Corporate Fixed Income Climate Transition Risk

Do Green Bonds Help?

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Summary

In this paper we quantify the climate transition risk for over $24trillion of outstanding global corporate debt. By 2030, we find over $1trillion of this outstanding corporate debt is at risk of at least 90% carbon cost liability under 1.5°C Net Zero scenarios. That equates to over 4% of the listed corporate bond market at extreme financial carbon exposure over the next five years.

Under more moderate Paris-aligned 2°C scenarios, we still find about $200billion of debt issued across 71 companies at extreme financial liability by 2030. Even under the Network for Greening the Financial System (NGFS) Current Policies scenario, some companies' debt still remains at extreme financial liability without any future changes in carbon pricing. This suggests their business models may be inherently unstable in the face of carbon pricing found today, something important for bond investors to understand in allocating capital.

Using Factset bond data, we perform an additional climate risk analysis for over $1trillion of corporate bonds designated as 'green bonds'. We find 18% of 'green bonds' to have significant climate transition risk by 2030 dominated across three industries: Electric Utilities, Motor Vehicles and Steel.

Green bonds are generally motivated by the desire to support 'green' activity. However, this paper considers the question of whether, in doing that, investors can reduce their climate transition risk directly. Overall, our analysis suggests that green bonds do not offer lower climate transition risk for investors by 2030, since the risk lies in the issuer's overall risk - not the bond.

As such, for investors to reduce their transition risk they need to invest in companies and/or sectors that are making efforts to address the root causes of climate risk, by committing to reduce carbon emissions, setting measurable targets, diversifying revenue sources, and investing in new low carbon products.

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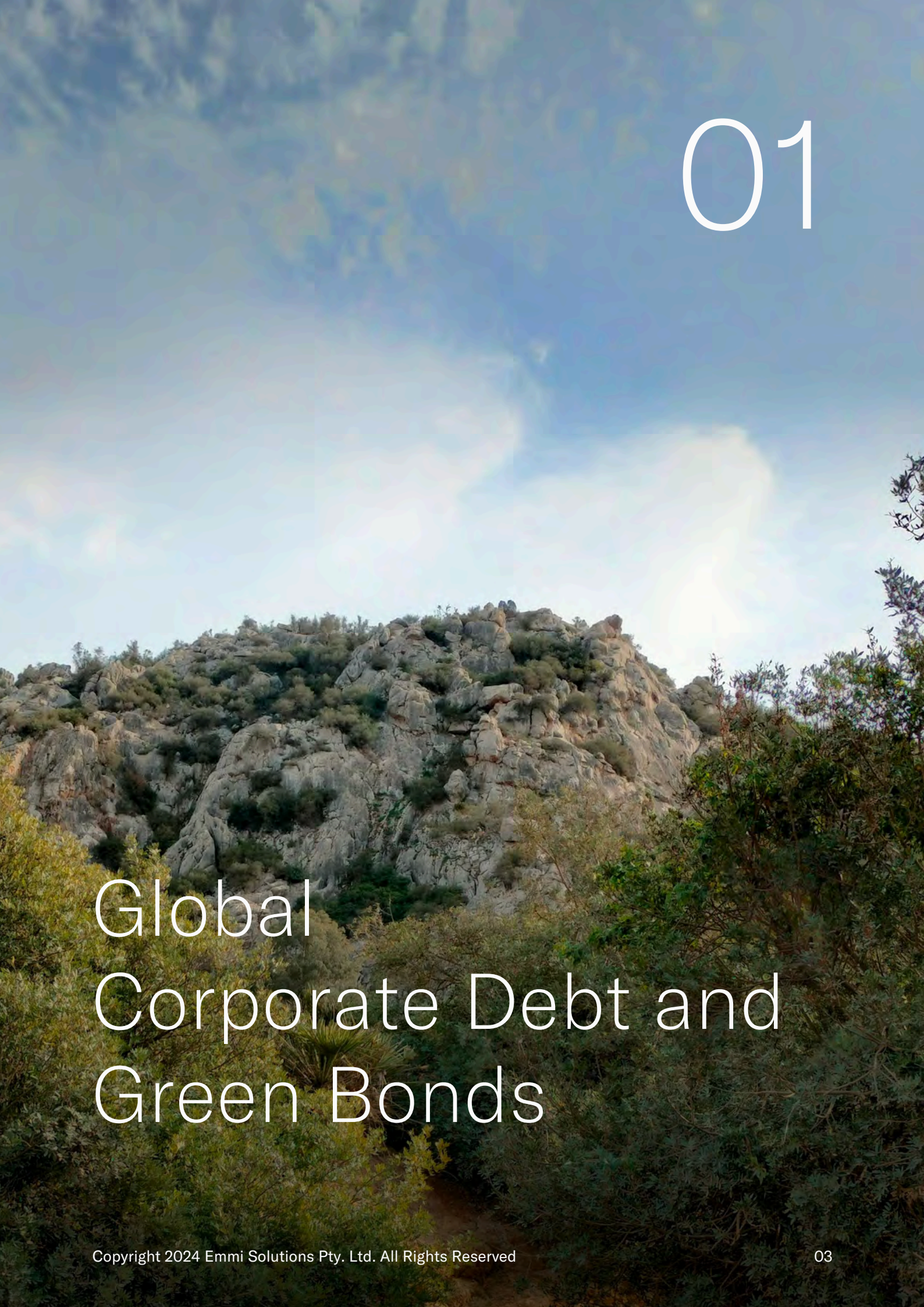

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Global Corporate Debt and Green Bonds

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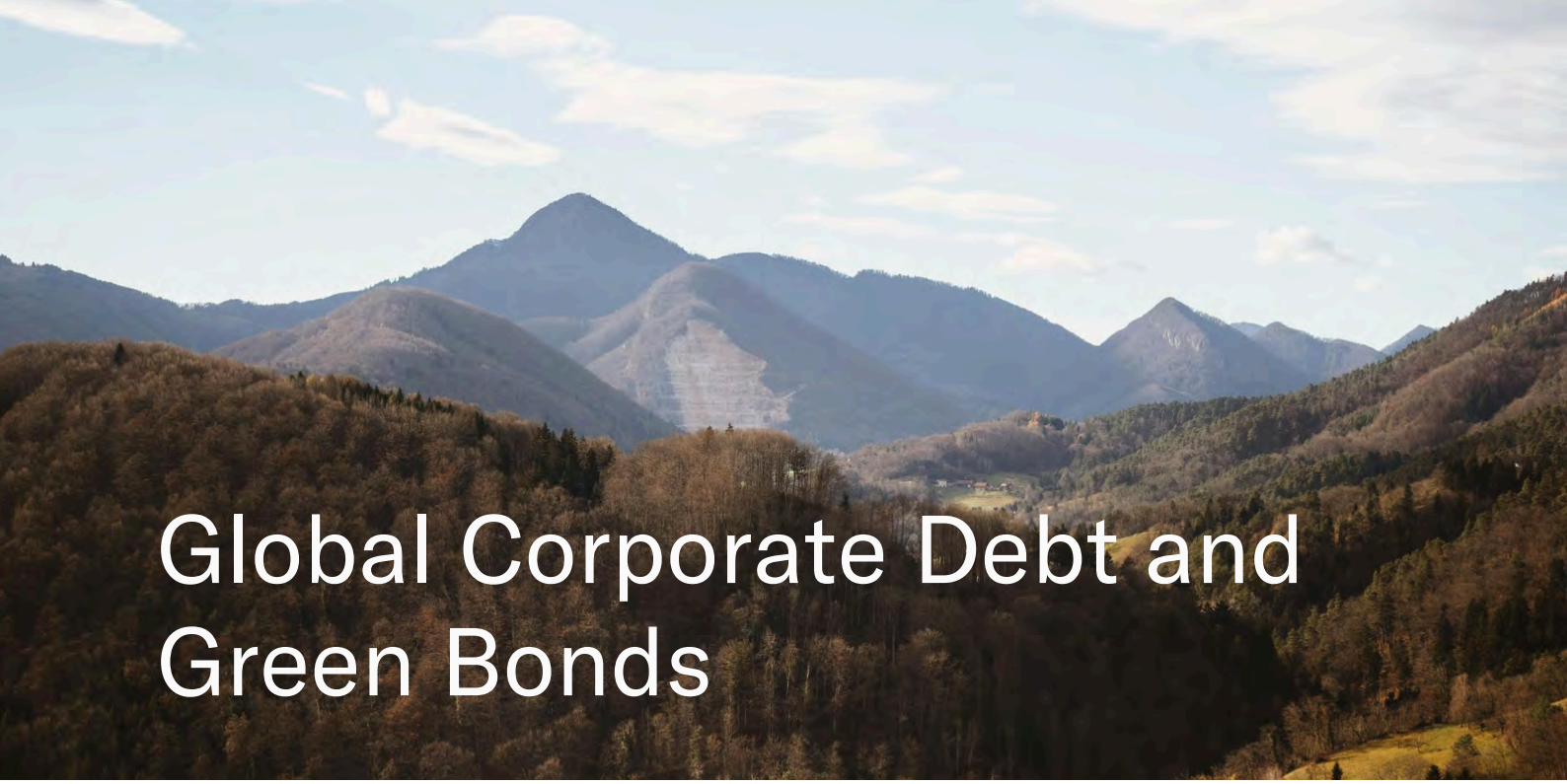

Global Corporate Debt and Green Bonds

In the past fifteen years, there has been a significant rise in corporate debt. At the end of 2023, the global amount of outstanding corporate bonds had reached $34trillion, an increase of $13trillion since 2008. Meanwhile, estimates suggest over $2trillion of 'green bonds' have been issued over the past 5 years.

Green bonds are financial debt instruments, and function in the same manner as traditional bonds. The defining characteristic of green bonds is that all funds raised go towards 'green' projects i.e. projects focused on environmental benefits. These initiatives typically target climate change, energy efficiency, renewable energy, biodiversity conservation, or pollution reduction.

Voluntary best practice guidelines called the Green Bond Principles (GBP) were established in 2014 by a consortium of investment banks.

The GBP set out a framework for how proceeds should be used, project evaluation and management, and reporting procedures. It's important to understand that the GBP do not provide details on what is 'green', but give guidance on the project classifications that can be used in issuing green bonds (see table below).

Green bonds have emerged as a growing debt instrument in recent years. While it is our belief that both issuance of and investment in green bonds is generally motivated by the desire to support 'green' activity, very little analysis has been done on one key question: does issuing a green bond lower a company's or investors' climate transition risk?

In this research paper we will help answer that question by assessing the climate transition risk for all listed corporate bonds and issuers to allow us to compare green and non-green bonds.

1. https://www.oecd.org/en/publications/global-debt-report-2024_91844ea2-en.html
2. https://www.climatebonds.net/2024/09/sustainable-debt-market-passes-5trillion-milestone-en-route-record-year

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Green Bond Project Categories

Green Bond Project Categories	Description
Renewable Energy	Including production, transmission, appliances and products.
Energy Efficiency	Such as in new and refurbished buildings, energy storage, district heating, smart grids, appliances and products.
Pollution prevention and control	Including reduction of air emissions, greenhouse gas control, soil remediation, waste prevention, waste reduction, waste recycling and energy/emission-efficient waste to energy.
Environmentally sustainable management of living natural resources and land use	Including environmentally sustainable agriculture; environmentally sustainable animal husbandry; climate smart farm inputs such as biological crop protection or drip-irrigation; environmentally sustainable fishery and aquaculture; environmentally sustainable forestry, including afforestation or reforestation, and preservation or restoration of natural landscapes.
Terrestrial and aquatic biodiversity conservation	Including the protection of coastal, marine and watershed environments.
Clean transportation	Such as electric, hybrid, public, rail, non-motorised, multi-modal transportation, infrastructure for clean energy vehicles and reduction of harmful emissions.
Sustainable water and wastewater management	Including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flooding mitigation.
Climate change adaptation	Including efforts to make infrastructure more resilient to impacts of climate change, as well as information support systems, such as climate observation and early warning systems.
Circular economy adapted products, production technologies and processes	Such as the design and introduction of reusable, recyclable and refurbished materials, components and products; circular tools and services; and/or certified eco-efficient products.
Green buildings	That meet regional, national or internationally recognised standards or certifications for environmental performance.

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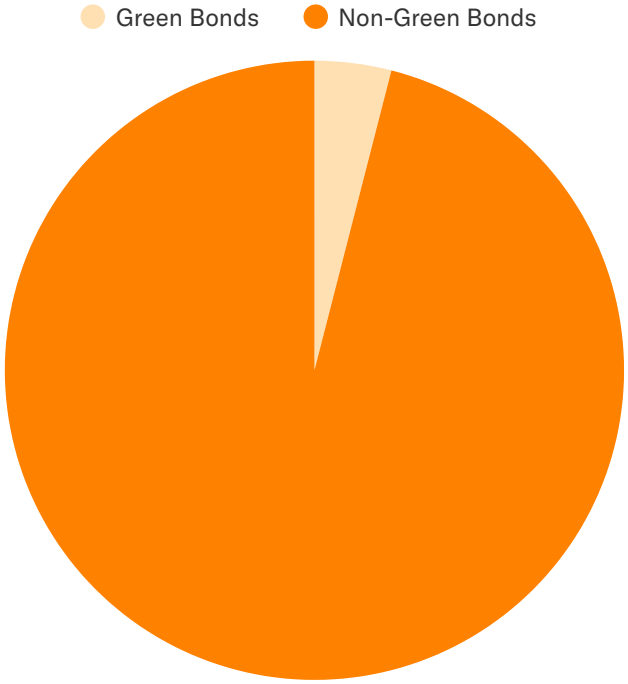
Breakdown of Global Corporate Bonds



Total Outstanding Amount
$24,859,006,061,596

Total Bonds Outstanding
79,614

Proportion of Green Bonds
4%

Number of Green Bonds
2,899

Global Corporate Fixed Income Data

We use FactSet for corporate fixed income classification and data. The number of corporate bonds that have not yet matured number nearly 80,000 securities. Overall the outstanding amount of this debt still to mature is ~US$25trillion.

When a bond is issued, the issuer categorises whether it is a green bond using the Green Bond Project Types described in the table above from the Green Bond Principles. Within FactSet, 2899 securities are categorised as green bonds, with a total outstanding amount of over $1trillion. Of those bonds, 80% are classified under 'project finance'.

The Forestry, Paper & Pulp, Aluminium, Alternative Power Generation, Motor Vehicles and Real Estate Trusts industries are some of the highest issuers of green bonds as a proportion of overall bonds (see chart). Over 20% of all bonds in these sectors are categorised as 'green'.

In terms of the maturity profile, green bonds typically have shorter terms (maturing before 2030) than general non-green corporate bonds, which more commonly have medium to long term maturities. For climate risk, the maturity profile is important, which we will discuss later.

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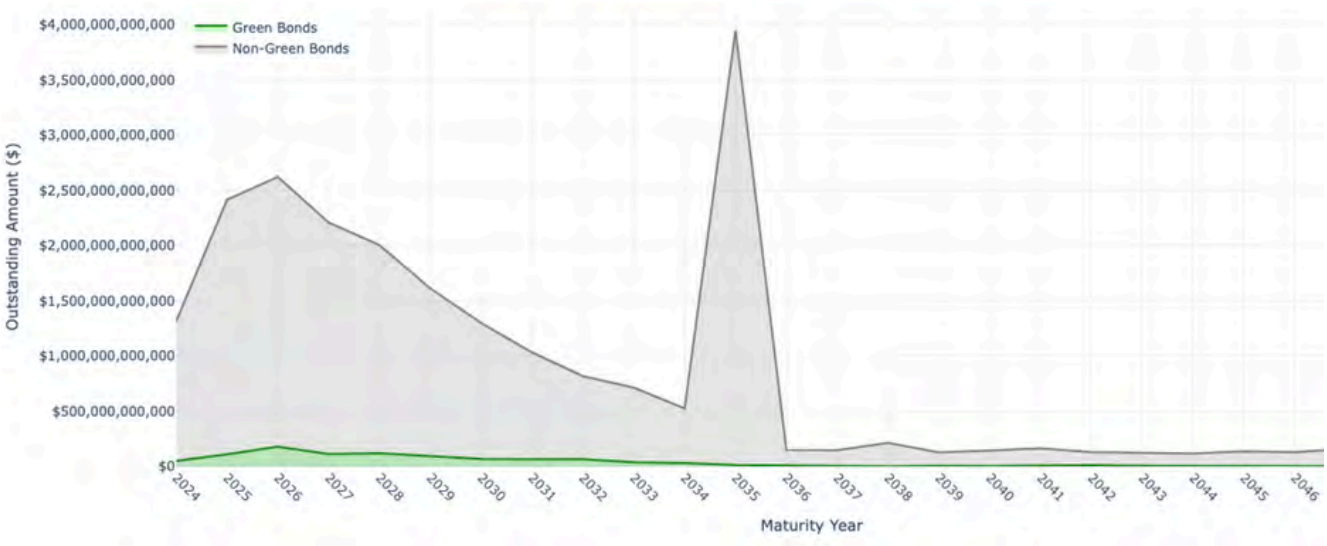
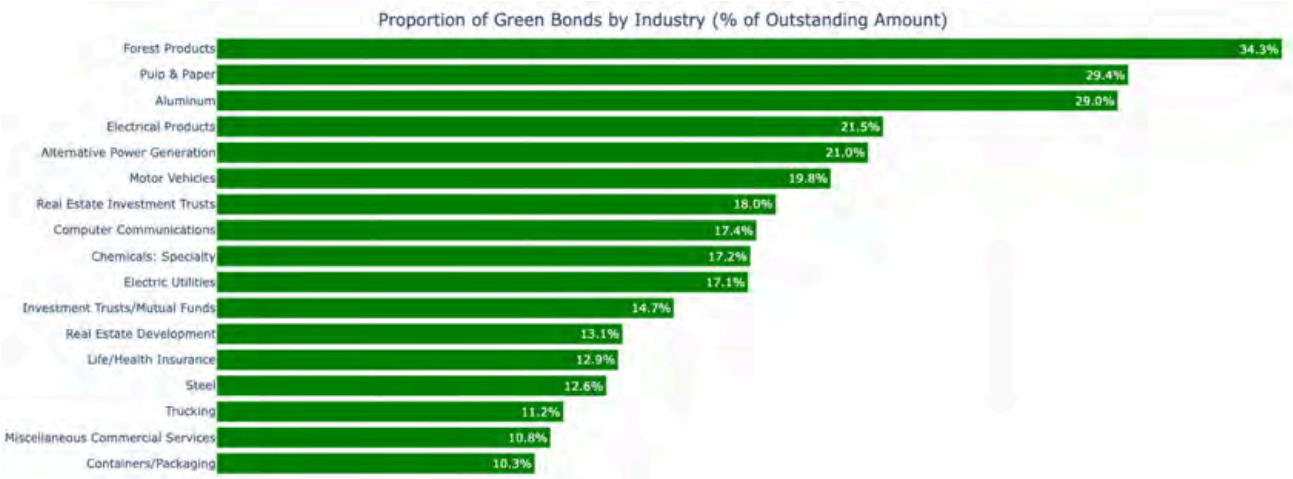
Corporate Bond Maturity Profile: Green vs Non-Green Bonds



Distribution of Green Bond Types by Outstanding Amount

Proportion of Green Bonds by Industry (% of Outstanding Amount)



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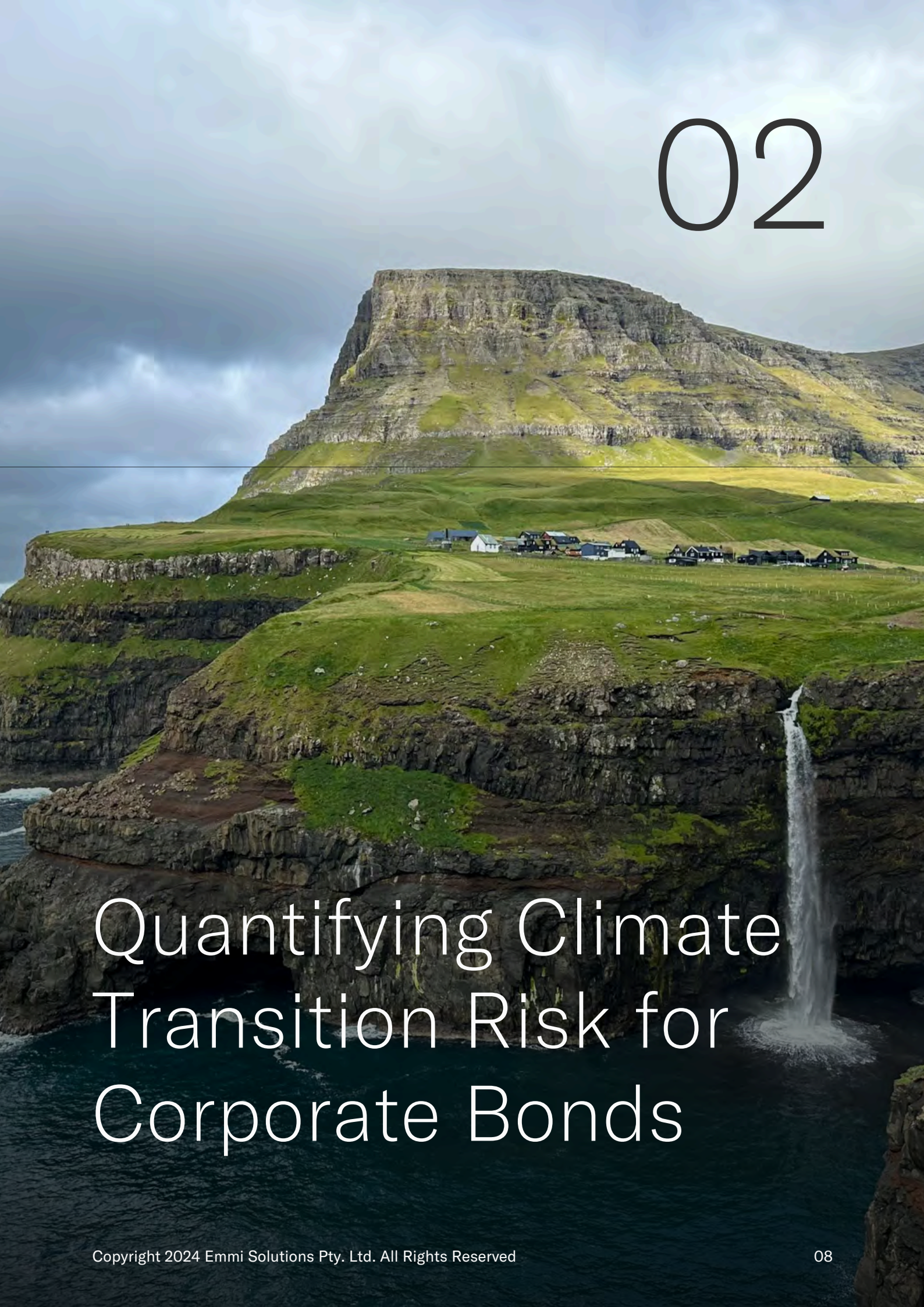

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Quantifying Climate Transition Risk for Corporate Bonds

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Quantifying Climate Transition Risk for Corporate Bonds

Assessing the financial impact of different climate scenarios and associated carbon pricing on a bond requires three steps: Calculating the issuer's financed emissions; apportioning the climate budget at the company/issuer level; calculating the Transition Value at Risk (TVaR) of the outstanding debt from carbon pricing.

1/ Financed Emissions

To quantify fixed income financed emissions, Scope 1, 2 and 3 for all listed companies is needed. We source these emissions for up to 45,000 listed companies using Emmi's Meta-Model machine learning approach (*McNeil et al., 2024*).

Financed emissions for corporate fixed income are then calculated in alignment with the Global Greenhouse Gas Accounting and Reporting Standard, developed by the Partnership for Carbon Accounting Financials (PCAF).

Under PCAF, the attribution factor is the proportion of outstanding amount of debt held by the borrower (issuer) or investee company compared to its Enterprise Value Including Cash (EVIC). In turn, the EVIC is the market capitalisation value of the underlying corporate plus the book value of any debt, without deducting cash or cash equivalents.

Company valuations are readily available in public markets each quarter.

> up to 45,000 companies emissions sourced using Emmi's Meta-Model Machine Learning approach

McNeil, B., Pittman, N, Kitto, A. and Greven, H. *Estimating the Corporate Carbon Footprint: A Meta-Model Machine Learning Approach*, (2024) https://www.emmi.io/newsroom/white-paper-nov-2024

https://carbonaccountingfinancials.com/

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2/ Carbon Budgets

We apportion each company's carbon budget based on its financial value to the economy. In line with the Task Force on Climate-Related Financial Disclosures (TCFD)/International Sustainability Standards Board (ISSB)'s consideration of transition risk for companies, we look at value to the economy through the lens of:

- Revenue
- Assets and Liabilities
- Capital and financing efficiency per carbon emission

The size of the 'fair share' carbon budget will depend on the climate scenario used – a company's budget for a 1.5°C scenario will be smaller than the 2°C or 4°C scenarios, reflecting the deeper carbon cuts required under those Paris-aligned scenarios. We use the climate scenarios and carbon budgets from the Intergovernmental Panel on Climate Change (IPCC) and the Network for Greening the Financial System (NGFS).

The difference between the company's emissions and the company's allocated carbon budget is referred to as the 'carbon budget overspend'. This value will change each year as the allocated carbon budget declines as we move closer to 2050 and beyond.

3/ Transition Value at Risk (TVaR)

The final step is to calculate the TVaR of the issued debt that remains outstanding. This is more complicated for fixed income securities than calculating the equivalent TVaR of a company's equities and has a number of embedded steps to reach the final result.

First, to calculate a corporation's TVaR, we take the expected carbon price associated with each climate scenario (whether IPCC or NGFS) and combine that with carbon budget overspend calculated in Step 2. This results in a figure for transition risk in dollar terms.

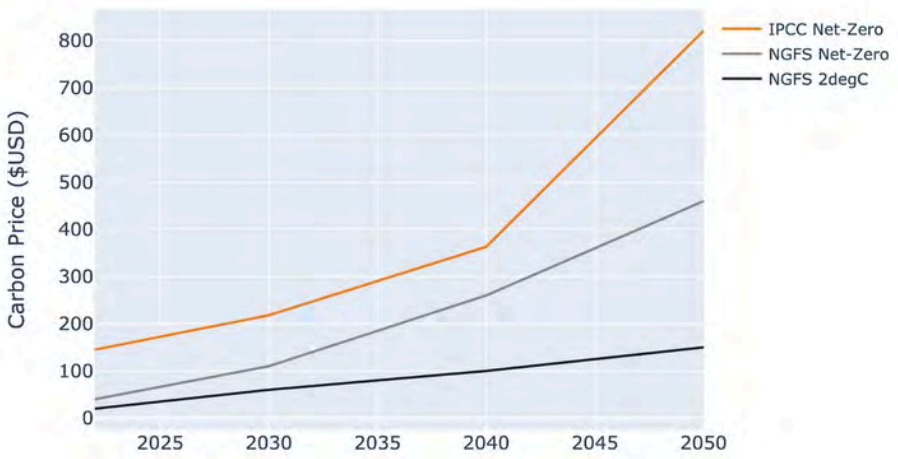

Chart: Example carbon prices for some selected climate scenarios

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Second, because each fixed income security has a specific time to maturity, we need to take that into account when calculating its apportioned TVaR. So, we must calculate the corporate issuer's cost of carbon on an annual basis, for each year to the maturity of the bond.

Third, we must also consider the extent to which a bond's value is impacted by the corporation's TVaR burden. As debt ranks higher in the security stack than equity, any value write downs impact equity holders first. So an equity buffer (the equity value of the corporate issuer) is first calculated.

If the equity buffer is greater than the sum of the annual cost of carbon to maturity, the fixed income security has no TVaR. If the equity buffer is less than the sum of the annual cost of carbon to maturity, the difference is considered to be the overall TVaR of the debt of the issuer.

Fourth, the individual fixed income security's TVaR is apportioned according to the ratio of its outstanding amount relative to the total outstanding debt of the issuer. For example, assuming that all debt ranks equally within a company, if an issuer has $100 billion debt outstanding and a security represents $2 billion of that debt, that security would incur 2% of the overall issuer's debt TVaR).

To calculate the TVaR % value:

$$\text{TVaR \%} = \frac{\text{Sum of annual cost of carbon to maturity} - \text{Equity buffer}}{\text{Total outstanding debt of issuer}}$$

To calculate the TVaR (Corporate Fixed Income) $ value, we take the above TVaR % and apply it to the outstanding debt of the security:

$$\text{TVaR} = \text{TVaR\%} \times \text{Outstanding debt of security}$$

> Each fixed income security has a specific time to maturity which needs to be taken into account when assessing each particular fixed income security.

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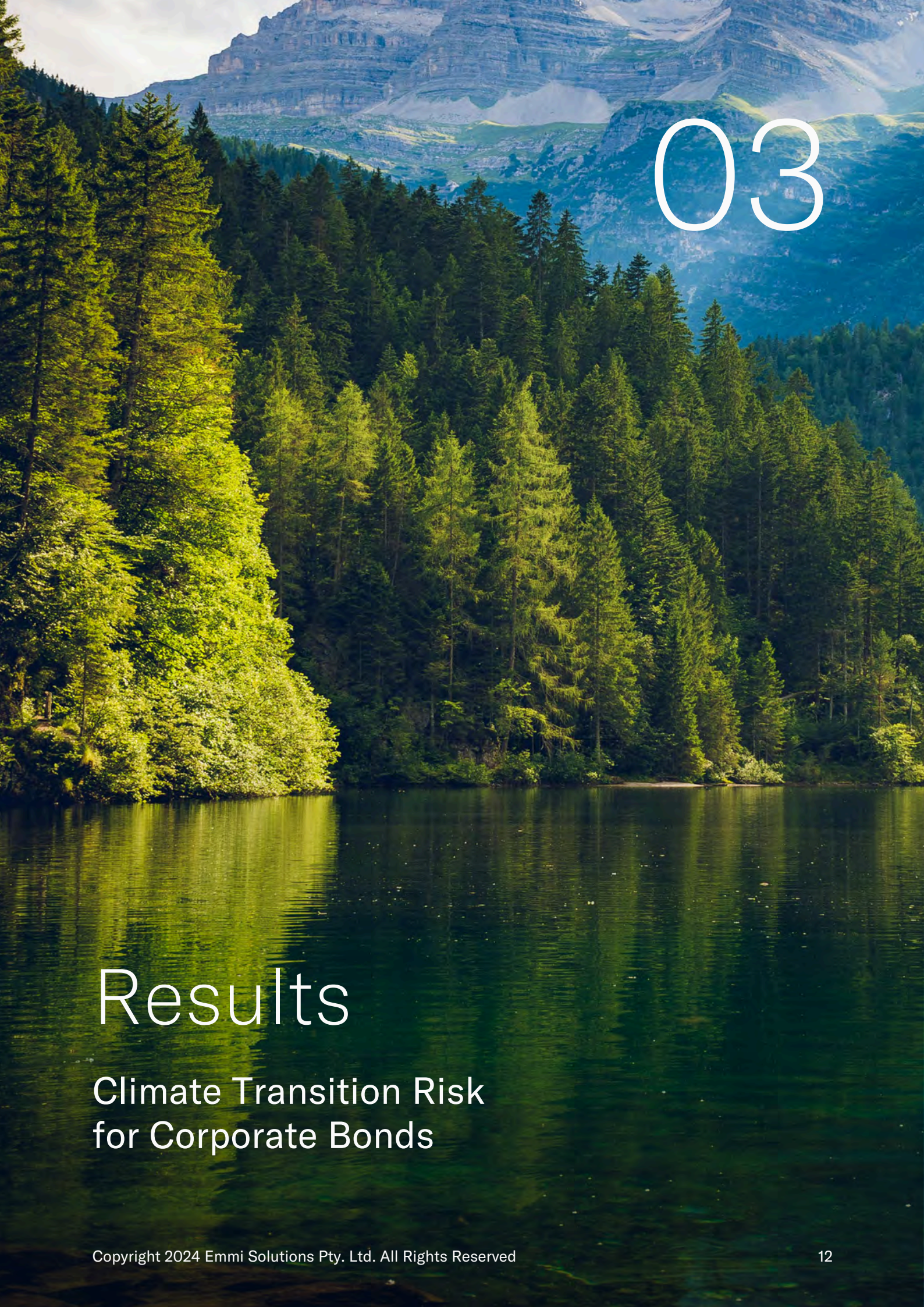

03

Results

Climate Transition Risk for Corporate Bonds

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Results: Climate Transition Risk for Corporate Bonds

Overall Carbon Exposure of Debt

Scenario	TVaR Threshold (<%)	Amount ($B)	# of Bonds	# of Companies
IPCC 4°C	-2%	37.80	144	10
	-10%	20.99	50	10
	-50%	11.65	20	3
	-90%	11.15	19	3
IPCC Net Zero	-2%	2,967.09	8,163	805
	-10%	2,694.89	7,396	756
	-50%	2,263.40	6,039	615
	-90%	1,966.59	5,172	539
IPCC 2°C	-2%	285.12	913	125
	-10%	266.41	836	116
	-50%	169.79	381	85
	-90%	126.86	238	63
NGFS Current	-2%	29.60	75	11
	-10%	15.29	31	8
	-50%	11.99	23	5
	-90%	11.99	23	5
NGFS Delayed	-2%	230.41	463	153
	-10%	199.24	385	138
	-50%	174.34	332	124
	-90%	152.32	293	111
NGFS Fragmented	-2%	94.52	231	76
	-10%	78.70	181	67
	-50%	59.82	133	51
	-90%	53.86	108	44
NGFS Low Demand	-2%	1,020.74	2,911	375
	-10%	912.96	2,566	350
	-50%	683.41	1,752	275
	-90%	563.51	1,343	228
NGFS NDC	-2%	215.53	741	96
	-10%	187.21	584	87
	-50%	111.16	287	61
	-90%	91.62	196	43
NGFS Net Zero 2050	-2%	1,850.88	5,276	576
	-10%	1,712.70	4,804	533
	-50%	1,360.61	3,578	436
	-90%	1,097.83	2,864	382
NGFS 2°C	-2%	263.59	850	130
	-10%	236.50	711	122
	-50%	161.90	394	98
	-90%	129.61	262	71

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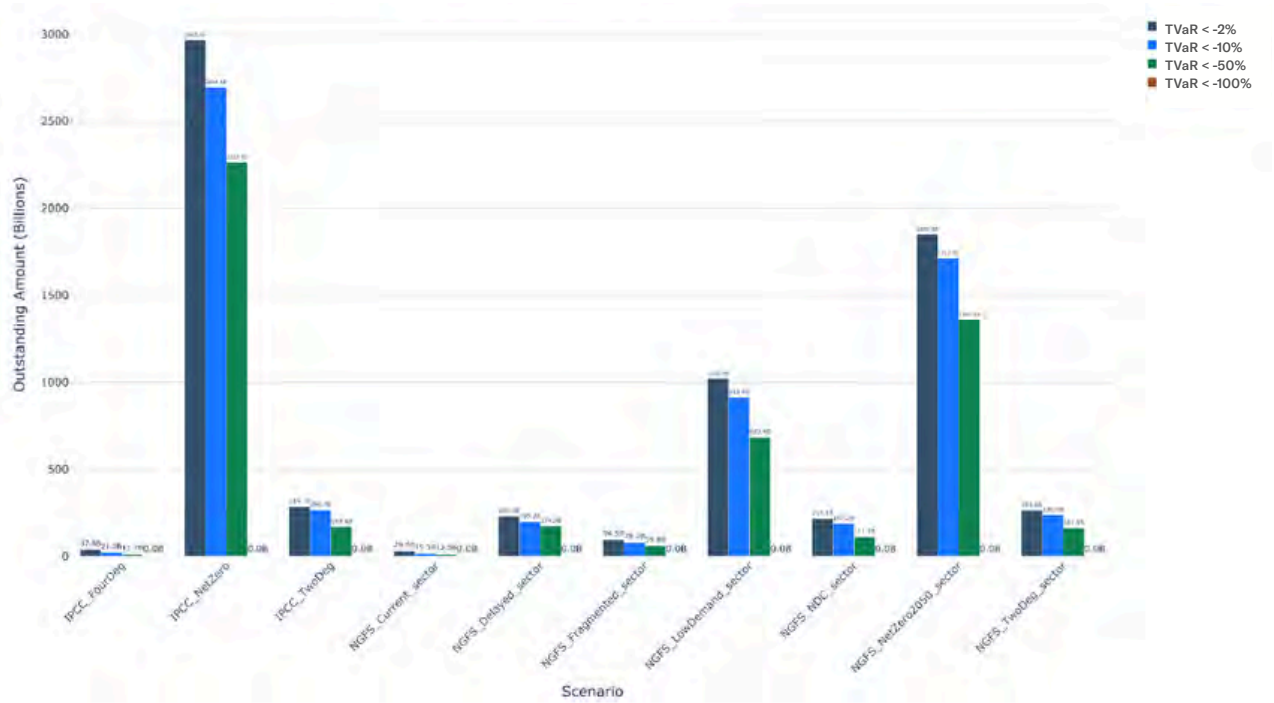
Global Outstanding Amount at Significant Transition Risk by Scenario

Our analysis shows that the TVaR of total outstanding corporate debt varies substantially among the climate scenarios by 2030, as carbon pricing evolves.



1.5° Net Zero Scenarios

In the IPCC 1.5°C Net Zero at -10% TVaR or lower threshold, $2.69tn in bonds are affected, spanning 7,396 bonds from 756 companies. This declines to $2.26tn affecting 6,039 bonds from 615 companies at -50% TVaR. At the most severe -90% threshold, $1.97tn in bonds are impacted, involving 5,172 bonds from 539 companies.

The NGFS 1.5°C Net Zero scenario shows lower but still substantial impacts. At -10% TVaR threshold, $1.71tn in bonds are affected across 4,804 bonds from 533 companies. This decreases to $1.36tn affecting 3,578 bonds from 436 companies at -50% TVaR threshold. At -90% TVaR threshold, $1.10tn in bonds are impacted, involving 2,864 bonds from 382 companies.

The IPCC scenario consistently shows about 1.5-1.8 times higher impacts than the NGFS scenario across all thresholds.

Both scenarios demonstrate a gradual decline in affected amounts, bonds, and companies as TVaR thresholds become more severe, though even at -90% TVaR threshold, the impacts remain significant with hundreds of companies affected and over a trillion dollars in bonds impacted in the IPCC case.

What's particularly notable is the relatively modest decline between liability levels in both scenarios. In the IPCC 1.5°C Net Zero, even at the 90% liability threshold, the at-risk debt remains at 73% of the 10% liability threshold amount. Similarly, in the NGFS 1.5°C Net Zero scenario, the 90% liability threshold still retains 64% of the 10% liability threshold amount. This suggests that under 1.5°C scenarios, when companies face transition risks, they are more likely to face severe rather than moderate impacts on their debt value.

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2°C Paris-aligned Scenarios

In the IPCC 2°C scenario at -10% TVaR threshold, $266.41bn ($0.27tn) in bonds are affected, spanning 836 bonds from 116 companies. This declines to $169.79bn ($0.17tn) affecting 381 bonds from 85 companies at -50% TVaR threshold. At the most severe -90% threshold, $126.86bn ($0.13tn) in bonds are impacted, involving 238 bonds from 63 companies.

The NGFS 2°C scenario shows similar impacts. At -10% TVaR threshold, $236.50bn ($0.24tn) in bonds are affected across 711 bonds from 122 companies. This decreases to $161.90bn ($0.16tn) affecting 394 bonds from 98 companies at -50% TVaR threshold. At -90% TVaR, $129.61bn ($0.13tn) in bonds are impacted, involving 262 bonds from 71 companies.

The two scenarios show remarkably similar impacts, with differences of less than 15% in bond values across thresholds. These parallel patterns between the IPCC and NGFS 2°C scenarios suggest strong agreement in their assessment of transition risks. The relatively modest decrease between the 50% and 90% loss levels also indicates that most companies facing severe transition risks in a 2°C scenario are likely to face very severe risks, rather than moderate ones.

NGFS Current Policies Scenario

Under the NGFS Current Policy scenario, which projects minimal global climate transition financial risk, about $29bn in bonds are at risk of at least -2% TVaR by 2030, spanning 75 bonds from 11 companies. This impact narrows to $15.29bn across 31 bonds from eight companies at the -10% TVaR threshold. At -50% TVaR, the exposure is $11.99bn affecting 23 bonds from five companies. Notably, at the most severe -90% TVaR threshold, the same five companies remain at risk, with their $11.99bn in bonds (23 bonds) still exposed. This finding highlights that five to eight companies are highly financially vulnerable to climate transition risks, even without any additional policy or pricing measures.

Though this vulnerability is significantly lower compared to Paris-aligned scenarios, the fact that these companies are facing such extreme risks under current policies suggests that their business models may be inherently unstable in the face of carbon pricing found today.

Overall, our analysis shows that across all scenarios, the amount of at-risk corporate debt decreases as the financial loss threshold (TVaR) increases (from 10% to 90%), suggesting that while many companies face moderate transition risks, fewer face severe risks that could lead to near-total losses.

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Carbon Exposures of Debt by Industry

Our analysis reveals substantial climate transition risks across multiple sectors by 2030 under the NGFS 1.5°C or 2°C scenarios. The concentration of risk is particularly notable in utility and energy-related sectors, which together represent a significant portion of the total exposure. (To simplify the analysis, we only show the suite of NGFS scenarios for comparison.)

Electric Utilities stands out as the most exposed sector, with $806.61billion in at-risk debt across 2,695 bonds. This high exposure likely reflects the sector's capital-intensive nature and its critical role in the energy transition of utilities away from fossil fuel-based power generation toward renewable alternatives. The large number of bonds also indicates the sector's heavy reliance on debt financing for infrastructure investments.

The energy sector shows widespread vulnerability, with several subsectors facing substantial risks:

- Integrated Oil companies have $219.43billion at risk across 389 bonds
- Gas Distributors show $177.78billion of exposure (674 bonds)
- Oil & Gas Pipelines face $162.02billion in risk (268 bonds)
- Oil Refining/Marketing companies have $124.13billion at risk (349 bonds)

Combined, these energy-related sectors account for approximately $683billion in at-risk debt, highlighting the significant financial challenges facing fossil fuel-dependent industries in a Net Zero transition.

Heavy industry sectors also show notable exposure:

- Aerospace & Defense has the second-highest individual sector exposure at $287.07billion (443 bonds)
- Chemicals across various specialties (Specialty, Agricultural, Major Diversified) collectively account for about $222billion (807 bonds)
- Steel manufacturers face $96.83billion in at-risk debt across 309 bonds

At the lower end of the scale, while sectors like Coal ($9.38billion across 65 bonds) and Miscellaneous Manufacturing ($12.28billion across 50 bonds) show smaller absolute exposures, these figures may still represent significant percentages of their total outstanding debt. The relatively small number of bonds in these sectors suggests more concentrated risk among fewer issuers.

The automotive sector's exposure is spread across different subsectors:

- Auto Parts: OEM shows $62.30billion at risk (249 bonds)
- Trucks/Construction/Farm Machinery faces $47.60billion in exposure (170 bonds)
- Automotive Aftermarket has $19.40billion at risk (65 bonds) This segmentation highlights how transition risks affect different parts of the automotive value chain.

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This comprehensive picture suggests that climate transition risks are not just concentrated in obvious carbon-intensive sectors but extend across the industrial economy, potentially affecting various supply chains and financial markets. The large number of bonds involved indicates that these risks are widely distributed among investors and financial institutions.

Table: Number of bonds and amount in $B for each sector at risk of at least 10% TVaR by 2030 under Net-Zero scenarios

Industry	# of Bonds	Amount ($B)
Electric Utilities	2,695	806.61
Aerospace & Defense	443	287.07
Integrated Oil	389	219.43
Gas Distributors	674	177.78
Oil & Gas Pipelines	268	162.02
Chemicals: Specialty	541	148.80
Oil Refining/Marketing	349	124.13
Steel	309	96.83
Alternative Power Generation	463	82.93
Industrial Machinery	347	75.58
Auto Parts: OEM	249	62.30
Electronic Equipments/Instruments	136	59.39
Trucks/Construction/ Farm Machinery	170	47.60
Food: Meat/Fish/Dairy	97	38.51
Chemicals: Agricultural	99	36.87
Chemicals: Major Diversifies	167	36.14
Electronics/Appliances	104	23.65
Pulp & Paper	93	21.57
Automotive Aftermarket	65	19.40
Miscellaneous Manufacturing	50	12.28
Coal	65	9.38
Services to the Health Industry	9	4.42

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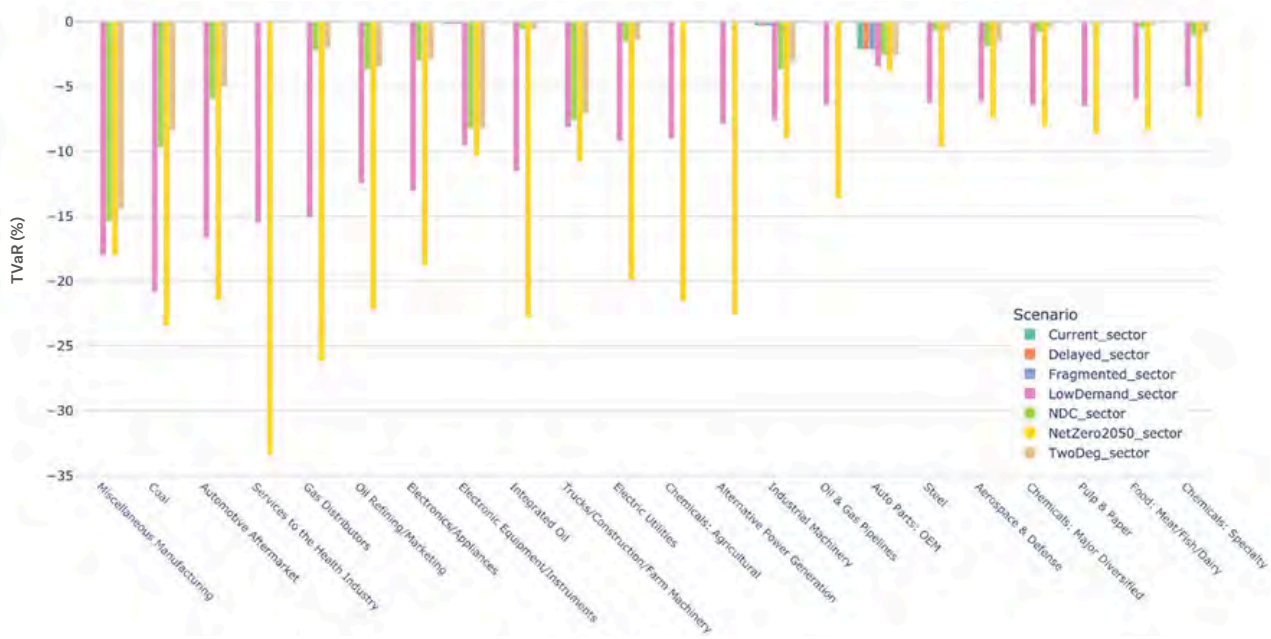
NGFS Scenarios – TVaR Comparison for High-Impact Industries (2030)



The 'Net Zero 2050' scenario shows the most significant potential debt risks across industries, with several sectors facing substantial liabilities. Gas Distributors face the highest risk in this scenario at 26.2% of debt at risk, followed by Coal (23.4%), Integrated Oil (22.8%), and Alternative Power Generation (22.6%). This suggests that fossil fuel-related industries are particularly vulnerable under aggressive decarbonisation pathways. (To note, while Services to the Health Industry shows a 33.3% risk, this is across only nine bonds, and is therefore not considered significant in the analysis.)

The 'Low Demand' scenario presents moderate but still significant risks, with Coal showing the highest vulnerability at 20.9%, followed by Miscellaneous Manufacturing at 18.0%, and Automotive Aftermarket at 16.6%. Notably, even traditionally stable sectors like Electric Utilities face meaningful risks (9.2%) in this scenario.

In contrast, the Current, Delayed, and Fragmented scenarios show minimal risk across almost all sectors, with most industries showing near-zero liability. This suggests that significant carbon-related financial risks primarily materialize under more ambitious climate action scenarios. Auto Parts: OEM is one of the few sectors showing some risk (2.2%) even in these less stringent scenarios. Something to consider is that if the overall risk to an entity is lower in these other scenarios, equity has the potential to absorb all the risk, meaning little risk with the debt.

The 'Nationally Determined Contributions (NDC)' and '2°C' scenarios present similar moderate risks, generally lower than the Net Zero 2050 pathway but still significant for certain sectors. Miscellaneous Manufacturing stands out with notably high risk levels in both scenarios (15.4% and 14.4% respectively), while most other sectors face single-digit percentage risks.

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Transition Value at Risk (TVaR) of Debt by 2030 Under Various Climate Scenarios

Industry	Current	Delayed	Frag	Low Demand	NDC	Net-Zero 2050	2˚C
Aerospace & Defense	-0.0%	-0.0%	-0.0%	-6.2%	-1.9%	-7.5%	-1.5%
Alternative Power Generation	-0.0%	-0.0%	-0.0%	-7.9%	-0.0%	-22.6%	-0.0%
Automotive Aftermarket	-0.0%	-0.0%	-0.0%	-16.6%	-6.0%	-21.4%	-4.9%
Chemical: Agricultural	-0.0%	-0.0%	-0.0%	-9.0%	-0.0%	-21.5%	-0.0%
Chemicals: Major Diversified	-0.0%	-0.0%	-0.0%	-6.4%	-0.8%	-8.1%	-0.5%
Chemicals: Specialty	-0.1%	-0.1%	-0.1%	-5.0%	-1.1%	-7.5%	-0.8%
Coal	-0.0%	-0.0%	-0.0%	-20.9%	-9.7%	-23.4%	-8.4%
Electric Utilities	-0.0%	-0.0%	-0.0%	-9.2%	-1.6%	-19.9%	-1.4%
Electronic Equipment/ Instruments	-0.2%	-0.2%	-0.2%	-9.5%	-8.2%	-10.3%	-8.2%
Electronics/ Appliances	-0.0%	-0.0%	-0.0%	-13.0%	-3.1%	-18.8%	-2.9%
Food: Meat/Fish/ Dairy	-0.0%	-0.0%	-0.0%	-6.0%	-0.4%	-8.4%	-0.3%
Gas Distributors	-0.1%	-0.1%	-0.1%	-15.1%	-2.2%	-26.2%	-2.0%
Industrial Machinery	-0.3%	-0.3%	-0.3%	-7.6%	-3.7%	-9.0%	-3.1%
Integrated Oil	-0.0%	-0.0%	-0.0%	-11.5%	-0.6%	-22.8%	-0.6%
Miscellaneous Manufacturing	-0.0%	-0.0%	-0.0%	-18.0%	-15.4%	-18.0%	-14.4%
Oil & Gas Pipelines	-0.0%	-0.0%	-0.0%	-6.5%	-0.0%	-13.6%	-0.0%
Oil Refining/ Marketing	-0.0%	-0.0%	-0.0%	-12.5%	-3.7%	-22.2%	-3.5%
Pulp & Paper	-0.0%	-0.0%	-0.0%	-6.5%	-0.0%	-8.7%	-0.0%
Services to the Health Industry	-0.0%	-0.0%	-0.0%	-6.3%	-0.7%	-9.7%	-0.6%
Steel	-0.0%	-0.0%	-0.0%	-6.3%	-0.7%	-9.7%	-0.6%
Trucks/Construction/ Farm Machinery	-0.0%	-0.0%	-0.0%	-8.1%	-7.6%	-10.8%	-7.1%

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Differences between 1.5˚C to 2˚C scenarios?

The Net Zero 2050 scenario consistently shows more severe debt TVaR compared to the 2°C scenario across nearly all sectors. The most striking differences are:

- Alternative Power Generation shows a 22.6% risk under Net Zero but drops to nearly 0% under 2°C - a dramatic difference of 22.6 percentage points
- Gas Distributors face 26.2% risk under Net Zero versus just 2.0% under 2°C - a 24.2 percentage point difference
- Integrated Oil shows 22.8% risk under Net Zero compared to just 0.6% under 2°C - a 22.2 percentage point gap
- Oil Refining/Marketing has 22.2% risk under Net Zero versus 3.5% under 2°C - an 18.7 percentage point difference

However, some sectors show relatively similar risk levels between the two scenarios:

- Electronic Equipment/Instruments (10.3% vs 8.2%)
- Miscellaneous Manufacturing (18.0% vs 14.4%)
- Trucks/Construction/Farm Machinery (10.8% vs 7.1%)

This suggests that while Net Zero 2050 generally presents higher transition risks, the impact is most pronounced in fossil fuel-related and energy-intensive industries, while other sectors see more modest differences between the two scenarios.

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04

Transition Value at Risk for Green Bonds

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NGFS Net Zero Scenario

Electric Utilities dominate the green bond issuance market, with 327 bonds totaling $138.1billion, representing over 70% of the total amount across all industries. Significantly, this sector's debt exposure by 2030 is -14.4%. Alternative Power Generation follows as the second most active issuer with 86 bonds, it has a significantly lower total amount outstanding of $17.41billion but a higher TVaR of -20.6%. It's important to note that some companies within a sector can skew the mean. This is the case with Alternative Power Generation, some companies classified in this industry have a significant proportion of traditional fossil fuel sources of power generation (which means a TVaR of near -100%).

The average debt TVaR across all industries that issue green bonds is -31.4%, with a wide range from -100% to -7%. The total outstanding amount across all industries is $192.73billion spread across 522 bonds, suggesting significant green financing activity in these high-impact sectors despite the substantial climate-related risks they face.

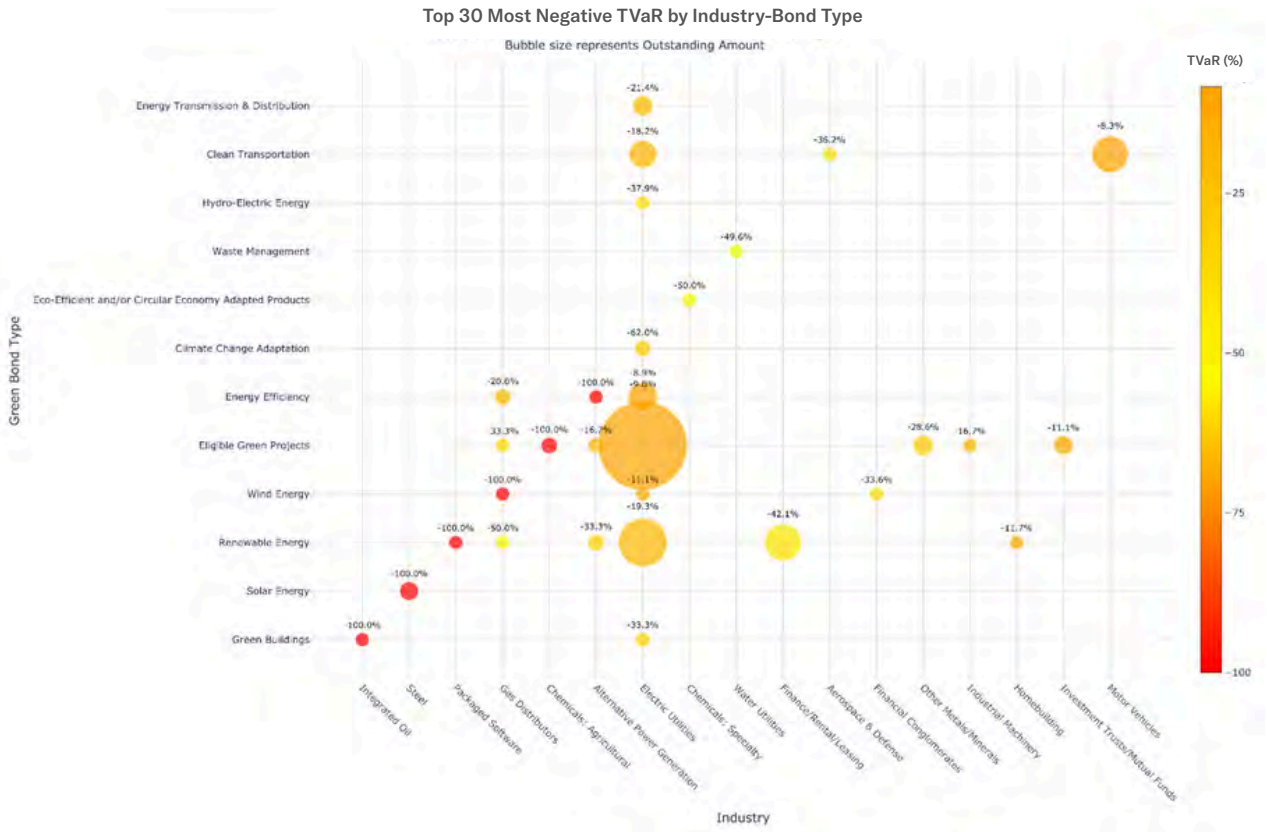

Chart: Top 30 Most Negative TVaR by Industry-Bond Type

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Understanding Green Bonds: A Tool for Financing, Not a Quick Fix for Climate Risk

While green bonds can play an important role in a company's climate strategy, issuing them alone doesn't immediately reduce climate risk. Instead, green bonds serve as a financing mechanism that, when used effectively, can contribute to long-term resilience against climate risk.

When investors purchase green bonds, the funds are specifically earmarked for green projects that have a positive impact on the environment. However, the issuance of a green bond does not automatically reduce a company's climate transition risk. Climate risk is embedded in the issuer's overall business operations, organisational structure, and reliance on specific markets. For example, an oil and gas company may issue a green bond to fund a renewable energy project, but its main source of income - fossil fuel extraction - still carries significant climate transition risk. In this scenario, while the green bond may support projects that lower emissions or diversify revenue streams, the primary climate risk remains within the core activities of the company.

While green bonds don't offer an immediate risk reduction, Green bonds support a company's long-term climate resilience by funding emission reduction projects and diversifying revenue streams.

These initiatives can lead to lower exposure to carbon pricing, regulatory costs, and supply chain pressures, as well as reduce vulnerability to the transition risk of a low-carbon economy. For example, a utility company could issue a green bond to expand renewable energy capacity, while a heavy industry company could develop sustainable products with the proceeds.

Green bonds can also enhance a company's reputation with stakeholders, such as customers, employees, and investors, who value environmental responsibility. By demonstrating a commitment to funding climate-friendly projects, companies may experience stronger loyalty and broader investor support. This can lead to improved access to capital and potentially reduce financial risk. For example, an energy company's green bond issuance for carbon capture technology may attract environmentally conscious investors and improve its standing in the market over time. While not offering immediate climate risk reduction, green bonds can contribute to long-term climate resilience by supporting a gradual transition to a more sustainable model.

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About Emmi

Emmi provides comprehensive climate risk intelligence for investors. Our datasets cover emissions, transition and physical risk across public and private markets, covering all major asset classes and driving 100% portfolio coverage.

Built on a consistent methodology, Emmi delivers the transparency and customisation investors need to make better investment decisions, meet climate disclosure requirements, and align with regulatory and mandate expectations.

Emmi is founded on a simple idea: mobilising capital is the fastest path to decarbonisation. By quantifying climate risk exposure at scale, we enable the financial sector to allocate capital more efficiently toward climate-aligned outcomes.

To meet this need, we built Carbon Diagnostics - decision-useful climate insights, delivered at scale.

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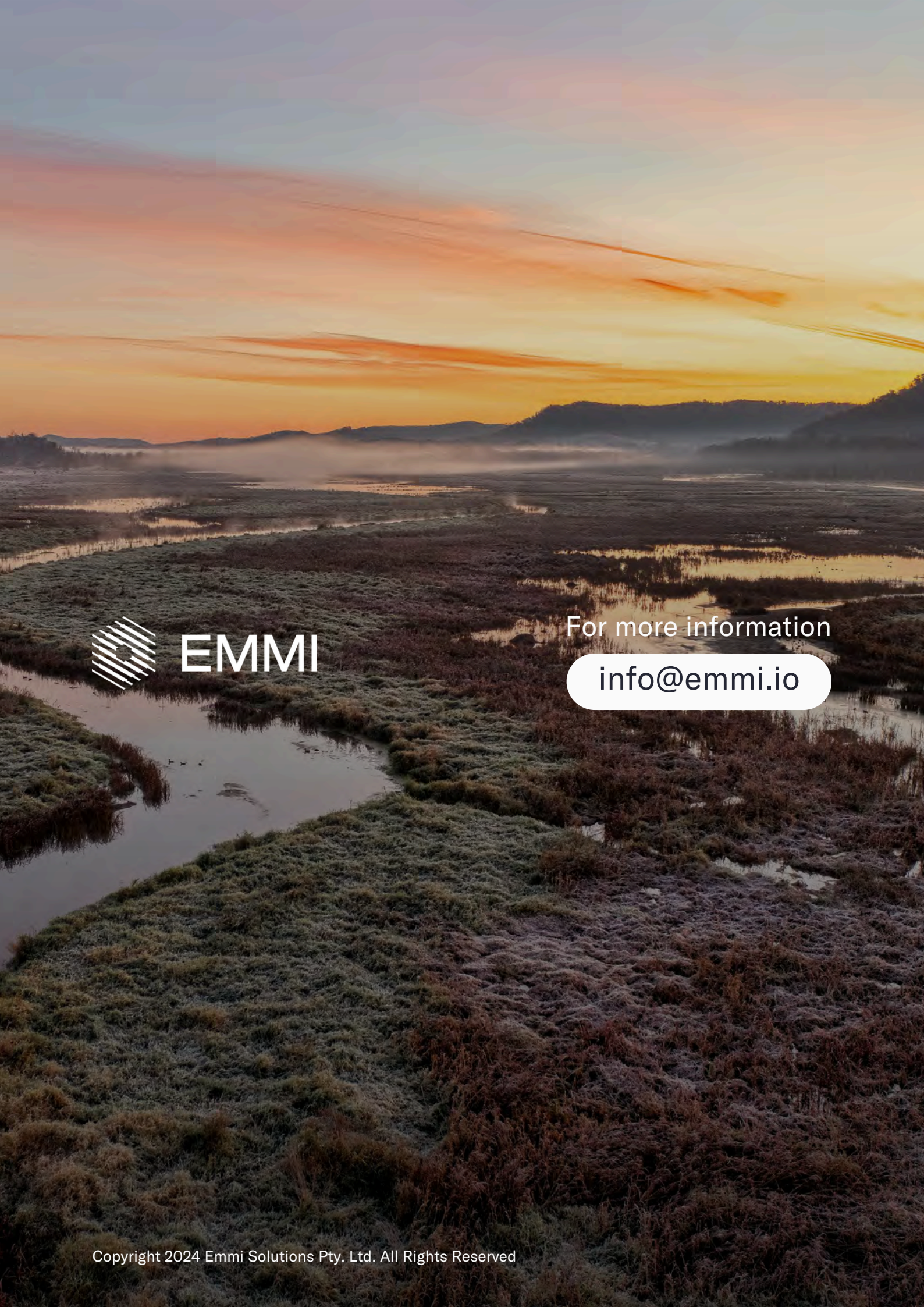

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