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GREEN BONDS VS. SUSTAINABILITYLINKED LOANS: WHICH WORKS FOR INDUSTRIAL DECARBONISATION?

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Abstract. Green bonds and sustainability-linked loans (SLLs) are the two main instruments for financing industrial emission reductions. This paper compares them using 2024–2026 market data, a BIS study, and academic research. Green bonds reduce Scope 1 emissions by 21% within one year of issuance [1]. Studies show no average emission improvement for SLLs [9]. SLL issuance peaked at USD 158 billion in Q4 2024 and then declined sharply, while green bonds reached USD 683 billion in the first nine months of 2025 [4]. A newer instrument, transition bonds, increased from USD 21 billion in 2024 to a forecasted USD 40 billion in 2026 [2]. Green bonds are effective but inflexible. SLLs are flexible but lack credibility unless KPIs are strict and verified. Policy measures should address verification gaps.

Keywords: green bonds, sustainability-linked loans, transition finance, industrial decarbonisation, greenwashing.

Аннотация. «Зелёные» облигации и кредиты, привязанные к показателям устойчивого развития (sustainability-linked loans, SLL), являются двумя основными инструментами финансирования сокращения промышленных выбросов. В данной статье проводится их сравнительный анализ на основе рыночных данных за 2024–2026 гг., исследования Банка международных расчётов (BIS) и результатов академических исследований. Установлено, что «зелёные» облигации позволяют сократить выбросы Scope 1 на 21% в течение одного года после выпуска [1]. В то же время исследования не выявили существенного среднего улучшения показателей выбросов при использовании SLL [9]. Объём выпуска SLL достиг максимума в размере 158 млрд долл. США в IV квартале 2024 года, после чего значительно снизился, тогда как объём выпуска «зелёных» облигаций достиг 683 млрд долл. США за первые девять месяцев 2025 года [4]. Новый инструмент — переходные облигации (transition bonds) — увеличился с 21 млрд долл. США в 2024 году до прогнозируемых 40 млрд долл. США в 2026 году [2]. «Зелёные» облигации демонстрируют высокую эффективность, однако отличаются ограниченной гибкостью. SLL обладают большей гибкостью, но их надёжность снижается при отсутствии строгих и проверяемых ключевых показателей эффективности (KPI). В связи с этим особое значение приобретает совершенствование механизмов верификации.

Ключевые слова: зелёные облигации, кредиты, привязанные к показателям устойчивого развития, переходное финансирование, декарбонизация промышленности, гринвошинг.

INTRODUCTION

Industry — including cement, steel, chemicals, and textiles — accounts for about 30% of global CO_2 emissions. Reducing these emissions requires substantial financing. However, many industrial plants are considered too “brown” for pure green finance. In this context, two financial instruments have become increasingly important.

Green bonds are use-of-proceeds bonds. They allow issuers to raise funds that must be allocated to approved green projects, such as solar panels, energy-efficient motors, and other environmentally beneficial investments. Sustainability-linked loans (SLLs) are different. They are general-purpose loans whose interest rates increase or decrease depending on whether the borrower meets predefined sustainability targets, such as reducing CO_2 emissions per ton of output by 2028.

In theory, SLLs provide industrial firms with greater flexibility. For example, a steel plant can use an SLL to finance a combination of efficiency upgrades, hydrogen pilot projects, and workforce training, some of which

may not qualify as “green” under strict classification rules. In practice, however, the market has become more cautious toward SLLs.

The numbers illustrate this trend. In the first three quarters of 2025, green bond issuance reached USD 683 billion [4]. SLL issuance peaked at USD 158 billion in Q4 2024 and then declined. Overall, sustainable loans fell by 22% in 2025, with SLLs leading the decline [4]. At the same time, a third label — transition bonds — is growing rapidly, increasing from USD 21 billion in 2024 to a projected USD 40 billion in 2026 [2].

This paper asks which instrument actually works for an industrial firm. It compares green bonds and SLLs based on three criteria: market size, emission reductions, and enforcement. It also examines transition bonds as an emerging hybrid instrument.

LITERATURE REVIEW

A significant body of research has been published on green finance instruments since 2020, but direct comparisons remain limited. This review focuses on three areas: green bonds, sustainability-linked loans, and the newer category of transition bonds.

Green bonds. Most early studies focused on the “greenium”, meaning a lower interest rate associated with green financing. In 2025, however, the BIS published a study that directly measured emission outcomes. It found that companies issuing green bonds reduced their Scope 1 emissions by 21% within one year and total emissions by more than 10% over four years [1]. This provides strong evidence of their effectiveness. However, green bonds have one important limitation: the proceeds can only be spent on projects already classified as “green”. For example, this may not be suitable for a cement plant attempting to shift from coal to hydrogen.

Sustainability-linked loans (SLLs). SLLs were introduced to address this limitation. The Loan Market Association issued its principles in 2019, and the market expanded rapidly, reaching USD 158 billion in a single quarter in 2024 [4]. However, academic studies later examined the instrument more critically. Wang et al. (2025) identified two common issues: claiming credit for emission reductions that had already been planned and setting targets that were too easy to achieve [6]. SDA Bocconi (2025) analyzed a range of SLLs and found no average emission improvement, although it concluded that SLLs can work when KPIs are clear and verifiable [9]. Regulators also raised concerns. In August 2025, the UK Financial Conduct Authority (FCA) stated that banks were not sufficiently clear about how they accounted for SLLs, which could weaken market trust [7].

Transition bonds. Transition bonds represent the newest label in sustainable finance. ICMA published guidelines in November 2025 for financing the “brown-to-green” transition [3]. The purpose of this instrument is to fill the gap between green bonds, which may be too strict, and SLLs, which may be too flexible. Moody’s expects issuance to nearly double from USD 21 billion in 2024 to USD 40 billion in 2026 [2]. S&P Global notes that the transition label can improve transparency in hard-to-abate sectors. However, there is still very limited empirical evidence on whether transition bonds actually reduce emissions, as the first major deals only appeared in late 2025.

Research gap. Three key gaps remain in the existing literature. First, few studies directly compare green bonds and SLLs side by side using the same industries and time periods. Second, research on transition bonds is mostly forward-looking and lacks ex-post evidence. Third, most existing evidence comes from developed economies, while emerging economies remain understudied. This paper aims to address the first of these gaps.

RESEARCH METHODS

Three types of data are used in this study.

First, market aggregates from Environmental Finance Data, the Loan Market Association, Moody’s, and ING’s Sustainable Finance Pulse (2025–2026) are used. These sources provide information on issuance volumes, growth rates, and loan and bond categories.

Second, peer-reviewed studies are analyzed, including the BIS working paper on green bond outcomes published in March 2025 [1], Wang et al. (2025) on SLL greenwashing [6], and the SDA Bocconi study on SLL effectiveness [9].

Third, seven real industrial transactions with publicly reported KPIs are examined. These cases were selected to ensure sectoral diversity, including cement, steel, chemicals, and multi-sector companies, and because they provide sufficient detail for comparison.

For each case, the following aspects are analyzed: financial structure, including use-of-proceeds versus general-purpose financing; KPI ambition; third-party verification; and reported outcomes.

ANALYSIS AND RESULTS

The dynamics of sustainable finance instruments demonstrate significant differences in market development and investor preferences. Green bonds continue to dominate the sustainable finance market, while sustainability-linked loans (SLLs) have experienced a decline in issuance volumes in recent years. At the same time, transition bonds are emerging as a rapidly growing financing instrument for hard-to-abate industrial sectors. Table 1 presents key market indicators and development trends for green bonds, SLLs, and transition bonds during the period 2024–2025 (Table 1).

Table 1
Market Statistics for Green Bonds and Sustainability-Linked Loans (SLLs), 2024–2025[1]

Indicator	Value
Green bond issuance (January–September 2025)	USD 683 billion
SLL issuance peak (Q4 2024)	USD 158 billion
Total sustainable loan issuance (2025)	USD 749 billion
Change in sustainable loan issuance (2025 vs. 2024)	–22%
Green bond market forecast (2025–2031)	USD 661 billion → over USD 1 trillion
Transition bond market forecast (2024–2026)	USD 21 billion → USD 40 billion

Green bonds accounted for more than 60% of the labelled sustainable bond market in 2025 [4]. SLLs showed the opposite trend: their issuance declined sharply, and green loans, which are use-of-proceeds loans, exceeded SLLs in terms of transaction count [4]. This indicates that the market is increasingly directing capital toward instruments with clearer use-of-proceeds structures and stronger credibility (Figure 1).

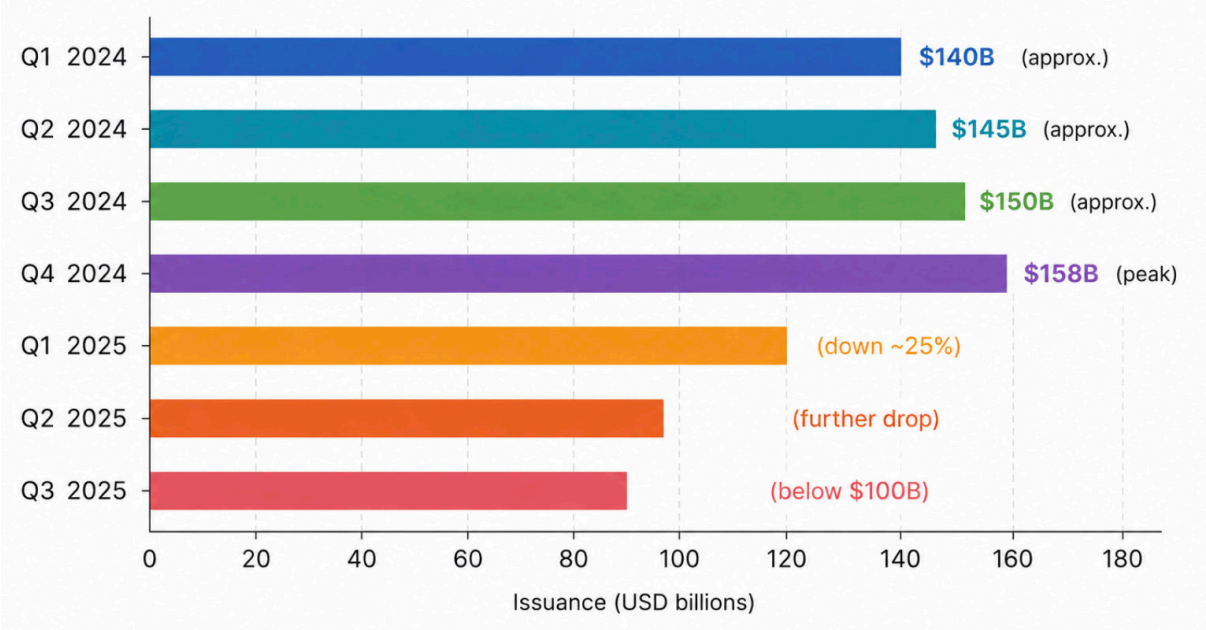

Figure 1. SLL quarterly issuance trend (simplified)[2]

The BIS study examined thousands of companies. The results are clear:

– Within one year after the first green bond issuance, Scope 1 emissions fell by 21% on average [1];
– Total emissions declined by more than 10% within four years [1];
– Emissions per dollar of revenue decreased by 30% [1].

For SLLs, the picture is different. SDA Bocconi analyzed SLLs and found “no average effect on emissions at any time horizon” [9]. The problem is not the concept itself, but its implementation. When SLLs have clear, verifiable, and material KPIs, they can be effective. However, most SLLs do not meet these conditions.

Wang et al. (2025) examined greenwashing in SLLs and identified two common practices [6]:

1 author’s development
2 Note: Exact quarterly figures vary by source; the shape – peak in Q4 2024 then decline – is confirmed by Environmental Finance Data [4].

1. Project misrepresentation — claiming credit for emission reductions that had already been planned;
2. Weak sustainability performance targets (SPTs) — setting targets that are too easy to achieve.

The cement industry provides a useful side-by-side comparison.

To better understand the practical differences between sustainability-linked loans (SLLs) and green bonds, it is useful to examine specific examples from the cement industry, one of the most carbon-intensive industrial sectors. Table 2 compares two financing cases—UltraTech Cement and CEMEX—focusing on the structure of the instrument, sustainability targets, transparency, and verification mechanisms. The comparison highlights the differences in accountability and monitoring requirements associated with each financing approach (Table 2).

Table 2

Comparison of Sustainability-Linked Loan and Green Bond Financing in the Cement Industry: Selected Company Cases[3]

Indicator	UltraTech Cement (SLL)	CEMEX (Green Bond)
Instrument	USD 500 million SLL	Green bond under a sustainability framework
KPI	27% Scope 1 emission reduction by 2032; 85% renewable energy by 2030	564 kg CO_2/t of cement by 2025; less than 475 kg CO_2/t by 2030
Base Year	Not publicly specified	2020
Third-Party Verification	Not disclosed	Yes (independent assurance)

The difference is not that one instrument is always better than the other. Rather, the green bond came with a verified, public, and time-bound emissions-intensity target. The SLL targets were ambitious on paper, but without verification, there is no reliable way to confirm whether they are credible.

Green bonds now operate under stricter rules in the EU. The EU Green Bond Standard (Regulation 2023/2631) states that [5]:

– at least 85% of proceeds must be allocated to EU Taxonomy-aligned activities;
– an independent external reviewer must assess pre- and post-issuance disclosures;
– from June 2026, external reviewers from outside the EU must register with ESMA.

Although the standard is currently voluntary, large issuers are already adopting it.

SLLs are governed by the LMA Sustainability-Linked Loan Principles, updated in March 2025 [2]. These principles state that KPIs should be “relevant, core, and material”. However, they remain voluntary. On 14 August 2025, the UK Financial Conduct Authority (FCA) issued a letter stating that banks lacked clarity on how they accounted for SLLs, which could undermine market trust [7].

As a result, green bonds are more credible but less flexible, while SLLs are more flexible but less credible unless borrowers go well beyond the minimum requirements.

If green bonds are too strict and SLLs are too flexible, transition bonds attempt to occupy the middle ground. They directly label the financing of “brown-to-green” transition activities.

The ICMA Climate Transition Bond Guidelines, issued in November 2025, provide a framework for such instruments [3]. In December 2025, IFC and QNB Türkiye issued a USD 100 million climate transition bond, the first global transaction under the ICMA guidelines. At least USD 50 million of the proceeds will be allocated to hard-to-abate sectors such as cement and steel.

Moody’s expects transition bond issuance to nearly double in 2026, increasing from USD 21 billion to USD 40 billion [2]. This remains small compared with the green bond market, but its growth rate is high.

The BIS study shows that green bonds can be effective when properly used. A 21% reduction in Scope 1 emissions within one year is a significant result. However, green bonds cannot finance every type of industrial transition. For example, a cement plant switching from coal to hydrogen may not be able to issue a green bond if the hydrogen does not yet qualify as “green” under the relevant taxonomy.

SLLs could fill this gap. However, market data show that SLL issuance is shrinking rather than growing. Academic evidence suggests one reason: too many SLLs have weak or unverifiable targets. Investors and banks have taken notice, and the FCA letter confirms that regulators have also identified this concern.

Transition bonds represent an attempt to address this problem. They label the transition process itself, rather than only the final green outcome. This makes them suitable for financing real-world industrial decarbonisation pathways, which are often complex, gradual, and long-term.

3 author’s development [11], [12]

For industrial firms seeking transition finance, the following instrument choices apply:

– Projects that fit the EU Taxonomy or an equivalent framework are suitable for green bond issuance. Such instruments may offer a lower cost of capital, often referred to as the "greenium", and empirical evidence from the BIS confirms associated emission reductions.

– For complex, multi-site transition plans, a sustainability-linked loan (SLL) may be appropriate, but only under strict conditions. The borrower must set ambitious and externally verifiable key performance indicators (KPIs). An independent third-party verifier should be engaged. Where material, Scope 3 emissions should also be included. Weak or easily achievable targets are penalised by the market.

– Firms in hard-to-abate sectors, such as cement, steel, and chemicals, should monitor the transition bond market. Although it is currently small, this market is growing rapidly. The ICMA guidelines provide a clear and practical framework for such issuances.

Three measures would help strengthen the market.

First, transition taxonomies should be harmonised. The EU, China, and ASEAN apply different rules, which increases costs for cross-border issuers.

Second, independent verification should be mandatory for SLLs. The voluntary LMA principles are not sufficient, and the FCA's concerns are justified.

Third, Scope 3 reporting should be required where material. Many industrial SLLs ignore Scope 3 emissions, which can account for up to 80% of emissions in some sectors. This creates a significant loophole.

The BIS green bond results may partly reflect better-managed companies, so causality is not fully proven. For SLLs, reliable longitudinal emissions data are difficult to obtain because reporting remains weak. Transition bond forecasts are based on estimates from one rating agency, and actual market outcomes may differ.

CONCLUSION AND RECOMMENDATIONS

Green bonds reduce emissions, and the evidence supporting their effectiveness is strong. However, they cannot finance the entire industrial transition. SLLs could help fill this gap, but the market is moving away from them because many deals lack credibility. Transition bonds represent a new option that attempts to combine the credibility of green bonds with the flexibility required by industry.

For an industrial firm, the choice of instrument depends on its specific transition plan. For policymakers, the main task is to close the verification gap. For researchers, the key open question is whether transition bonds will scale up while delivering real emission reductions, or whether they will repeat the mistakes of early SLLs.

REFERENCES

1. Bank for International Settlements (BIS). (2025). *Green Bond Issuance and Corporate Emissions: A Causal Analysis*. BIS Working Paper, March 2025.
2. Moody's Investors Service. (2026). *Sustainable Finance Outlook 2026*. January 2026.
3. International Capital Market Association (ICMA). (2025). *Climate Transition Bond Guidelines (CTBG)*. November 2025.
4. Environmental Finance Data; Loan Market Association (LMA); ING. (2025–2026). *Sustainable Finance Pulse: Aggregate Market Statistics*.
5. European Commission. (2023). *Regulation (EU) 2023/2631 on European Green Bonds*. Official Journal of the European Union.
6. Wang, L., et al. (2025). "Design of Sustainable Performance Targets: Mitigating Greenwashing in Sustainability-Linked Loans". *Journal of Environmental Management*, Vol. 377.
7. Financial Conduct Authority (FCA). (2025). *Dear CEO Letter: Sustainability-Linked Loans*. 14 August 2025.
8. SDA Bocconi School of Management. (2025). *Sustainable Finance Put to the Data Test: KPIs Matter More than Labels*. Research Report.
9. UltraTech Cement. (2025). *Sustainability-Linked Loan Announcement*.
10. CEMEX. (2025). *Sustainability-Linked Bond Framework*.
11. UPL. (2021). *USD 750 Million Sustainability-Linked Loan*.
12. IFC & QNB Türkiye. (2025). *USD 100 Million Climate Transition Bond: First Global Issuance Aligned with ICMA CTBG*. 8 December 2025.
13. S&P Global Ratings. (2025). *Sustainability Insights: Transition Bonds Reached a Record USD 21 Billion in 2024*. February 2025.

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