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Mobilizing the Transition: Putting Road Public Transport and Rail in the Driver's Seat of Decarbonized Mobility

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As transport decarbonization requires private capital at scale, road public transport and rolling stock offer scalable opportunities for sustainable infrastructure investors.

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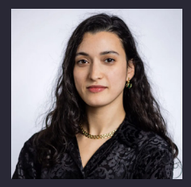

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The transport sector accounts for nearly a quarter of the European Union's greenhouse gas emissions and remains the largest contributor to urban air pollution. Unlike other major sectors of the economy, transport emissions have not experienced structural declines over the past decade and could increase by as much as 60% by 2050 if no further action is taken[1].

With over a hundred years of development around conventional fuels, today's transport infrastructure and value chain will **need significant capital to transition to cleaner technologies.** Meeting the EU's net-zero objectives is estimated to require around €265 billion annual investments between 2025 and 2030 within the transport sector[2], **with the bulk of this funding expected to come from private capital[3].**

Decarbonizing transport is a multimodal challenge encompassing road, rail, maritime and aviation, each with different emission profiles and levels of technological maturity. Road transport represents the largest share, accounting for roughly 73% of EU transport emissions, compared with just 0.3% for rail. Aviation and maritime account for around 23% of transport emissions and 2–3% of global CO_2 output; as other sectors decarbonize and global trade continues to expand, they may contribute to more than 40% of residual emissions by 2050[4]. **As road transport carries over half of EU freight and nearly 80% of passenger traffic and accounts for most transport emissions, decarbonizing it is critical to deliver meaningful emissions reductions.**

Significantly reducing emissions from road transport — across both **passenger and freight activities** — requires coordinated action across multiple fronts. This includes accelerating the adoption of cleaner private vehicles; enabling a sustained shift from private car use to public transport; and decarbonizing public transport fleets themselves – from zero-emission buses and coaches to metros, trams and rail increasingly powered by renewable electricity; and expanding safe infrastructure for walking and cycling. On the freight side, progress depends on deploying low and zero-emission trucks and vans, upgrading depots and logistics hubs, improving the efficiency of goods movement in urban and regional corridors, and shifting as much as possible from road to rail. Decarbonizing road freight remains particularly complex mainly due to the limited and uneven distribution of charging and refueling infrastructure necessary for its effective decarbonization. In the near term, rail—already a relatively low-carbon mode—can therefore act as the backbone of decarbonized logistics, absorbing more volume on suitable corridors, especially long-haul routes, while road freight's technology and infrastructure catch up. While climate investments across these levers have increased significantly in recent years (from € 66 billion in 2020 to € 119 billion in 2023), meeting the EU's net zero objectives would still require additional investment of at least €145 billion per year between 2025 and 2030 across those levers[5].

As private capital mobilizes to help close these investment gaps, our analysis highlights two segments that stand out for sustainable infrastructure investors seeking exposure to transport decarbonization: **road public transport (buses and coaches)** and **rolling stock. Both combine high decarbonization relevance with characteristics well suited to long-term infrastructure capital.** Buses and coaches sit at the heart of urban and regional mobility, enabling meaningful modal shift—one full bus can replace up to 50 private cars. Despite accounting for less than 2% of road transport emissions[6], decarbonizing road public transport offers one of the most immediate and scalable levers to reducing road emissions while delivering clear societal benefits: cleaner air, reduced traffic congestion and noise, increased cost savings and improved accessibility for communities ranging from aging populations to students and lower-income groups. Rolling stock, in turn, covering all railway vehicles operating on rails or tracked systems, is an essential service for accelerating and expanding a low-carbon mobility system. Unlike tracks electrification which remains predominantly state led and capital constrained rolling stock investment can be deployed more flexibly and deliver near-term gains in both capacity and emissions performance, making it a more actionable focus for private capital.

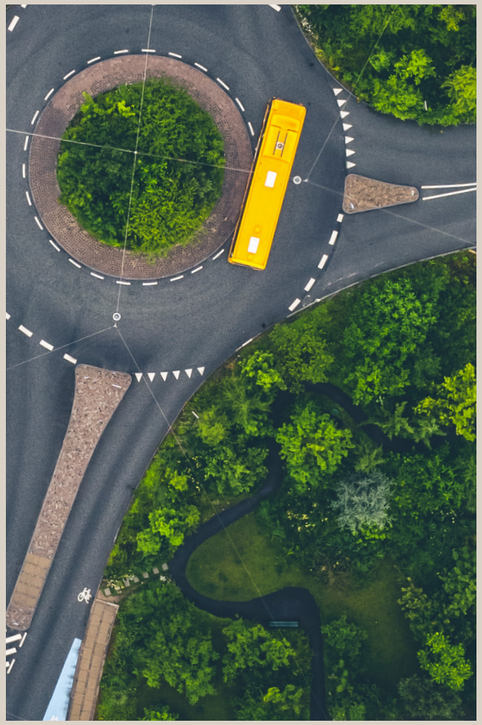
Shifting market dynamics are expanding investment opportunities for decarbonizing these two segments. Long-term contracted models and public-authority decarbonization mandates increasingly support cost-recovery and cash-flow visibility of decarbonized road transport while an ageing fleet and a progressively liberalized rolling stock market drive the decarbonization of rail. Both segments rely on essential, long-lived assets, operate under availability-based and lease-backed structures, and require sustained investment in clean fleets, depots, charging or refueling infrastructure, and grid interfaces — creating strong alignment with infrastructure investors seeking visibility on long-term cash flows and tangible climate contribution.

[1] World Bank, Enhancing Transport Decarbonization in the European Union, January 2025
[2] I4CE, The State of Europe's Climate Investment, 2025
[3] Transport & Environment, Financing transport decarbonisation, November 2024
[4] Idem
[5] I4CE, The State of Europe's Climate Investment, 2025
[6] PwC, Through the labyrinth of decarbonization, September 2025

Growth Drivers:
Regulatory developments and growing demand are turning decarbonized mobility across road and rail from ambition into execution

Momentum is building across Europe as regulation increasingly provides a clear and credible framework for transport decarbonization. EU policy is actively discouraging high-emission mobility while strengthening the economic and operational case for cleaner alternatives.

In road transport, climate ambition is translating into tighter CO_2 performance standards across vehicle segments.



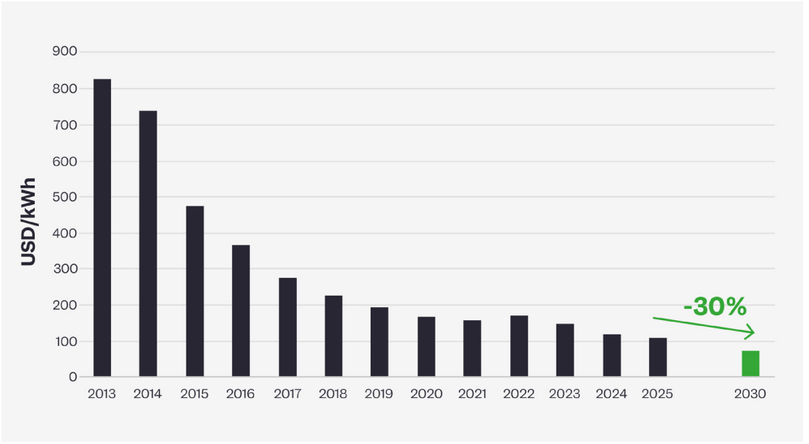
For passenger cars and vans, these standards accelerate the shift towards zero-emission vehicles while increasing the cost and complexity of private car ownership—reinforcing the relative attractiveness of public transport. In parallel, CO_2 standards for heavy-duty vehicles are pushing manufacturers and operators towards cleaner trucks, buses and coaches. Demand-side regulation further supports this transition: public procurement rules such as the Clean Vehicles Directive create predictable demand for low- and zero-emission fleets, while the Alternative Fuels Infrastructure Regulation (AFIR) addresses a key bottleneck by mandating the rollout of charging and refueling infrastructure across Europe. Complementary frameworks, including the EU Urban Mobility Framework and Sustainable Urban Mobility Plans (SUMPs), reinforce modal shift by improving the quality, connectivity and usability of public transport networks, while the expansion of Low Emission Zones across European cities is accelerating the move away from high-emission vehicles.

On the other hand, as the least carbon-intensive and most energy-efficient transport mode, rail expansion sits at the center of Europe's long-term mobility strategy. **The EU set objectives to double high-speed rail use by 2030 and triple it by 2050 and double rail freight traffic by 2050 compared to 2015 through various policy measures and incentives.** Persistent fragmentation and speed limitations have historically constrained the EU rail sector's efficiency and cross-border returns. To address this, targeted regulatory reforms since 2001 and the Trans-European Transport Network (TEN-T) framework more recently have driven rail market liberalization and interoperability, unlocking new investment opportunities. The deployment of European Rail Traffic Management System (ERTMS) represents a crucial technological step towards harmonizing diverse national signaling and train control systems across borders. By establishing this unified standard, ERTMS facilitates seamless international rail traffic, fundamentally enabling greater service speed, enhanced flexibility, improved capacity, and increased volume throughout the European network.

These regulatory ambitions are increasingly supported by public funding frameworks. Across Europe, governments are deploying grants and co-financing mechanisms that help move zero-emission road public transport from policy targets to procurement by reducing upfront capital costs and funding enabling infrastructure. At the same time, in rail, programs such as the Connecting Europe Facility (CEF) aim to upgrade networks and accelerate fleet modernization. Europe already benefits from one of the world's most extensive rail networks – nearly half electrified – providing a strong foundation to scale capacity and support modal shift despite progress remaining uneven. However, while public funding plays a critical enabling role, in reality, funding constraints at both national and EU levels have resulted in delays in areas such as network electrification and ERTMS deployment, highlighting widening investment gap. **In this context, funding mechanisms are evolving to act as catalysts, but mobilizing private capital is indispensable to deliver the scale of investment required.**

Meanwhile, **falling battery prices and continued technology maturation are rapidly reshaping the economics of fleet decarbonization.** Since 2010, lithium-ion battery pack costs have fallen by more than 90%. In 2025, prices fell to a record low of $108/kWh despite high battery metal costs. BNEF forecasts that average global battery pack costs will decline to $72/kWh by 2030[7]—a shift well beyond the long-recognized $100/kWh threshold for EV–ICE price parity. As these cost curves continue to break downward, electrification is moving decisively from an environmental aspiration to a clear financial optimization strategy.

Average Lithium-ion battery pack prices, 2023-30



Layered onto this is growing demand for decarbonized transport. In road public transport, **public transport authorities (PTAs) increasingly embed climate KPIs, life-cycle emissions assessments, and broader ESG criteria directly into tender evaluations**, making sustainability a core determinant of competitive performance. In France, environmental scoring can account for up to 30% of PTA evaluations. Industry initiatives like the Clean Bus Europe Platform are also helping scale zero-emission fleets. In parallel, rail is gaining renewed strategic importance as a low-carbon transport backbone, supported by **EU-wide reforms—from rail freight liberalization to the progressive opening of rail passenger markets.** This is reinforced by evolving user preferences, with passengers increasingly favoring lower-carbon mobility options, alongside rising ESG and decarbonization pressures on corporate shippers driving demand for lower-emission logistics solutions. Rail's structural efficiency on long-distance corridors positions it as a key enabler for long-haul low-carbon logistics, while road transport remains essential for first- and last-mile delivery—underscoring the need for cleaner vehicles and infrastructure across both modes. **These demand-side tailwinds are strengthening long-term visibility and supporting a growing pipeline of investable opportunities across both segments.**

[7] BNEF, 2025 Lithium-Ion Battery Price Survey, December 2025

Rail Market Architecture:

Rolling stock is emerging as a primary entry point for private capital to accelerate Europe's rail expansion and decarbonization—even while network electrification lags

Europe's rail sector has been undergoing a structural transformation enabling it to expand significantly. The EU has progressively opened national markets to competition, most recently through the Fourth Railway Package.

While passenger rail liberalization is still uneven across countries, open-access operators are gaining ground, and public service obligations (PSOs) remain the dominant model for regional and intercity services. Demand is growing steadily driven by climate ambition, congestion in other modes, and a shift in user preferences towards sustainable travel. High-speed rail continues to expand, and cross-border connectivity is improving, albeit slowly. In freight, liberalization began earlier, driven by successive EU railway packages that introduced open access and common rules on licensing, safety certification and non-discriminatory access to infrastructure. This has enabled new entrants to run services across Member States, supported the development of international freight corridors, and increased the importance of transparent path allocation, track-access charging and independent regulatory oversight.

Against this backdrop, **rolling stock has emerged as key investment entry point.** As both freight and passenger markets open, operators increasingly require access to modern fleets without bearing the full upfront capital expenditure, supporting a structural shift towards asset ownership separated from operations. **This dynamic is enabling specialized lessors and asset-backed financing models to play a growing role, offering long-duration, contract-based revenue streams with strong visibility.** At the same time, fleet quality and availability are becoming critical to service performance and competitiveness, further reinforcing demand for rolling stock investments across Europe. This evolution is opening the door to new entrants and innovation.

At the same time, the ageing profile of rolling stock across European networks is driving a sustained need for renewal. A large share of the fleet—particularly diesel-powered locomotives—was built several decades ago, with many units now approaching 50 years of age and reflecting design standards set long before fuel efficiency and climate considerations became investment priorities. As a result, life-extension through refurbishment, retrofits and mid-life upgrades is increasingly used to maintain near-term capacity, while a broader replacement cycle is unfolding in parallel. This replacement cycle represents a critical opportunity to **align fleet renewal with decarbonization objectives, accelerating the deployment of energy-efficient and electrified locomotives.**

However, the decarbonization of rail is not without challenges. While electrification remains the most efficient pathway to reducing emissions, a significant share of the European rail network – particularly regional and secondary lines – remains non-electrified and uneven across European countries, limiting the immediate applicability of electric rolling stock. In addition, electrification programs are often capital-intensive, time-consuming and subject to permitting and coordination constraints, which can slow deployment. These challenges mean that while the market is becoming more investable, execution still requires careful navigation of regulatory, technical and operational constraints.

Beyond decarbonization, there are other sustainability considerations impacting rolling stock investments. These include **noise and vibration**, which in Europe have become regulated under the noise Technical Specification for Interoperability (TSI). For freight wagons in particular, compliance-driven retrofits (e.g., quieter braking solutions) and maintenance standards that prevent noise deterioration over time can directly affect where and when assets can be operated. Additional considerations include **circularity and end-of-life**, where heavy overhauls, refurbishment and component reuse can extend asset life and reduce embedded emissions versus new-build, provided that safety and interoperability requirements are met. Sustainability due diligence also extends to **supply-chain impacts** (critical materials for batteries and electronics, human-rights and traceability expectations) and to **responsible disposal/recycling** of batteries and other hazardous components, often managed through OEM commitments or take-back clauses.

Road Public Transport Market Architecture:
Long-term contracts are locking decarbonization into procurement—making execution capability the defining competitive moat

Across Europe, the structure of public transport markets is shifting in ways that directly support fleet decarbonization. Liberalized, Public Transport Authority (PTA)-led competitive tendering has become an increasingly dominant model: public authorities set service standards and long-term mobility objectives — including decarbonization commitments — while private operators compete to deliver services. This division of roles allows climate and city-planning priorities to be embedded directly into contract design, turning decarbonization targets into procurement requirements rather than voluntary ambitions.

Crucially, most urban networks and many interurban and regional routes operate under availability-based and gross-cost contracts with indexed, predictable cash flow.

These frameworks insulate operators from ridership volatility and give them the revenue visibility needed to invest in decarbonization technologies and their associated infrastructure at scale. These contracts are increasingly embedding **explicit decarbonization requirements** — from life-cycle emission metrics to climate transition key performance indicators (KPIs) and fleet transition milestones — making decarbonization no longer a discretionary strategy but **structurally incentivized and contractually enforced.** In addition, fleet decarbonization and its associated infrastructure are becoming a strategic moat: their capital intensity, long lead times, grid connection constraints, and operational complexity create barriers that favor early movers with a track record of delivery.

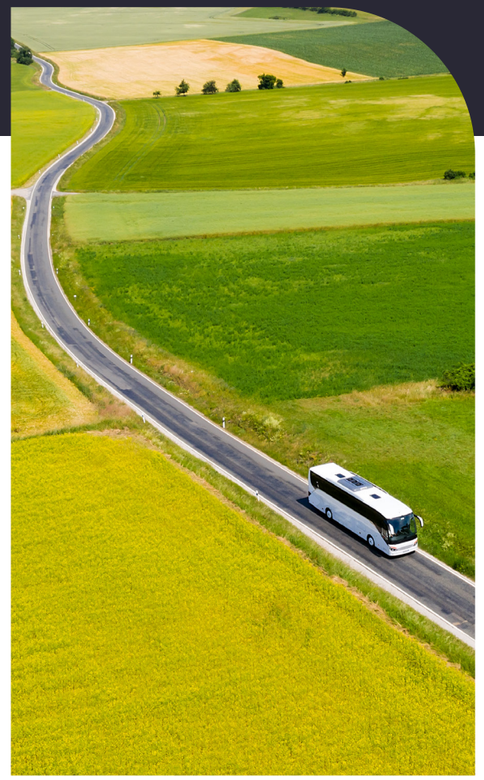
However, road public transport is not a homogenous market. Even within the contracted, concession-based segment, decarbonization unfolds across two distinct operating realities, each with its own economics and transition pathway:

Urban and Peri-Urban Buses: The Accelerated Transition

Urban bus networks sit at the epicenter of Europe's zero-emission momentum. Their characteristics — predictable, short-distance routes, centralized depots, dense service patterns and strong PTA control — make them ideally suited for scalable zero-emission fleet, in particular with electrified vehicles.

Interurban and Regional Coaches: A More Complex Frontier

In contrast, coach operators operate in an entirely different reality: multiple depots, longer duty cycles, variable routes and limited charging windows. Even for interurban and regional coach services, which are largely driven by similar decarbonization growth drivers as urban bus services, the operational translation is much more complex — requiring broader infrastructure roll-out, tighter planning around current range capacities and charging/refueling windows and more heterogeneous technology choices to support decarbonization while avoiding operational disruptions.



This is why coach decarbonization is still in its early innings. Yet paradoxically, it is also where some of the strongest strategic moats are forming. The decarbonization step-change is harder to finance, execute, and operationalize for smaller players. As a result, the competitive landscape is already shifting: **smaller operators unable to deploy decarbonized solutions at scale are becoming acquisition targets**, while scaled, forward-looking operators consolidate market share by leveraging procurement power, project-management capability, and retrofit expertise. In France, for example, the interurban coach segment remains highly fragmented — with more than 200 small independent players — creating substantial external growth potential for operators able to deliver decarbonization at scale.

Across both market segments, the direction of travel is unmistakable. **Contract structures are derisking revenues; decarbonization CapEx and operational complexity are raising barriers to entry. The result is a market where strategic differentiation is deepening, and where the winners will be those capable of executing fleet and infrastructure transitions reliably, efficiently, and at scale.**

Multiple Technologies are Powering the Decarbonization of Road Public Transport: Battery-electric leads with retrofit solutions helping to accelerate deployment, and hydrogen and biofuels address the harder-to-electrify routes

The decarbonization of road public transport has moved from pilots to scaled deployment across Europe: six out of ten new EU city buses were zero-emission in 2025.

Battery-electric buses (BEBs) are leading this shift, even though upfront CapEx remains well above diesel—often around 2–2.5x once charging infrastructure and battery life-cycle planning are considered. Momentum is explained by fundamentals that are strengthening quickly: the total cost of ownership gap is narrowing through meaningfully lower OpEx (cheaper energy per km and lower maintenance from fewer moving parts and regenerative braking), longer public concession contracts that allow investment amortization, and declining battery costs over time. That said, Europe still faces strategic supply-chain exposure—Chinese OEMs have gained meaningful share and much of the battery value chain sits outside Europe—creating risks that can show up as higher CapEx and delivery delays. In the interim, **retrofitting offers a pragmatic bridge for operators, helping manage tight CapEx budgets and long OEM lead times while supporting circularity.**

Converting an existing coach can materially reduce upfront investment versus purchasing a new battery-electric vehicle by more than 50%, although it is likely that both options will become closer in terms of price sooner rather than later. In addition, supply-chain constraints have pushed OEM delivery lead times well beyond a year in many markets. Retrofitting can materially shorten the timeline from 12+ months for a new vehicle to roughly ~3–4 months end-to-end delivery for a retrofitted vehicle. Finally, retrofitting also helps reuse existing assets and extend vehicle life contributing to circular economy.

While battery-electric solutions are a key pathway to decarbonizing road public transport, they also introduce environmental and social risks that require active management—most notably responsible sourcing and traceability of critical minerals, sustainable end-of-life management (collection, recycling and, where relevant, second-life use), and battery safety considerations. These topics are increasingly shaped by European regulation and are therefore moving from "nice to have" sustainability commitments into practical procurement, contracting and operational requirements.

In addition, BEBs raise an operational-efficiency question: because vehicles must charge and range remains a constraint, charging windows and dwell times need to be engineered into timetables and depot operations. This is typically manageable in dense urban and suburban networks with fixed, predictable routes, but becomes more challenging on longer-distance and variable services with tighter duty cycles—even though newer buses with higher efficiency, larger usable batteries, and faster-charging solutions are steadily improving real-world operability.

In those cases, other technologies can complement BEBs to address the "harder-to-electrify" tail of operations while electrification scales across the routes where it is operationally and economically strongest. Hydrogen fuel-cell buses can serve as a targeted complement for longer routes and high-utilization duty cycles, particularly where fast refuelling and tight scheduling requirements limit charging flexibility, although the decarbonization benefit depends on the availability and cost of low-carbon, renewable hydrogen, and scaling remains constrained by refuelling infrastructure and total cost of ownership (TCO).

Biofuels (including HVO) and biomethane can act as transitional decarbonization levers for existing fleets, enabling near-term emissions reductions with limited vehicle changes, subject to ensuring they are produced from sustainable feedstocks and meet verified emissions-reduction thresholds. For biomethane specifically, it is also critical to minimize methane losses at each step (production, upgrading, storage, and distribution), as even small leakage rates can materially reduce the climate benefit, and manage digestate to a high standard so impacts are not shifted to soils and water. For further details on the investment case of biomethane and its key sustainability considerations, please refer to our dedicated publication here.

Case Study:

Transarc as a Blueprint for Scalable Coach Decarbonization

Transarc is a mid-sized French regional coach operator. It benefits from a contracted business model (largely multi-year public transport contracts) and has built a scalable platform with strong operational integration and in-house technical know-how. In a segment where decarbonization is more complex than in urban bus transport (longer distance, dispersed depots, and tighter charging windows), Transarc pursued a retrofit-led approach by partnering with RETROFLEET, a company which offers retrofit solutions for heavy-duty vehicles to accelerate their decarbonization. By converting existing vehicles rather than relying only on new-fleet purchases, the company is achieving emissions reduction, while keeping costs down and shortening deployment timelines—turning in-house technical capability into a competitive advantage in low-carbon tenders. real-asset protection, infrastructure offers an attractive solution.

Infranity's partnership with Transarc as a majority shareholder since acquisition in July 2024 provided the capital and long-term backing to scale this transition. The investment enabled faster fleet electrification, depot upgrades, and charging-infrastructure modernization, strengthening operational resilience and improving competitiveness versus peers. In parallel, Transarc continues to grow by acquiring smaller regional operators, using its enlarged footprint to roll out the same decarbonization and operational playbook across additional depots, regions, and public transport contracts.

TRANSARC

Scaling a Decarbonized Transport System through Investable Pathways

Overall, the convergence of regulation, technology maturity and evolving market structures is turning decarbonized mobility into an investable infrastructure theme. In rail, liberalization and renewed demand are accelerating fleet renewal needs, creating a growing role for rolling stock ownership and leasing models that offer long-term, asset-backed revenues with strong visibility. In road public transport, competitive tendering and long-duration concession contracts are embedding decarbonization requirements into procurement while providing indexed, availability-based cash flows that can support fleet and depot investment at scale. As battery-electric buses become increasingly competitive on a total cost of ownership basis—and with retrofitting and complementary technologies addressing harder-to-electrify use cases—operators with execution capability and access to capital are building durable competitive advantages.

For infrastructure investors, these segments combine essential-service characteristics, a clear policy and demand runway, and tangible climate outcomes—making them well suited to long-term capital seeking resilient returns and measurable impact.

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An infrastructure specialist with scale, expertise, and discipline

Infranity is a well-established global infrastructure investment specialist, managing over €13.4 billion since inception across private debt and equity. Supported by Generali Group, one of Europe's largest institutional investors, Infranity combines the strength and governance of a major financial institution with the agility and entrepreneurial spirit of an independent boutique.

Our 70-plus-member team brings exceptional depth across origination, credit analysis, and asset management. At Infranity, we access an estimated 90% of total European deal flow, often as lead or bilateral lender, enabling us to negotiate bespoke terms and covenant structures aligned with each borrower's profile and investors' risk appetite. Our strict underwriting culture targets a 0% loss rate, a standard maintained since inception.

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