Inc	7.5	Antarchile SA	5.1	China National Building Material Co	7.2
Nippon Steel Corp	6.2	International Paper Co	4.3	Heidelberg Materials AG	7
Aluminium		**Autos**		**Airlines**	
Aluminum Corporation of China	20.6	Toyota Motor Corp	100.6	United Airlines Holdings Inc	10.5
Guangxi Investment Group Co	4.4	Porsche Automobil Holding SE	85.3	Delta Air Lines Inc	9.4
Indonesia Asahan Aluminium (Persero) PT	3.8	General Motors Co	65.1	Deutsche Lufthansa AG	7.4
China Hongqiao Group	3.7	Ford Motor Co	65	Singapore Airlines	7.2
Hindalco Industries	3.6	Mercedes Benz Group AG	53.2	Southwest Airlines Co	5.8
Shipping					
China Cosco Shipping Corp	4.1				
HMM Co	2.6				
AP Moeller - Maersk A/S	2.4				
China Merchants Group	1.9				
Hanjin Shipping Co Ltd.	1.2				

Source: LSEG, 2024

EMERGING MARKETS ACCOUNT FOR A GROWING SHARE OF CARBON-INTENSIVE DEBT

The US and China lead in the absolute volume of carbon-intensive debt with approximately US$2.57 trillion outstanding, but the shares of carbon-intensive debt in their corresponding non-financial corporate bond market are below the global average, given the substantial sizes of their overall debt capital markets. Saudi Arabia, Russia, and Indonesia, in contrast, have the highest shares of carbon-intensive debt (see Exhibit 9).

Overall, emerging markets have seen an increase in carbon-intensive debt securities (see Exhibit 10). Measured by annual issuance amount, the share of carbon-intensive debt from emerging markets increased from 4.1% in 2000 to 41.3% in 2022.

By annual issuance, the share of developed market currency-denominated (or 'hard currency')[12] carbon intensive debt decreased by 35.4 percentage points between 2000 and 2022. Specifically, the share of US$-denominated debt in all carbon-intensive debt issued in a year dropped from 54% in 2000 to 20% in 2022, while CNY-denominated debt increased most from less than 1% to 34% in the same period (see Exhibit 11).

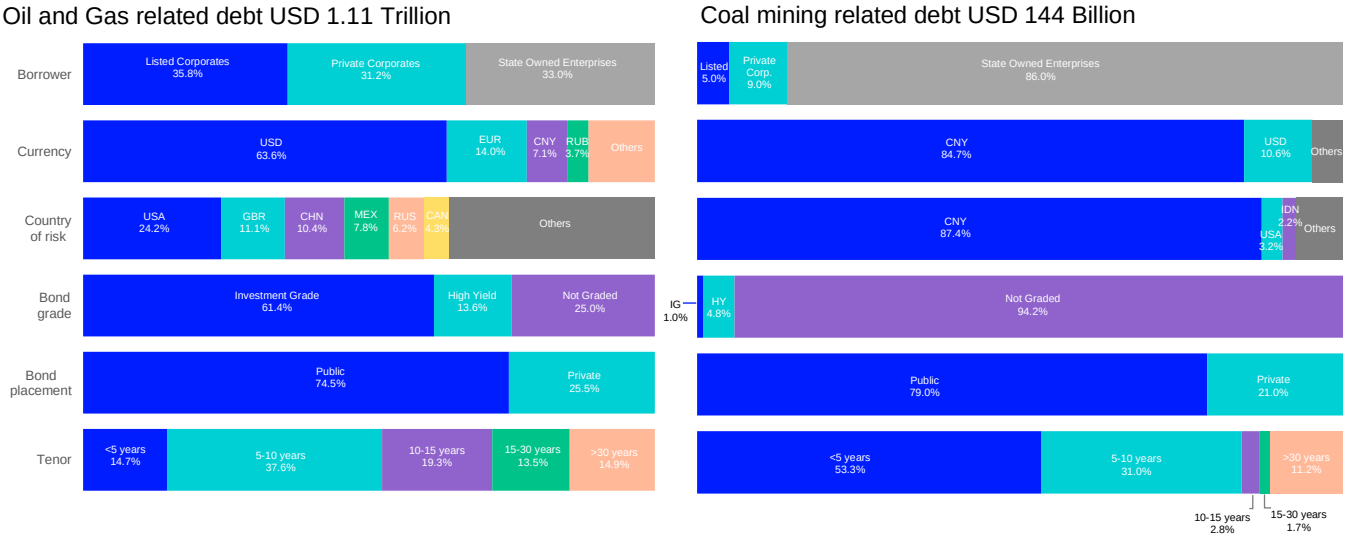
Box 2: Spotlight on the debt profile of fossil fuel producers

Fossil fuel producers face a particularly challenging transition with global coal consumption having plateaued over the past decade and oil consumption expected to peak before the end of this decade according to IEA data.[13] But our data shows a sharp contrast between the debt profile of Coal compared to Oil & Gas.

With US$1.1 trillion outstanding as of June 2023, the Oil & Gas debt sector, which is nearly eight times the size of coal-linked debt, is geographically diversified and issued in broadly equal terms by listed companies, privately held corporates and SOEs. It also consists of mostly investment-grade, US$-denominated and publicly traded bonds.

In contrast, the coal sector debt is dominated by China, which accounts for over half of the world's coal production and consumption, consisting mainly of renminbi-denominated, non-rated, shorter-term bonds issued by Chinese SOEs in the domestic debt market.

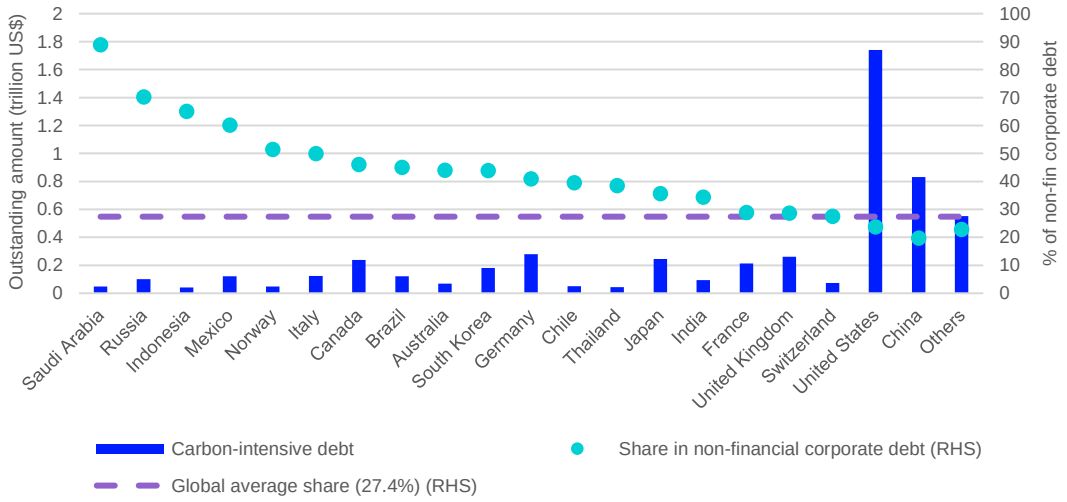
Exhibit 8: Spotlights on Oil &Gas and Coal industries



Source: LSEG, 2024

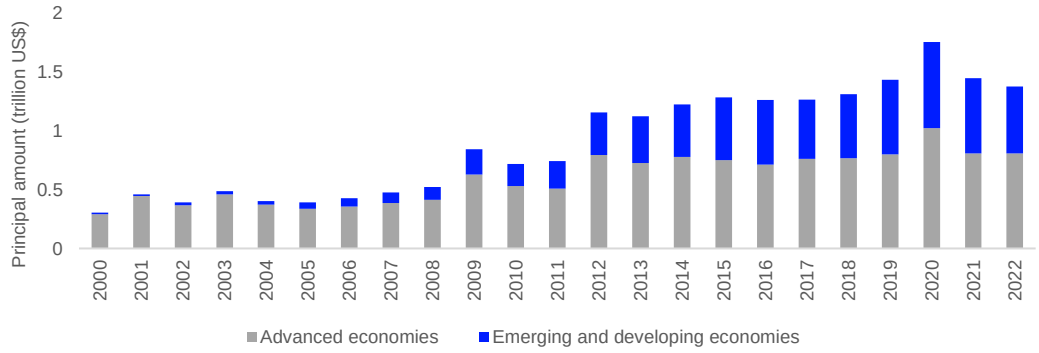
[12] Hard currencies include USD, EUR, GBP, JPY, CAD, AUD and CHF
[13] IEA. (2022) 'The world's coal consumption is set to reach a new high in 2022 as the energy crisis shakes markets'. Available at: https://www.iea.org/news/the-world-s-coal-consumption-is-set-to-reach-a-new-high-in-2022-as-the-energy-crisis-shakes-markets (Assessed: 15 Dec 2022)

Exhibit 9: The 20 largest countries for carbon-intensive debt, and respective proportions with respect to non-financial corporate debt



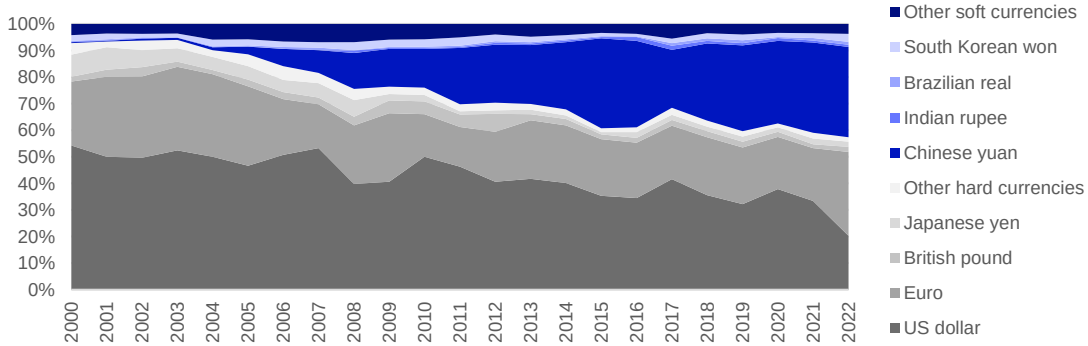
Source: LSEG, 2024

Exhibit 10: Emerging markets' share in carbon-intensive debt issuance has increased



Source: LSEG, 2024 Note: The country classification uses the definitions provided in the International Monetary Fund's World Economic Outlook

Exhibit 11: Denominated currency of carbon-intensive debt



Source: LSEG, 2024

Carbon-intensive debt in transition

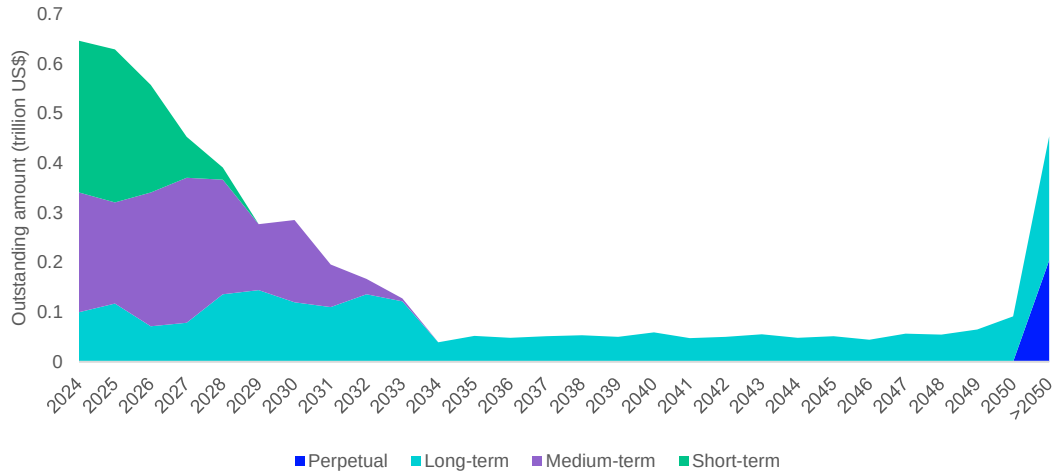
OVER HALF OF CARBON-INTENSIVE DEBT IS SET TO MATURE BEFORE 2030…

With obligations for new medium-term debt now commonly stretching into the 2030s and long-term debt obligations extending to the 2040s and beyond, carbon-intensive debt refinancing presents issuers and investors with increasingly urgent and complex challenges. Issuers may struggle to refinance maturing carbon-intensive debt with a similar volume and tenor or have to accept that investors may look for higher risk premia to compensate for taking on growing transition risk.[14]

Indeed, over half (US$3.2 trillion) of the outstanding carbon-intensive debt is set to mature before the end of 2030 (Exhibit 12), including US$931 billion in Electric Utilities, followed by US$669 billion in Oil & Gas. This also includes US$765 billion in long-term debt issued with an original tenor of over 10 years, which is typically used to finance large capital expenditure programs or to reconfigure the capital structure of companies.

Another perspective is that global fixed income markets will need to refinance over half a trillion dollars worth of carbon-intensive debt each year, including approximately US$200 billion in medium-term (5-10 years) and about US$100 billion in long-term debt (10 years or more). The remaining refinancing demand consists of circa US$300 billion in short-term debt (issued with a tenor of less than five years), which is typically refinanced on a revolving basis and mainly used to finance working capital needs.

Exhibit 12: Maturity profile of carbon-intensive debt



Source: LSEG, 2024 Note: the original tenor buckets are classified as: Short-term (less than five years), medium-term (greater than or equal to five years but less than 10 years), long-term (greater than or equal to 10 years), and perpetual debt.

Among the US$423 billion worth of non-financial corporate bonds without a maturity date (so-called perpetual bonds), companies in carbon-intensive sectors issued 48% (US$204 billion) of the total. A perpetual bond issuer pays coupons on the bond for perpetuity and has no obligation to redeem the principal. Therefore, investors are exposed to the climate-related credit risk of the issuer for an indefinite period.

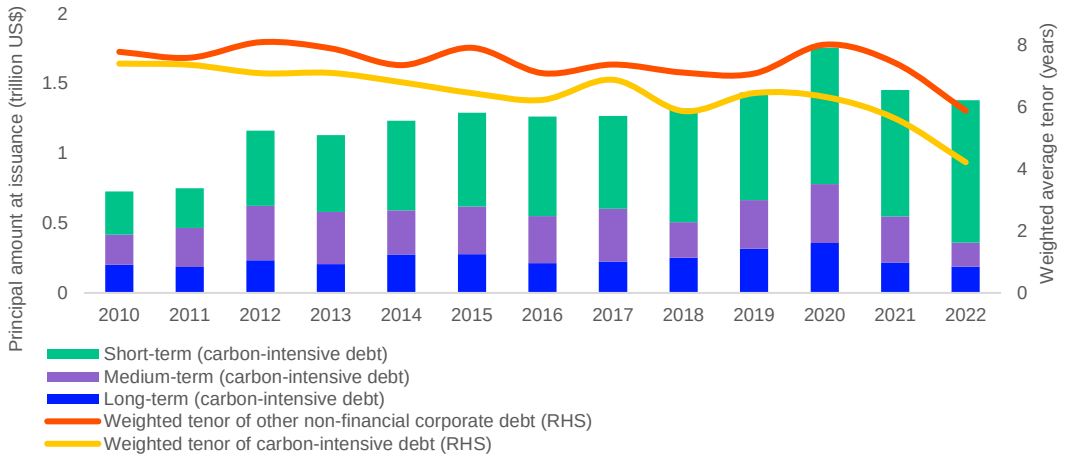
…WITH SHORTER-TERM REFINANCING PLAYING A GROWING ROLE

Our analysis also shows that against the backdrop of growing uncertainty about long-term demand and rising interest rates, carbon-intensive issuers have increasingly relied on shorter-term debt to finance their activities. Indeed, the weighted average tenor of the annual issuance of carbon-intensive debt has decreased over the last decade from 7.4 years in 2010 to just under 4.2 years in 2022 (Exhibit 13).

This dip in the carbon-intensive debt tenor has been primarily driven by the surge in short-term instruments, especially commercial paper – an unsecured fixed income instrument normally with a tenor less than 270 days (Exhibit 14). The share of commercial paper in carbon-intensive debt issuance increased by 33 percentage points between 2010 and 2022, accounting for almost half (48%) of the total issuance volume in 2022.

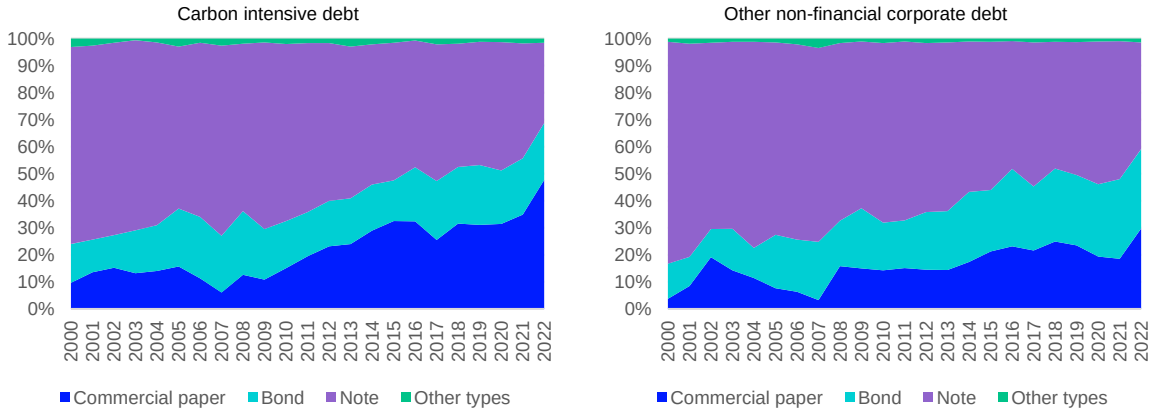
[14] There is some evidence that transition risk is being priced into longer-dated corporate bonds, see for example, Bats, J., Bua, G. and Kapp, D. (2023) *Physical and transition risk premiums in euro area corporate bond markets*. Working Paper No. 761. De Nederlandsche Bank.

Exhibit 13: Face value weighted average tenor of annual carbon-intensive debt (CID) issuance compared to other non-financial corporate debt



Source: LSEG, 2024

Exhibit 14: Instrument types of carbon-intensive debt and other non-financial corporate debt



Source: LSEG, 2024

GREEN AND TRANSITION DEBT: (NOT YET) CLOSING THE GAP

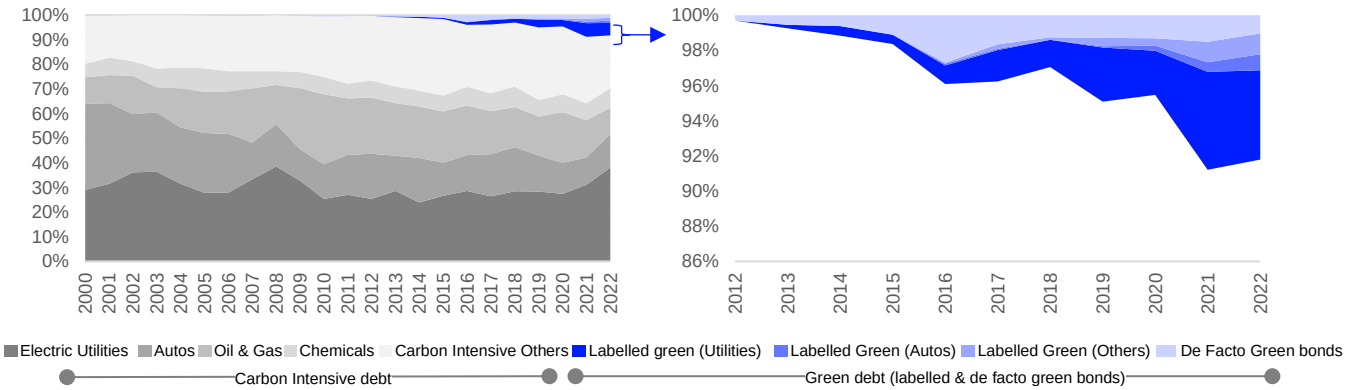
Carbon-intensive issuers' transition plans are likely to influence their refinancing strategies as the low-carbon transition accelerates. As many carbon-intensive issuers are setting emission reduction goals and formulating increasingly ambitious transition plans, earmarking proceeds and issuing labelled 'green' or 'transition' bonds emerges as a potentially appealing option. These bonds not only signal an issuer's commitment to decarbonising its business model, but also help attract investors who may otherwise hesitate to take on exposure to carbon-intensive assets.

Despite their rapid growth, our analysis shows labelled green bonds still play a limited role in carbon-intensive sectors. From 2012 to 2022 the proportion of green bonds in these sectors' overall annual debt issuances has increased twenty fold. Nonetheless, in 2022 only 7.2% of new debt offerings in carbon-intensive sectors were structured as labelled green bonds (or 8.2% if we consider both labelled and de facto green bonds[15]) (see Exhibit 15).

As of June 2023, the outstanding labelled green bonds only represented less than 7% of the total debt in carbon-intensive sectors (or 7.7% if we consider both labelled and de facto green bonds) – and they are mainly concentrated in a handful of sectors such as Electric Utilities and Autos, where the low-carbon transition is most advanced. Together, these two sectors account for approximately 85% of all green debt by carbon-intensive issuers (including both labelled and de facto green bonds). Notably, the Electric Utilities sector has the highest proportion of labelled green bonds (16% by outstanding amount), while they account for less than 1% of outstanding debts in Oil & Gas, Aluminium and Airlines, where the low-carbon transition is less advanced.

[15] Business activities in certain sub-industry of the carbon intensive sectors deliver positive climate impact, such as Renewable Energy and Electric Vehicle. Debt securities from such corporates are classified as 'de facto green' bonds in this research.

Exhibit 15 Share of carbon-intensive and green debt annual issuances in carbon-intensive sectors



Source: LSEG, 2024

In the overall labelled green bond market, carbon-intensive corporates also play a relatively modest role. Since the market started in 2007, cumulative green bonds from these sectors have totalled US$421 billion, only accounting about 14% of the overall US$3.1 trillion green bonds market (with others issued by governments, multilateral institutions and other corporates including financial institutions).

However, these gaps also highlights the potential opportunity for rapid growth in labelled bonds (including in the transition-themed debt market and the sustainability-linked bond (SLB) market[16] if the transition further accelerates in carbon intensive sectors including hard to abate sectors.

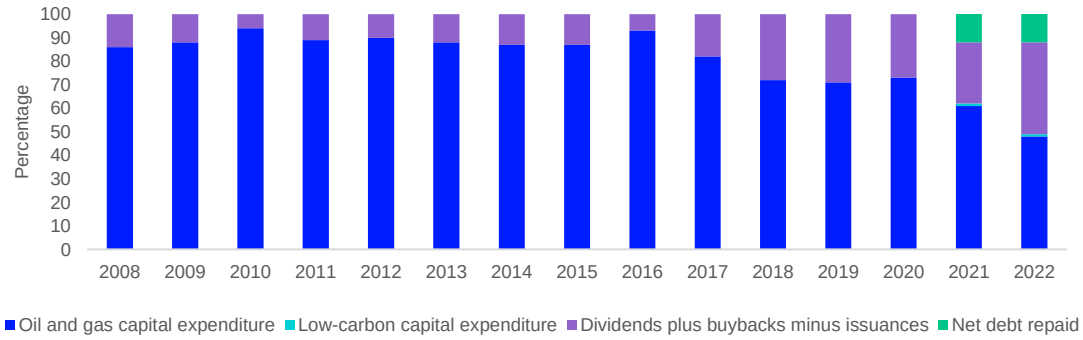
WILL BUSINESSES RETURN CARBON-INTENSIVE CAPITAL TO INVESTORS?

Carbon intensive issuers may instead opt to return capital to shareholders, especially if faced with a combination of growing regulatory pressure and limited transition opportunities. Today, we find limited evidence of this in our analysis, but point to early evidence from the International Energy Agency (IEA) on changing capital allocation decisions in the Oil & Gas industry where oil producers could face peaking demand potentially as early as this decade, according to some projections.

Indeed, the IEA data[17] shown in Exhibit 16 demonstrates that while many large Oil & Gas companies have announced higher spending plans on the back of record revenues, less than half of the industry's 2022 cash flow has been reinvested in future fossil fuel production. This level of investment compares to an average of over 75% over the past decade. At the same time, only about 1% of cash flow went to investment in low-carbon businesses reflecting relatively slow progress on transition plans in the sector.[18]

Instead, over half of cash flow was invested either in deleveraging balance sheets, with 13% invested in debt repayments with many companies in the sector exceeding their own debt reduction targets,[19] or returned to shareholders through dividends and share buybacks (39%) – though in many ways it is too early to tell whether this trend will be sustained in coming years.

Exhibit 16. Distribution of cash spending by the Oil & Gas industry, 2008-2022



Source: Reproduced from the IEA, 2023

[16] LSEG. (2023) Sustainability-linked bonds: a nascent market gaining traction. Available at: https://www.lseg.com/en/insights/ftse-russell/sustainability-linked-bonds-nascent-market-gaining-traction (Accessed: 15 Dec 2023)
[17] IEA. (2023) *Overview and key findings – World Energy Investment 2023*. Available at: https://iea.blob.core.windows.net/assets/8834d3af-af60-4df0-9643-72e2684f7221/WorldEnergyInvestment2023.pdf (Accessed: 20 Feb 2024)
[18] CDP. (2023) Research reveals no oil and gas companies have plans in place to phase out fossil fuels. Available at: https://www.cdp.net/en/articles/media/research-reveals-no-oil-and-gas-companies-have-plans-in-place-to-phase-out-fossil-fuels (Accessed: 20 Fed 2024)
[19] Potkins, M. (2022) 'Oil, gas investors' returns set to jump as companies near debt targets'. Available at: https://financialpost.com/commodities/energy/oil-gas/debt-reduction-targets-shareholder-returns (Accessed: 15 Dec 2023) | Financial Post

Appendix

A. SCOPE OF DEBT ISSUERS AND INSTRUMENTS

This research focuses on corporate sector debt. Debt directly issued by sovereigns, local governments and agencies are excluded while debt directly issued by banks is also excluded, but debt from other type of financials, such as a financing vehicle, are included.

Table 2 Scope of debt issuer sectors

Types of direct issuer	Scope	Reasons for inclusion/exclusion
Sovereign/regional government	Excluded	Government debt is not in scope. However, debt issued by state-owned enterprise (SoEs) is included.
Agency/supranational	Excluded	
Securitisations	Excluded	Securitisations: asset-backed securities and mortgage-backed securities are excluded due to the intricacies and difficulties in identifying the secured underlying assets.
Corporate – banks	Excluded	While financial sectors play an important role in funding the real economy, this research excludes debt directly issued by banks due to the ambiguity around the flow of funds raised by those instruments.
Corporate – all others	Included	Apart from debt in all other non-financial sectors, those issued by other financials such as a financing vehicle are also included.

This research includes a wide variety of debt instruments, though securitisations, loans and fixed income derivatives are not in scope. Please note although some debt instrument types are exclusively used by certain types of issuers which are not in the scope of this research (such as certificate of deposit by commercial banks) they are still in the scope of instrument types in the starting fixed income universe.

B. SCOPE OF CARBON-INTENSIVE SECTORS

We use the Transition Pathway Initiative (TPI)'s definition of carbon-intensive sectors that comprises 13 sectors. The mapping between TRBC and TPI carbon-intensive sectors has been conducted in collaboration with TPI. Please note that while some TRBC activities are mapped to TPI carbon-intensive sectors, some of their debt might not be considered as part of the carbon-intensive debt universe – due to these activities' positive impact on climate change mitigation and the acceleration of transition. These TRBC activities include Solar Electric Utilities, Wind Electric Utilities, Renewable IPPs, and Electric (Alternative) Vehicles (however excluding Nuclear Utilities).

Table 3 TPI vs TRBC mapping

TPI industry group	TPI sectors	TRBC activities
Energy	Coal mining	Coal Mining Support, Other Coal
	Oil & Gas	Integrated Oil & Gas, Other Oil & Gas Exploration and Production , Oil Exploration & Production - Onshore, Oil Exploration & Production - Offshore, Natural Gas Exploration & Production - Onshore, Natural Gas Exploration & Production - Offshore, Unconventional Oil & Gas Production, Other Oil & Gas Refining and Marketing , Petroleum Refining, Gasoline Stations, Petroleum Product Wholesale, Other Oil & Gas Drilling , Oil Drilling - Onshore, Gas Drilling - Onshore, Oil Drilling - Offshore, Gas Drilling - Offshore, Unconventional Oil & Gas Drilling
	Oil & Gas distribution	Integrated Oil & Gas, LNG Transportation & Storage, Natural Gas Pipeline, Oil Pipeline, Sea-Borne Tankers, Oil & Gas Storage
	Electric utilities	Other Electric Utilities, Fossil Fuel Electric Utilities, Nuclear Utilities, Alternative Electric Utilities, Hydroelectric & Tidal Utilities, Solar Electric Utilities, Wind Electric Utilities, Biomass & Waste to Energy Electric Utilities, Geothermal Electric Utilities, Other Independent Power Producers, Fossil Fuel IPPs, Renewable IPPs, Nuclear IPPs, Other Multiline Utilities
Industrials / Materials	Chemicals	Other Commodity Chemicals, Plastics, Paint & Coating, Tanning & Softening Agents, Explosives, Industrial Gas, Commodity Chemicals Wholesale, Glass, Other Agricultural Chemicals, Fertiliser, Pesticide, Organic Fertiliser, Agricultural Chemicals Wholesale, Colouring Agent, Cellular Fiber, Advanced Polymer, Industrial Biotechnology Chemicals, Specialty Chemicals Wholesale, Composites, Adhesive & Epoxy, Diversified Chemicals, Other Specialty Chemicals
	Diversified Mining	Silver Mining, Platinum Mining, Diamond Mining, Semiprecious Gemstones, Pearl Cultivation, Rare Earth Minerals, Gold Mining, Gold Refining, Other Gold, Other Precious Metals & Minerals, Integrated Mining, Iron Ore Mining, Coke Coal Mining, Other Specialty Mining & Metals
	Steel	Adhesive & Epoxy, Other Steel
	Aluminium	Primary Aluminium Production, Secondary Smelting & Alloying of Aluminium, Aluminium Refining, Other Aluminium
	Cement	Construction Material Processing, Cement & Concrete Manufacturing, Tile & Paving Material Manufacturing, Other Construction Materials
	Paper	Paper Mills & Products, Newsprint Mills, Pulp Mills, Paper Product Wholesale, Paper Packaging Wholesale, Other Paper Packaging, Other Forest & Wood Products, Other Paper Products
Transport	Shipping	Marine Logistics, Deep Sea Freight, Other Marine Freight & Logistics
	Airlines	Regional Airlines, Other Airlines
	Autos	Automobiles & Multi Utility Vehicles, Light Trucks, Electric (Alternative) Vehicles, Luxury Vehicles, Other Auto & Truck Manufacturers

C. METHODOLOGY: GRAPH-BASED APPROACH

The algorithmic graph-based approach uses the ownership tree of a certain company to classify and aggregate debt. The following rules have been applied in the graph algorithm:

- **Removal of ineligible debt**
  Government debt and debt issued by a government-related financing vehicle are excluded
- **Identifying the type of debt's use-of-proceeds**
  The classification of the 'closest non-financial parent company' of the direct issuer is used to define the use-of-proceeds type of the debt security. This is identified by going up the corporate tree, starting from the issuer, until a company is identified which is not a financial entity (e.g. SPAC, SPV) and not related to the Business Support Services industry
- **Aggregating debt in a corporate tree**
  Following rules have been applied to group the relevant debt in a corporate tree
  - For any debt issuer, if there is a publicly listed parent company in the ownership chain, the debt from all subsidiaries is aggregated to the listed company
  - If there is no listed entity in the entire ownership chain, all debt from the subsidiaries are aggregated to the highest level of a non-government parent entity

  After determining the relevant non-financial parent company, TPI sector of the parent or the direct issuer itself is applied to all debt of the certain issuer (Appendix B)

D. DATA-RELATED CHALLENGES AND LIMITATIONS

The research was performed using the LSEG fixed income and ownership datasets. The corporate tree dataset contains complex ownership information for different entities, where each connection between two entities can be of queried in one of two ways:

- Parent-subsidiary: a single organisation (the parent) that has a controlling ownership (>50% shares of voting stock) over another organisation (the subsidiary).
- Related organisation: A one-to-many relationship where one organisation can be related to several different organisations, which are either subsidiaries (majority ownership), affiliates (over 20% ownership) or joint ventures of the queried organisation.

Although recursively querying for related organisations of affiliates and joint ventures in the 'related organisation' relationship can help develop future depth of the debt ownership picture, the key challenge is the complication in verifying the connections between entities and dealing with even larger size of data. Therefore, this research has mainly focused on the 'parent-subsidiary' relationship and has not included 'affiliate-of-an-affiliate' into the scope of research.

Secondly, by applying the graph-based approach, we are assuming all debt, except for labelled debt instruments, such as green bonds issued by a certain company, is linked to the main business activities of the issuer or a relevant parent company. While this is true in vast majority cases where debt is used to supplement working capital and finance/refinance capital expenditures of a company, we acknowledge that there might be cases where a vanilla bond can still be used to support the climate transition of the issuer. However, we assume a company tends to structure the bond as 'green' or 'transition' rather than a conventional bond if proceeds are used to support such transition.

Please also note that figures presented in this report are rounded to facilitate comprehension. Therefore, minor discrepancies may exist between the displayed figures and the precise values.

E. CARBON-INTENSIVE DEBT – OUTSTANDING AND INTENSITY

Exhibit 17: Geographical spread of carbon-intensive debt

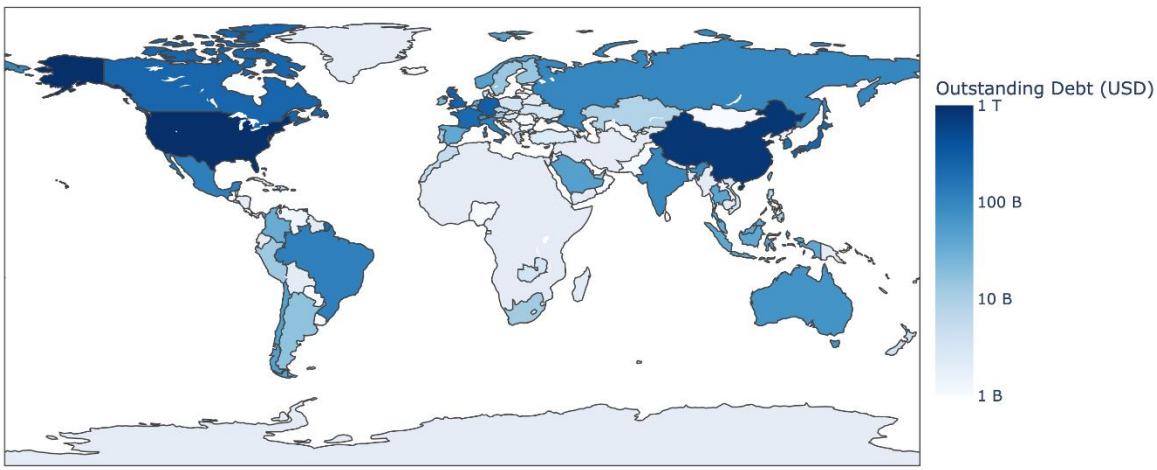
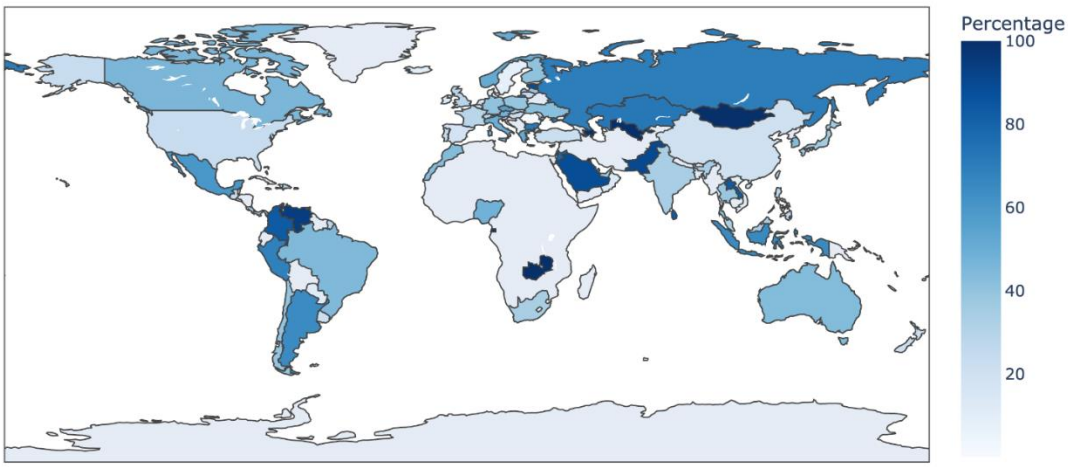


Exhibit 18: Carbon-intensive debt as % of all non-financial sector debt



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