2024 GLOBAL RAIL SUSTAINABILITY REPORT

INTERNATIONAL UNION OF RAILWAYS

The UIC supports the Sustainable Development Goals

FOREWORD

The United Nations has declared 2026–2035 as the Decade of Sustainable Transport. This landmark decision recognises transport's vital role in driving the achievement of the Sustainable Development Goals (SDGs) and calls for decisive action across all modes of mobility. As the most sustainable motorised mode of transport, rail must be at the heart of this global movement.

Railways connect people, goods, and regions while generating just a fraction of the emissions and land-use impact that other modes of transport do. They offer unmatched benefits for safety, inclusion, health, and climate resilience – qualities that will be indispensable in a sustainable, equitable future.

The third edition of the Global Rail Sustainability Report is more than just a snapshot of progress; it is a stepping stone toward the Decade of Sustainable Transport. Through transparent data, real-world examples, and sector-wide cooperation, UIC and its members are laying the groundwork for accelerated change.

We hope that this report inspires a renewed commitment to rail, to sustainable development, and to working together for people and the planet.

François DAVENNE
Director General
International Union of Railways (UIC)

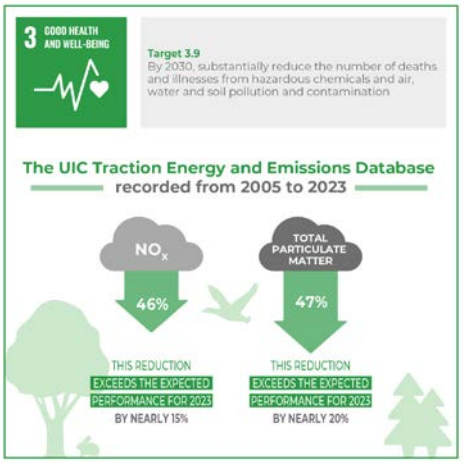
PREFACE

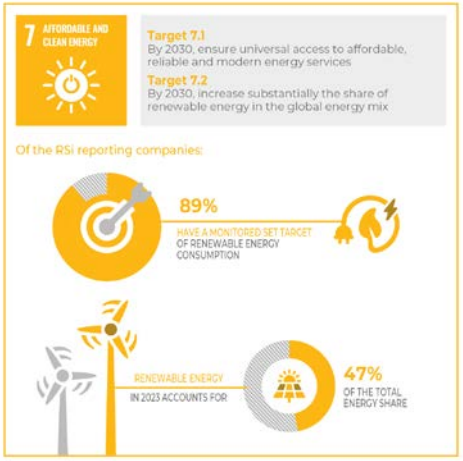
Welcome to the third edition of the UIC Global Rail Sustainability Report, launched this year on the UN International Day of Sustainable Transport. The report showcases the collective progress made by the rail sector on sustainability and the SDGs worldwide.

Against the backdrop of the launch of the UN Decade of Sustainable Transport (2026-2035), the 2024 edition of the Global Rail Sustainability Report affirms rail's central role in shaping the future of transport. The report aligns with the United Nations Sustainable Development Goals (SDGs) and draws on the most recent data from the Rail Sustainability Index (RSi), Traction Energy and Emissions Database (TED), and Railisa platform. The report also features a new set of member-driven case studies, highlighting practical innovation in action.

Through partnerships, evidence, and drive, UIC and its members will help turn the UN decade of action into a transformational journey for people and its planet.

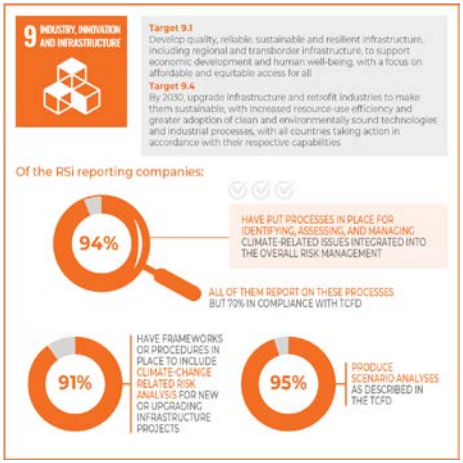
CONTENTS





RAIL SUSTAINABILITY 2024

AT A GLANCE



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UNITED NATIONS DECADE OF SUSTAINABLE TRANSPORT (2026-2035)

In 2023, the United Nations General Assembly adopted resolution 78/148, “Strengthening the links between all modes of transport to achieve the Sustainable Development Goals” [1], proclaiming 2026–2035 as the first UN Decade of Sustainable Transport. This is a global initiative which aims to accelerate the transition toward sustainable, inclusive, and efficient transport systems [2]. The decade offers a unique opportunity to underscore the central role of railways in advancing sustainable mobility and delivering on the Sustainable Development Goals (SDGs). As part of this and through this report, UIC reaffirms its full commitment to supporting the implementation of the UN Decade of Sustainable Transport through collaboration, innovation, and knowledge sharing. The decade aims to:

- Enhance the role of transport as a key catalyst for sustainable development, addressing global challenges such as climate change.
- Promote inclusive and resilient transport systems that support equitable access to jobs, education, and healthcare.
- Foster collaboration among governments, civil society, and the private sector to advance sustainable transport agendas.
- Develop an Implementation Plan to coordinate action and monitor progress towards sustainable transport goals.
- Strengthen the links between all modes of transport to achieve the SDGs.

United Nations
Decade of
Sustainable Transport
2026–2035

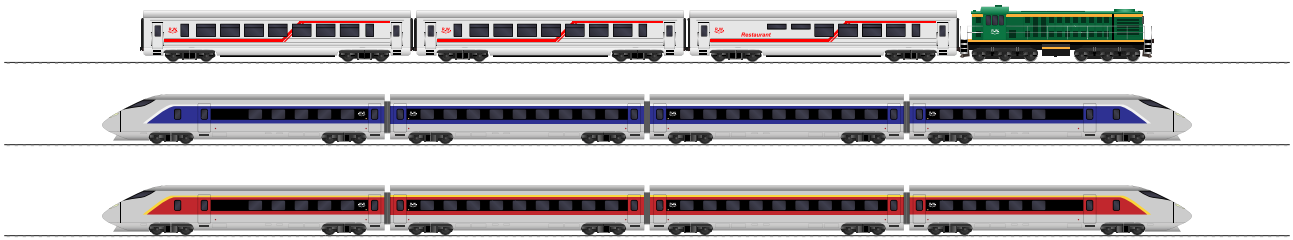
11 SUSTAINABLE CITIES AND COMMUNITIES

RAIL AS THE BACKBONE OF SUSTAINABLE MOBILITY

Target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

Rail transport continues to be a key driver of inclusive, safe, resilient, and sustainable cities and communities. As urban areas expand and mobility needs grow, rail offers a scalable and low-emission solution that supports compact urban development, reduces congestion, and enhances access to essential services.

Despite its potential, many regions are still at a disadvantage in terms of public transport coverage as per Figure 1 related to Indicator 11.2.1: Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities.



Share of urban populations with convenient access to public transport, 2022

Our World in Data

Share of the urban population who can access a public transport stop within a walking distance of 500 meters (for low-capacity public transport systems) or 1000 meters (for high-capacity public transport systems).

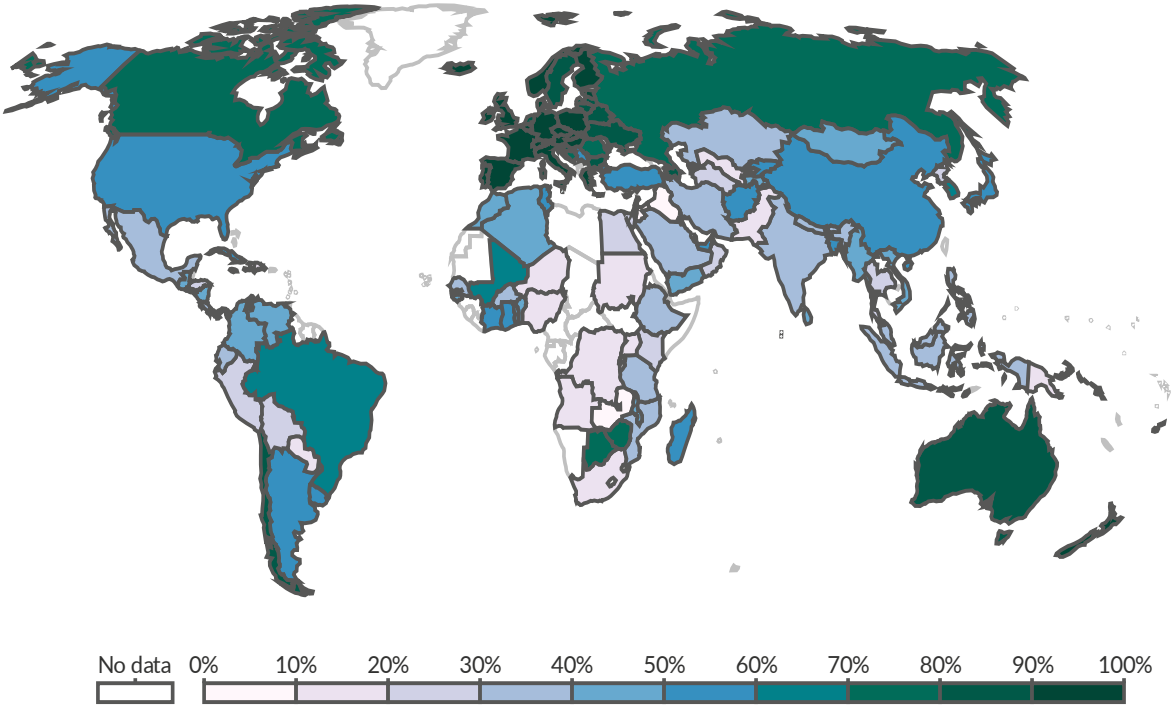
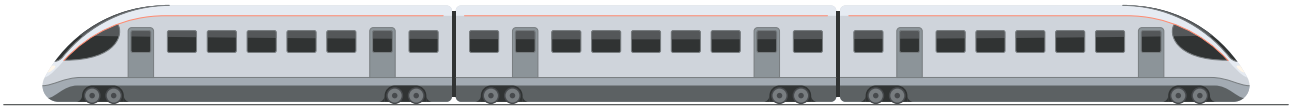


Figure 1: Share of urban populations with convenient access to public transport (United Nations (2023) – processed by Our World in Data)



THE GLOBAL RAILWAY NETWORK

In 2023, there was 1.17 million km of track across the globe – equivalent to 29 times the circumference of the Earth **+7.6% growth in global railway length** between 2004 and 2023.

3.8 trillion passenger-km travelled by rail in 2023 – representing 6% of global inland passenger traffic.

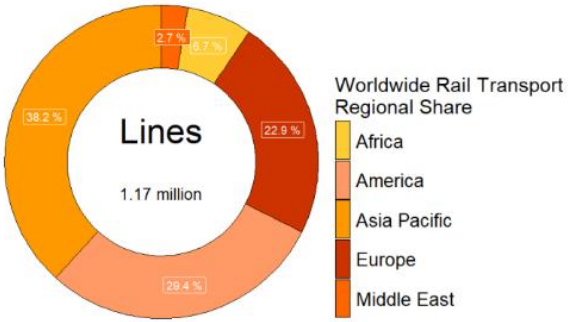


Figure 2: Global rail network size and regional share

12 trillion tonne-km of freight moved by rail in 2023 – 38% of global inland freight, down from 44% in 2009.

Rail's share of infrastructure investment fell to 25% in 2023 (averaging 29% in the 2009-2023 period with a peak of 32% in 2014) [3].

DID YOU KNOW?

- **JAPAN** LEADS THE WORLD WITH **180+ TRAIN JOURNEYS PER PERSON EACH YEAR** – THE HIGHEST GLOBAL FREQUENCY.
- IN **EUROPE**, THE TOP USERS ARE **SWITZERLAND (AT 68 TRIPS)** AND **LUXEMBOURG (43)**, FOLLOWED BY **AUSTRIA (36)**, **GERMANY (33)**, AND THE **UK (27)**.
- IN CONTRAST, IN **AFRICA, CENTRAL ASIA, AND THE AMERICAS**, RAIL USE IS OFTEN AT **BELOW 1 TRIP PER PERSON PER YEAR**.

AMERICAS

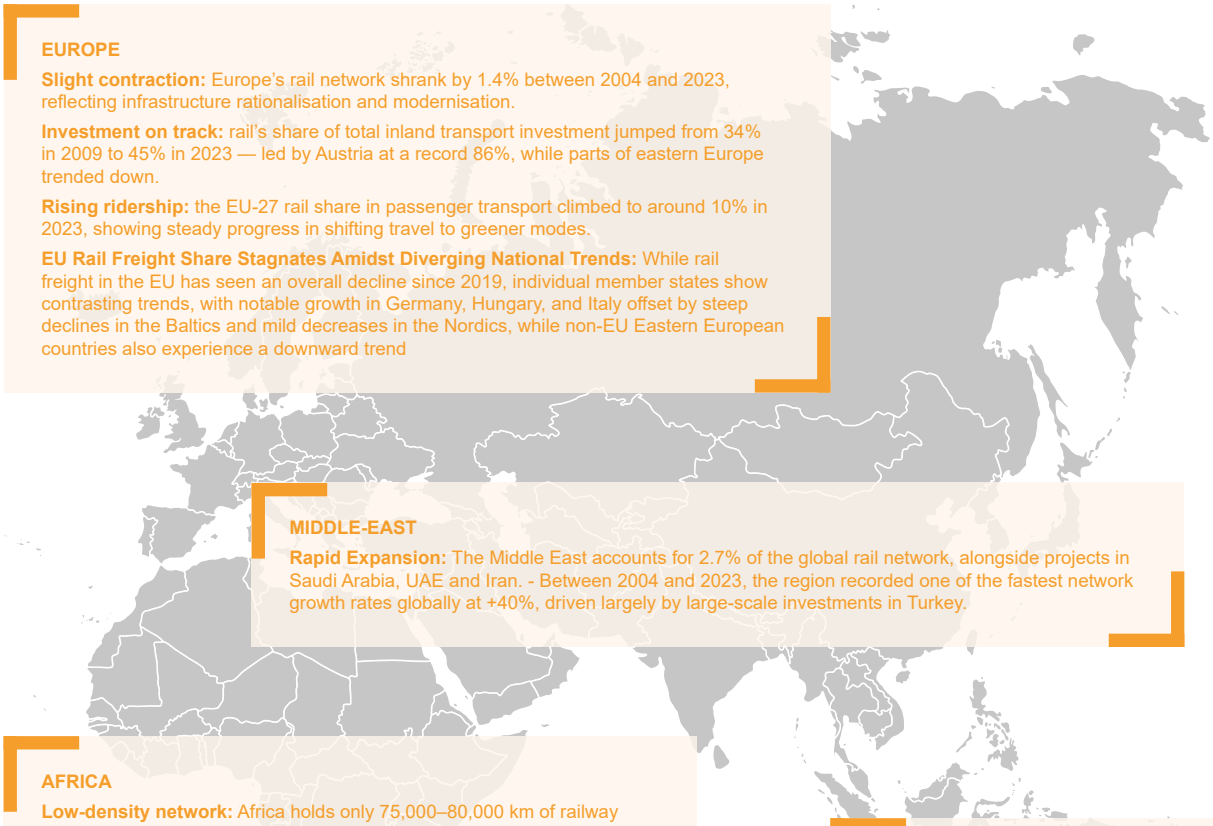
Network contraction: rail length shrank by 7.8% between 2004 and 2023, reflecting consolidation and efficiency drives.

Falling investment: rail's share of inland transport funding peaked at 16% in 2015, dropping to just 8% by 2023.

Passenger niche: rail remains under 1% of passenger travel in the U.S. A largely freight-focused system.

Freight heavyweight: the Americas move 25.8% of global rail freight, led by the U.S. (2,155 bn t-km) and Canada (413 bn t-km).

Shifting shares: rail freight's modal share fell in the U.S. (44%→39%), but stayed steady in Canada (~60%) and Mexico (~26%).



EUROPE

Slight contraction: Europe's rail network shrank by 1.4% between 2004 and 2023, reflecting infrastructure rationalisation and modernisation.

Investment on track: rail's share of total inland transport investment jumped from 34% in 2009 to 45% in 2023 — led by Austria at a record 86%, while parts of eastern Europe trended down.

Rising ridership: the EU-27 rail share in passenger transport climbed to around 10% in 2023, showing steady progress in shifting travel to greener modes.

EU Rail Freight Share Stagnates Amidst Diverging National Trends: While rail freight in the EU has seen an overall decline since 2019, individual member states show contrasting trends, with notable growth in Germany, Hungary, and Italy offset by steep declines in the Baltics and mild decreases in the Nordics, while non-EU Eastern European countries also experience a downward trend

MIDDLE-EAST

Rapid Expansion: The Middle East accounts for 2.7% of the global rail network, alongside projects in Saudi Arabia, UAE and Iran. - Between 2004 and 2023, the region recorded one of the fastest network growth rates globally at +40%, driven largely by large-scale investments in Turkey.

AFRICA

Low-density network: Africa holds only 75,000–80,000 km of railway across 30.2 million km² of land, averaging just 2.5 km per 1,000 km² - below the world average of 23km per 1,000 km². South Africa accounts for 20,000 km, dwarfing Egypt (6,679 km) and Algeria (4,286 km), while Marocco is actively extending the first high-speed line in the region.

Low global presence: Despite holding 22% of global land and 17% of the population, Africa manages just 7–8% of the world's rail market

Continental vision: The African Integrated Rail Network, a flagship of Agenda 2063 supports the African Continental Free Trade Area (AfCFTA)—the world's largest free trade zone, spanning all 55 African Union countries and 8 Regional Economic Communities.

Financing challenge: The 2023 Dakar Declaration highlighted rail as essential for economic growth, climate resilience and regional integration, but called for new funding models—global carbon taxation, public–private partnerships, and climate finance—to overcome persistent investment gaps.

ASIA-PACIFIC

Expanding fast: the region's rail network grew by 30% between 2004 and 2023, the strongest global increase.

Investment shifts: spending rose in Australia, Japan, and south Korea, while China's share fell from 40% to 20% as projects matured.

Passenger powerhouse: Asia–pacific carried a massive 82.8% of global rail passengers in 2023, led by China (1,472 bn p-km), India (959 bn), and Japan (394 bn).

Freight giant: the region moved 67.9% of global rail freight, with China, India, and Australia dominating—Kazakhstan and Mongolia playing key long-haul roles.

Data retrieved from "PART C - Global Railway Statistics: Network, Traffic, and Modal Share (2004-2023), UIC [3]

Transport activities in general generate significant external costs (negative impacts not paid by users but absorbed by society). These include congestion, noise, air pollution, accidents, greenhouse gas emissions, and upstream and downstream effects such as energy production and land use [4].

To provide a visual representation of this, UIC has developed the External Costs Dynamic Dashboard, which offers up-to-date insights into how rail outperforms road in reducing environmental and social costs (further modes of inland transport have not yet been included in the comparison).

IN 2022 THE TOTAL EXTERNAL COSTS OF TRANSPORT FOR ROAD AND RAIL

WERE ESTIMATED AT €784 BILLION, ALMOST 5% OF THE EU'S GDP

FROM WHOM?

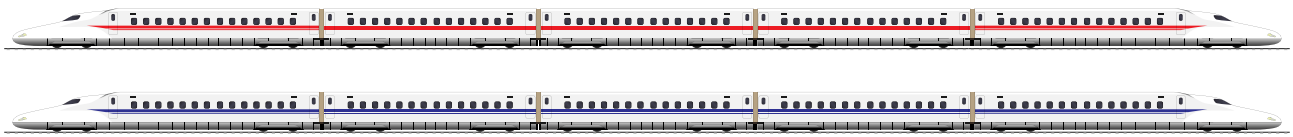
ROAD TRANSPORT: 98%
RAIL TRANSPORT: ONLY 2%

2022 TOTAL EXTERNAL COSTS

ROAD PASSENGERS: €573 BN
RAIL PASSENGERS: €10 BN
ROAD FREIGHT: €197 BN
RAIL FREIGHT: €4.4 BN

AVERAGE EXTERNAL COSTS PER PASSENGER-KM AND PER TONNE-KM

PRIVATE CAR: 17× HIGHER THAN HIGH-SPEED RAIL (€/PASSENGER-KM)
ROAD FREIGHT: 23× HIGHER THAN RAIL FREIGHT (€/TONNE-KM)



SAFETY

By design, rail is particularly safe, with a very low rate of accidents and injury or death for passengers and staff.

Why it's safe:

- Segregated tracks reduce the risk of colliding with other vehicles
- Centralised control and monitoring systems minimise human error

INFRABEL prioritises safety for vulnerable groups

INFRABEL places strong emphasis on protecting vulnerable groups through a comprehensive national action plan focused on safety around railway tracks. The strategy combines awareness campaigns, infrastructure improvements, enforcement measures, and inclusive education to reach all audiences in an effective manner.

Recently, INFRABEL launched a targeted initiative, developed in collaboration with specialised organisations, for individuals with deafness or who are hard-of-hearing. To further engage younger audiences, a virtual reality animation was introduced to illustrate the risks of unsafe behaviour near railways and promote an improved safety culture across generations.

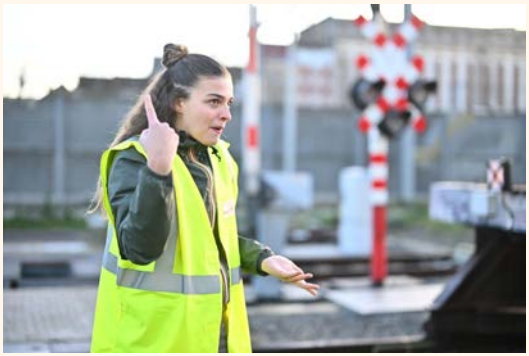
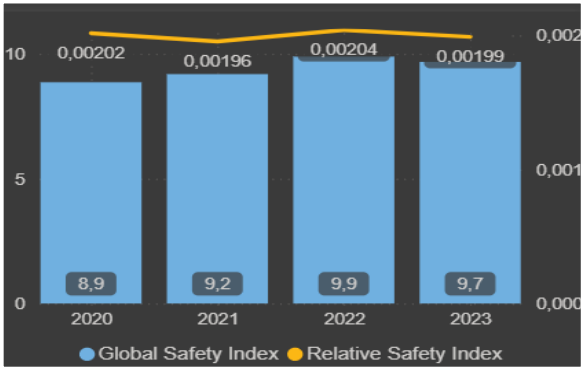


Photo Credits: Infrabel

The railways are also continuing to seek to improve their safety record through the UIC Safety Platform, which, in 2015, developed the UIC Safety Index (a tool reported in the UIC Safety Database), which considers a range of factors beyond simply counting incidents and occurrences. Each incident is evaluated based on accident type, victim category, number of victims, and cause. It specifically assigns greater weight to accidents involving passengers, staff, and internal causes than incidents involving trespassers and external causes. Moreover, incidents with a higher number of victims receive a higher weighting than those with fewer victims. [5]



In 2023, significant railway accidents continued to rise in both total numbers and per train-kilometre rates, reversing the long-term decline seen from 2006–2019.

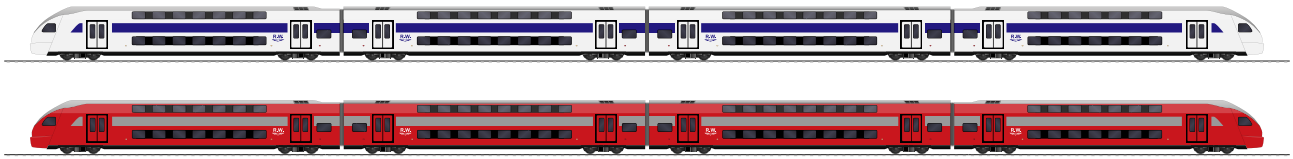
Despite this increase, both the Global Safety Index and the Relative Safety Index showed a slight improvement compared to 2022, indicating a modest positive trend in overall safety.

LOWER TOTAL EXTERNAL COSTS

IN 2022, THE EU'S TOTAL EXTERNAL COSTS FROM RAIL ACCIDENTS WERE ESTIMATED AT **€2.3 BILLION**, COMPARED TO **€267 BILLION** FROM ROAD TRANSPORT. [4]

SAFETY GAINS PAYING OFF

BETWEEN 2016 AND 2022, THE TOTAL EXTERNAL COSTS FOR ACCIDENTS IN RAIL **FELL BY 3%**, WHILE **ROAD COSTS INCREASED BY 8%**. [4]



ACCESSIBILITY

Accessibility is at the heart of a modern, customer-oriented rail system. To increase rail's appeal, making rail travel easier, safer, and more welcoming for all passengers, especially those with disabilities or reduced mobility, is essential. Through the UIC Accessibility Group of Experts (PASSAGE) Group, the sector developed the Person with Reduced Mobility (PRM) Assistance Booking Tool, enabling the seamless coordination of assistance services across borders. The service now connects 20 national call centres, exchanging over 3,000 assistance messages per month [6]. These initiatives, aligned with EU Regulation 1371/2007, ensure that passengers requesting support can travel confidently and independently across Europe's rail networks.

ACCESSIBILITY ON TRACK

ACCESSIBILITY IN RAIL HAS SEEN A STRONG UPWARD SHIFT — FROM 91% IN 2022 TO 96% IN 2023, A 5-POINT INCREASE IN JUST ONE YEAR. EVEN MORE STRIKING, THE SHARE OF COMPANIES PLANNING FURTHER IMPROVEMENTS JUMPED FROM 86% TO 100%.

THIS STEADY PROGRESS HIGHLIGHTS RAIL'S GROWING COMMITMENT TO UNIVERSAL ACCESS AND INCLUSION FOR PASSENGERS WITH REDUCED MOBILITY.

JR East's Collaborative Approach to Accessibility

The East Japan Railway Company (JR East) actively promotes accessibility and inclusion through hands-on collaboration with a range of partners. The company conducts joint disaster and accident response trainings with specialist schools for individuals with hearing and visual impairments, fire departments, and freight operators. It also organises trial sessions for railway facilities with persons with disabilities, local residents, and advocacy organisations to share ideas and identify barriers.

These initiatives help JR East better understand passengers' needs, enhance staff training, and continuously improve accessibility – contributing to a safer, more inclusive railway system where everyone can travel with confidence.

Photo Credits: East Japan Railway Company

8 DECENT WORK AND ECONOMIC GROWTH

ECONOMIC GROWTH AND RAIL EMPLOYMENT

Target 8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.

Target 8.8: Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment.

CONTRIBUTION TO THE ECONOMY & EMPLOYMENT

Rail transport continues to be a critical driver of economic growth and employment, supporting millions of jobs, stimulating industrial competitiveness, and underpinning sustainable mobility across regions.

In Europe alone, the sector contributed an estimated €247 billion to EU GDP in 2023, equivalent to 1.4 % of the total economy, and supported over 3.1 million jobs, spanning direct, indirect, and induced effects [7].

Similar trends can also be observed around the world. In the United States, rail transportation generated $233.4 billion in economic output and supported nearly 750,000 jobs in 2023, while operating on a self-funded infrastructure network that reduces public spending and boosts trade competitiveness [8].

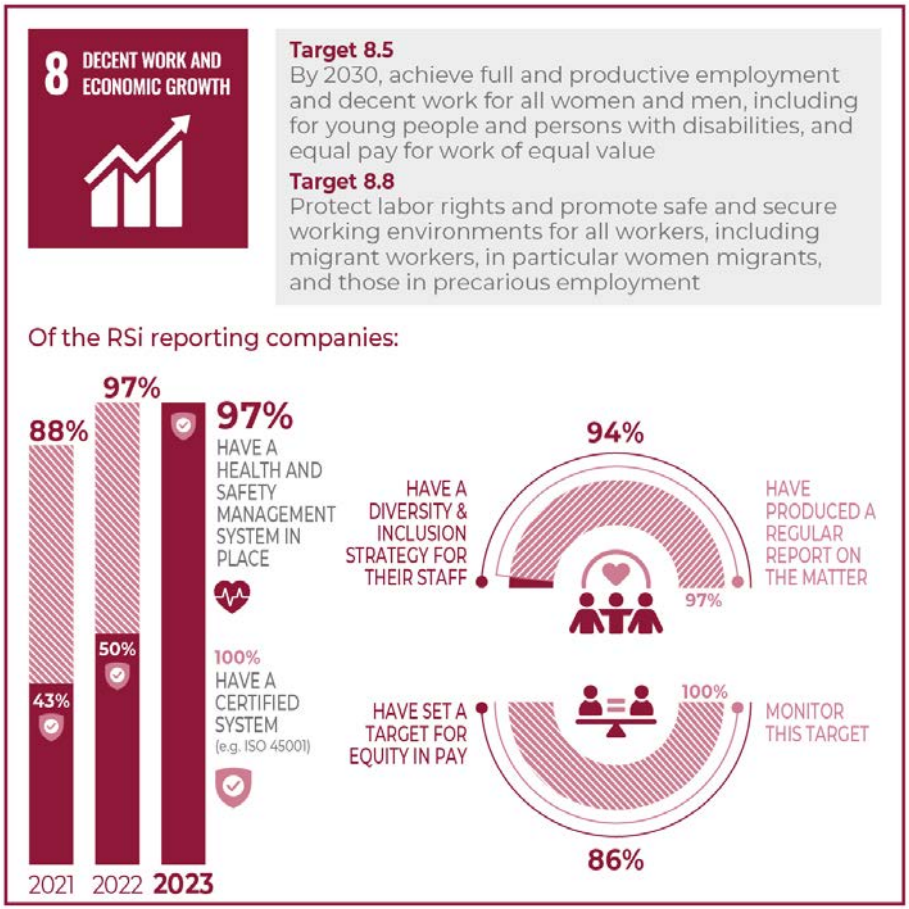
In developing economies, railways remain pivotal for boosting economic growth while maintaining low emissions, though challenges persist in reversing modal share losses to road and air [9]. Nevertheless, investment in transport infrastructure remains a catalyst for economic development, particularly for under-developed economies and when supported by strong planning and concrete economic strategies [10].

For example, empirical evidence indicates that regional economic disparities have decreased since the development of high-speed rail in China, as it has promoted regional economic convergence [11]. For instance, in China a 1% increase in market access leads to a 0.12% increase in real income, illustrating how improved connectivity drives regional growth through both direct and spillover effects [12].

WORKFORCE INCLUSIVENESS

The railway sector's workforce is evolving to meet new social, economic, and operational challenges. Beyond its role as a major employer, the industry is increasingly focusing on creating safer working environments, promoting diversity and inclusion, and ensuring fair and equitable conditions for all employees. These efforts are essential not only for improving staff well-being and retention but also for attracting new talent, fostering innovation, and ensuring the long-term resilience of the sector.

THE RAILWAY SECTOR EMPLOYS OVER 5.5 MILLION PEOPLE WORLDWIDE, WITH MORE THAN 70% BASED IN THE ASIA–PACIFIC REGION [21]



BUILDING A SAFER, FAIRER, AND MORE INCLUSIVE WORKFORCE

HEALTH AND SAFETY PRACTICES HAVE SUBSTANSTIALLY IMPROVED, WITH ALMOST ALL RESPONDENTS NOW OPERATING CERTIFIED MANAGEMENT SYSTEMS.

DIVERSITY AND INCLUSION EFFORTS HAVE ALSO EXPANDED AS MORE COMPANIES ADOPT DEDICATED STRATEGIES AND PROVIDE REPORTS ON THEIR PROGRESS (20% MORE THAN IN 2022)

PAY EQUITY REMAINS A KEY FOCUS AREA, WITH MOST MEMBERS SETTING TARGETS AND INCREASINGLY MONITORING THEIR ACHIEVEMENT.

LTG Women's Club

Lithuanian Railways (LTG) is building a supportive workplace that encourages professional growth, well-being, and equality. Through the LTG Women's Club and a six-month mentorship programme, part of its diversity & inclusion strategy, the company is promoting gender equality, youth engagement, and the employment of people with disabilities. Since 2020, the Women's Club has brought together over 376 women to strengthen leadership and confidence. The mentorship programme, open to all levels, helps create trust and a feeling of safety. As a result, women's representation in leadership has grown from 25% to 31%.

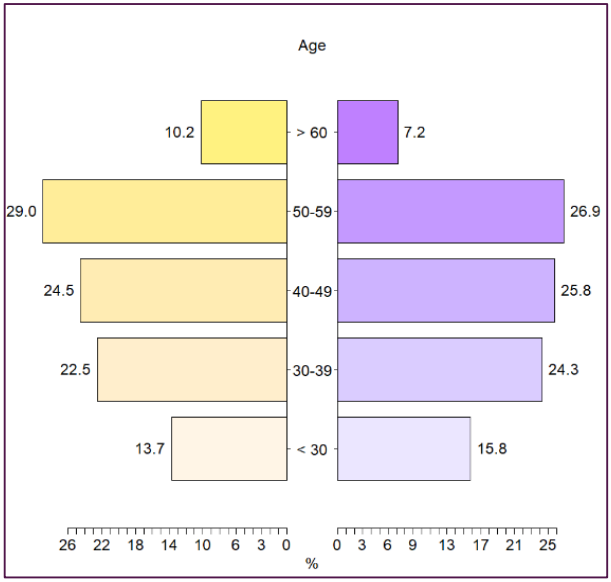
Photo Credits: Lithuanian Railways (LTG)

AN IN-DEPTH ANALYSIS OF 53 UIC MEMBERS, MOSTLY FROM EUROPE, HAS PROVIDED AN INSIGHT ON THE WORKFORCE AGE DISTRIBUTION.

MOST EMPLOYEES—BOTH MEN (29%) AND WOMEN (26.9%)—ARE CONCENTRATED IN THE 50–59 AGE GROUP, HIGHLIGHTING AN AGING STAFF BASE AS MANY APPROACH RETIREMENT.

YOUNGER AGE GROUPS ARE LESS REPRESENTED, PARTICULARLY AMONG MEN, WHICH MAY POSE CHALLENGES IN TERMS OF FUTURE RECRUITMENT AND SKILLS TRANSFER.

ON A POSITIVE NOTE, WOMEN HAVE A SLIGHTLY HIGHER SHARE IN THE YOUNGER AGE BRACKETS, INDICATING A GRADUAL SHIFT TOWARD GREATER GENDER BALANCE IN RECENT YEARS.



13 CLIMATE ACTION

CO_2 EMISSIONS, DECARBONISATION AND CLIMATE CHANGE MITIGATION

Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

Target 13.2: Integrate climate change measures into national policies, strategies and planning.

Transport is one of the fastest-growing sources of greenhouse gas emissions, increasing by 1.7% per year since 1990 [13] . Rail stands out as the least emissions-intensive motorised mode: despite carrying 7% of global passenger-kilometres and 6% of freight tonne-kilometres, it accounts for only around 1% of transport emissions.

Expanding high-speed and night rail, accelerating electrification, and deploying hydrogen and low-carbon fuels are key to further reducing rail's climate impact and achieving the Net Zero Emissions 2050 scenario [14]. According to the UIC Traction Energy & Emissions Database (TED), in 2023, European rail CO_2 emissions fell further, with a total reduction of 58% (market-based[1]) and 57% (location-based[2]) since 2005, already surpassing the 2030 target of a 30% absolute reduction [15].

Electrification drives rail's environmental advantage, with over 85% of passenger and 55% of freight rail running on electric traction, producing no direct CO_2 [14]

1 Market-based: These are the emissions associated with the procurement choices made in the electricity market. They may include green certificates and/or guaranties of origin.
2 Location-based: These are the emissions from the energy mix on the grids. The electricity grid is physically bound, and the consumption is linked to those local grids.

PASSENGERS

CO_2 EMISSIONS FROM PASSENGER TRAINS CONTINUE TO DROP: **-60% MARKET-BASED AND -56% LOCATION-BASED SINCE 2005**.

THE 2023 FIGURES ARE SIGNFICANTLY BELOW THOSE EXPECTED ON THE "PATH TO 2050", WITH REDUCTIONS OF 22.8% (LOCATION-BASED) AND 13.4% (MARKET-BASED) COMPARED TO 2022.

FREIGHT

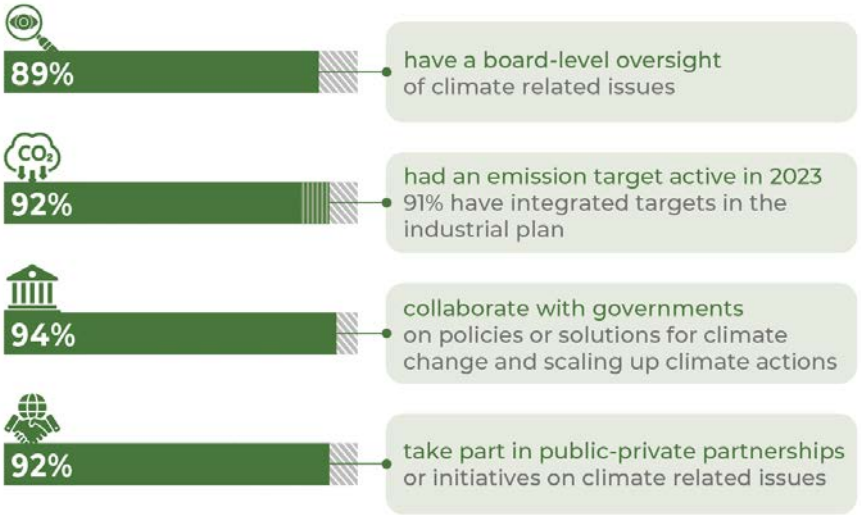
FREIGHT RAIL HAS CUT ITS CARBON FOOTPRINT DRAMATICALLY: **-51% MARKET-BASED AND -59% LOCATION-BASED SINCE 2005**.

IN 2023, BOTH INDICATORS REMAINED SIGNIFICALLY BELOW THE EXPECTED LINEAR REDUCTION OF 43%, SHOWING THE SECTOR IS OUTPERFORMING TARGETS.

Target 13.1
Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Target 13.2
Integrate climate change measures into national policies, strategies and planning

Of the RSi reporting companies:



ACCELERATING THE RAIL SECTOR'S CLIMATE LEADERSHIP

ACCORDING TO UIC RSI DATA, FROM 2021 TO 2023, BOARD-LEVEL OVERSIGHT ON CLIMATE ISSUES INCREASED BY 18%, ACTIVE EMISSION TARGETS ROSE BY 36%, COLLABORATION WITH GOVERNMENTS GREW BY 38%, AND PARTICIPATION IN PUBLIC-PRIVATE CLIMATE INITIATIVES CLIMBED BY 39%.

THIS REFLECTS A RAPID STRENGTHENING OF GOVERNANCE, ACTION, AND PARTNERSHIPS ACROSS THE INDUSTRY.

Eurostar and Jernhusen AB Commit to the UIC Climate Pledge

Recently, Eurostar and Jernhusen AB signed the UIC Railway Climate Responsibility Pledge, reaffirming their commitment to the Paris Agreement and rail decarbonisation. There are now more than 40 UIC members that since 2019 commit to carbon neutrality by 2050.

Eurostar's electric fleet and carbon-efficient operations aim for net zero by 2050, with a 30% reduction in emissions per passenger kilometre by 2030, alongside investments in energy-efficient rolling stock, renewable electricity, and sustainable passenger practices.

Jernhusen, Sweden's state-owned rail infrastructure manager, finances its operations entirely through green bonds, targeting reduced energy use and CO_2 emissions for carbon neutrality by 2050. Here, both companies are demonstrating leadership in sustainable rail and supporting the global shift to low-carbon mobility.

Photo Credits: UIC

Policy

To maximise rail's climate potential, governments can embed rail strategies within their Nationally Determined Contributions (NDCs) [16]. The UIC Rail NDC Template supports this effort by providing a structured approach to defining measurable targets for rail electrification, network expansion, and engendering a modal shift, with these directly linked to emissions reductions.

Including rail in the NDCs, version 3.0, not only accelerates national decarbonisation efforts but also enables access to climate finance, supports cooperative mechanisms under Article 6 of the Paris Agreement, and ensures transparent, accountable progress reporting.

Moreover, complementary financial tools – such as sustainability-linked financing and carbon credit schemes – can channel investment into rail electrification, reduced emissions, and the modal shift while also acknowledging wider societal benefits like lower air pollution and congestion.

The Swiss Federal Railways (SBB) Insurance AG's sustainability-linked reinsurance model shows how aligning financial terms with CO_2 reduction targets can incentivise action, as rail's performance strengthens its case for financial recognition. Under the same umbrella, UIC is advocating for mechanisms, including under Article 6 and the Paris Agreement Crediting Mechanism (PACM), to ensure rail is rewarded in international carbon markets for its contribution to global climate goals.

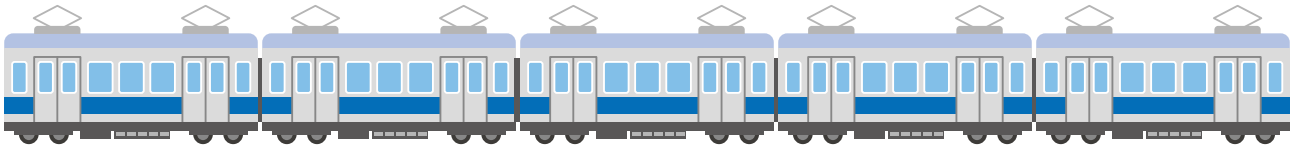
SBB Insurance AG: Sustainability meets reinsurance

SBB CFF FFS

SBB Insurance AG is pioneering a world first: Sustainability-linked Reinsurance, developed in collaboration with AXA, Helvetia, and Zurich Insurance.

The innovative model ties insurance premiums to SBB's CO_2 reduction targets (Scope 1 & 2)—rewarding goal achievement with a bonus or applying a penalty if targets are missed. All resulting payments are directed to the SBB Climate Fund to support sustainability projects. Recognised with the European Captive Innovation of the Year Award, the initiative aims to include all reinsurance contracts after the 2025 pilot scheme, proving that innovation and sustainability can advance together in the insurance sector.

Photo Credits: SBB Insurance AG



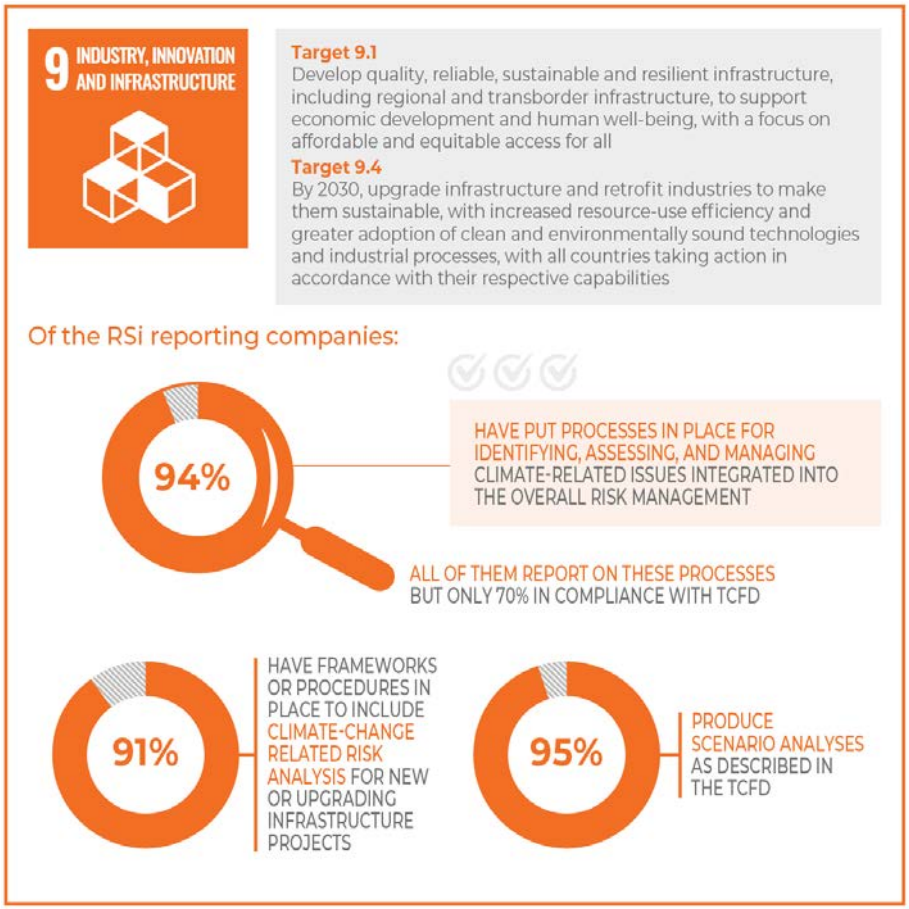
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

CLIMATE CHANGE ADAPTATION AND RESILIENT INFRASTRUCTURE

Target 9.1: Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

Transport infrastructure worldwide is increasingly exposed to the impact of climate change. Rising temperatures, heavier rainfall, more frequent storms, and rising sea levels threaten the reliability and longevity of assets, while increasing the risk of disruptions snowballing across interconnected systems [17]. Traditional planning based on historical weather data is no longer sufficient, as uncertainty about potential extreme conditions complicates design and investment. For long-lived assets such as railways, this poses a dual challenge: avoiding under-specification that leads to costly failures while also preventing over-investment that locks in unproductive costs.



To remain reliable in a changing climate, railways must integrate resilience-based planning, robust maintenance, and advanced decision-support tools. These approaches help ensure safety and service continuity as rail seeks to attract more passengers and freight.

The impact of climate change is already evident across railway networks – from incremental temperature shifts to severe floods, storms, heatwaves, and droughts. Although rail remains one of the most resilient modes of transport, damage and service interruptions are rising, with far-reaching effects on communities, supply chains, and economies [18]. When rail services are disrupted, freight and passengers often shift to higher-emission alternatives, which undermines climate objectives.

CLIMATE RISK MANAGEMENT RAPIDLY EXPANDS

RAIL COMPANIES HAVE MADE SIGNIFICANT PROGRESS IN INTEGRATING CLIMATE CHANGE CONSIDERATIONS INTO CORE RISK MANAGEMENT AND INFRASTRUCTURE PLANNING.

IN JUST TWO YEARS, CLIMATE-RISK PROCESSES, SCENARIO ANALYSES, AND PROJECT FRAMEWORK INTEGRATION HAVE ACCELERATED, SHOWING A CLEAR SHIFT FROM EARLY ADOPTION TO NEAR-UNIVERSAL IMPLEMENTATION.

HOWEVER, ALIGNMENT WITH TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES (TCFD) STANDARDS STILL HAS ROOM FOR IMPROVEMENT.

Railways face a range of climate change-related risks: intense rainfall and flooding can erode tracks and embankments, heatwaves cause rail buckling, droughts and desertification threaten foundations and rolling stock, while coastal lines face storm surges and rising sea levels [18]. Addressing these challenges demands coordinated adaptation strategies – linking infrastructure design, operations, and governance – to keep rail systems resilient and competitive in a warming world.

POLICY SPOTLIGHT

RAIL ADAPTATION IS STILL NOT PRESENT IN MOST NATIONAL CLIMATE PLANS.

ONLY **25%** OF NATIONALLY DETERMINED CONTRIBUTIONS (NDCS) MENTION RAIL, AND JUST **10%** INCLUDE SPECIFIC TARGETS.

SETTING CLEAR ADAPTATION GOALS, SCALING UP INVESTMENT IN RESILIENT INFRASTRUCTURE, AND INTEGRATING RAIL INTO CLIMATE STRATEGIES – SUPPORTED BY MECHANISMS LIKE THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE **(UNFCCC) LOSS AND DAMAGE FUND** – CAN HELP **FUTURE-PROOF RAIL AS THE BACKBONE OF SUSTAINABLE TRANSPORT** [18].

UIC's *Future Proof Railways* report emphasises that resilience must be integrated into all levels of railway planning, operations, and policy. It identifies key solutions including adaptive design (such as elevating assets above flood level, upgrading drainage systems, and applying nature-based solutions for water management and cooling), resilient construction (such as reinforced bridge supports, geotextiles for embankment stabilisation, and expansion devices to prevent buckling), improved maintenance protocols for extreme weather events, and advanced monitoring technologies such as drones and automated weather stations. [18]

RERA
Resilient Railways facing Climate Change

The completion of the RERA RAIN project marked a key milestone in enhancing railway resilience to heavy rainfall. The project addressed asset vulnerability and offers tools for improved forecasting and adaptive planning [19].

In parallel, the RERA TEMP project tackled the rising threat of extreme heat, providing a framework to assess temperature-related risks. Using climate projections, it maps the future impact of heat on critical assets such as tracks, signalling, and rolling stock, supporting long-term adaptation across railway systems [20].

RERA METHODOLOGIES:
A THREE-PHASE FRAMEWORK FOR CLIMATE RESILIENCE

THE RERA TEMP AND RERA RAIN PROJECTS PROVIDE PRACTICAL, STRUCTURED APPROACHES TO ASSESS CLIMATE RISKS – FROM EXTREME HEAT TO CHANGING RAINFALL PATTERNS – AND STRENGTHEN RAILWAY RESILIENCE.

1. **CLIMATE IMPACT ANALYSIS:** DEFINE THE GEOGRAPHIC SCOPE AND ANALYSE FUTURE CLIMATE SCENARIOS (TEMPERATURE OR RAINFALL) USING RELEVANT DATA AND MAPPING.
2. **VULNERABILITY & RISK ASSESSMENT:** IDENTIFY EXPOSED AND CRITICAL ASSETS, PRIORITISING THEM BASED ON PROJECTED CLIMATE IMPACTS.
3. **ADAPTATION PLANNING & MONITORING:** SELECT AND IMPLEMENT TARGETED ADAPTATION MEASURES — SUCH AS DRAINAGE UPGRADES OR HEAT-RESISTANT SOLUTIONS — AND ESTABLISH MONITORING SYSTEMS TO TRACK THEIR EFFECTIVENESS OVER TIME.
[19] [20]

Measuring and Enhancing the Resilience of ADIF's Railway Network

One of the approaches that ADIF has implemented to assess network resilience against climate change is quantitative, by using KPIs: incident numbers and delay minutes related to climate conditions. Monthly climatological and corrective maintenance data since 2012 were analyzed to identify trends linked to extreme, adverse, or normal weather. Hydraulic models and historical flood data mapped potentially floodable zones (12.85%) and informed alerts and protocols, as in the case of Pina de Ebro, where four alert levels guide operational adjustments from normal traffic to suspension. This integrated approach enables impact estimation, preventive measures, and prioritization of structural and non-structural interventions, improving infrastructure resilience amid diverse weather challenges.

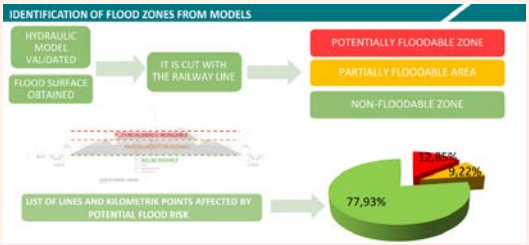


Photo Credits: ADIF

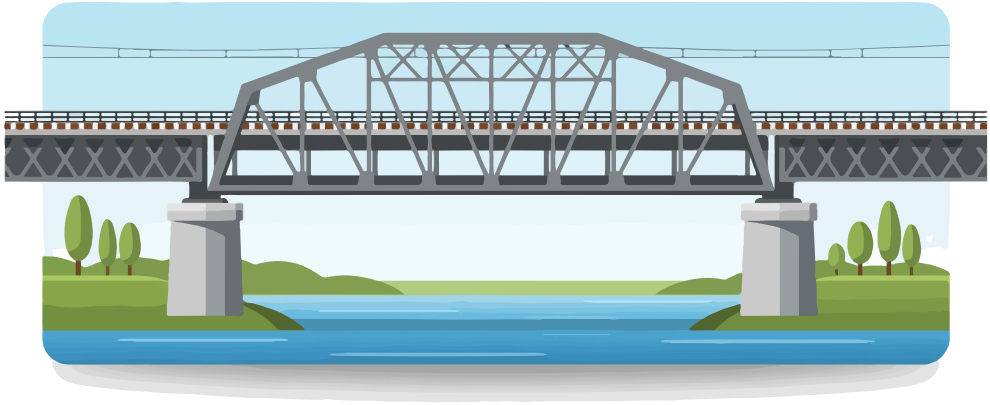
7 AFFORDABLE AND CLEAN ENERGY

ENERGY CONSUMPTION, EFFICIENCY AND SAVINGS

Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix.

Target 7.3: By 2030, double the global rate of improvement in energy efficiency.

Railways are playing an increasingly central role in the modal shift toward low-carbon transport. While diesel remains dominant in freight operations, accounting for 75% of energy use, electricity now represents 45-47% of the total rail energy mix, with biodiesel contributing a small share [14] [21]. Battery trains are also emerging as a complementary solution to extend electrification and optimise energy use, with harmonised charging strategies being developed to maximise operational efficiency [22].



Greening cross-border trade: The Ethio–Djibouti Railway

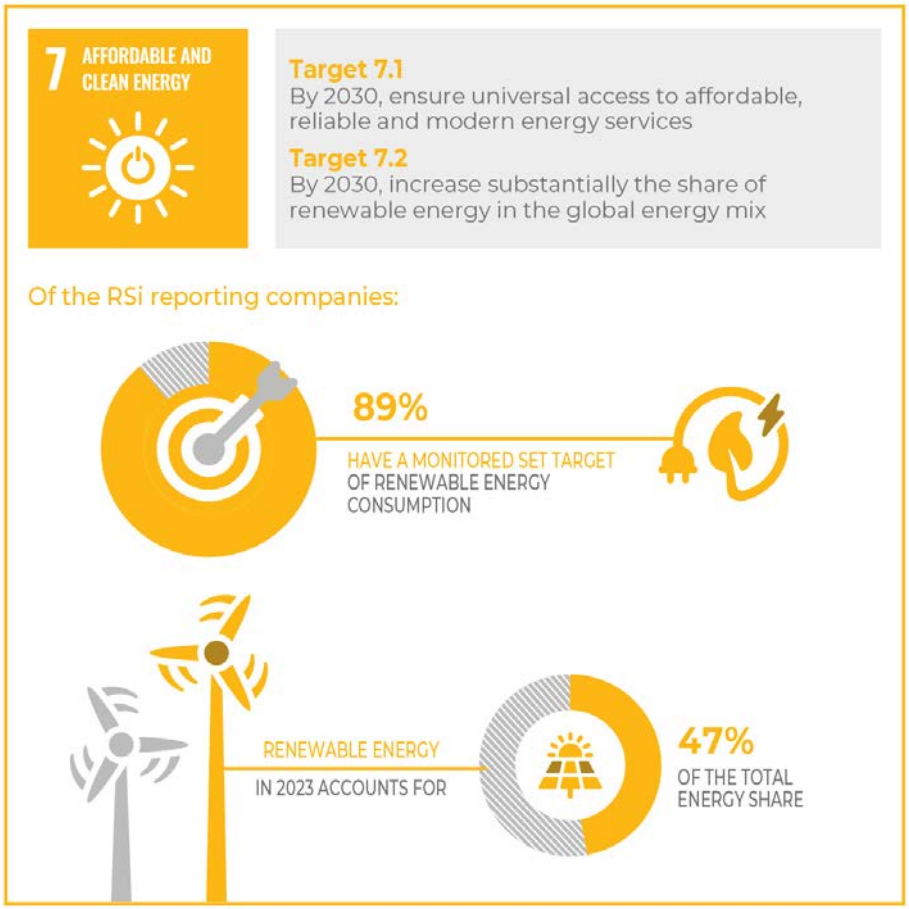
ETHIO-DJIBOUTI RAILWAY

In just seven years, the Ethio–Djibouti Railway (EDR) has become a model for sustainable transport in East Africa. The 756 km fully electrified line, powered by renewable hydropower, connects Addis Ababa to the Port of Djibouti, offering efficient, zero-emission freight and passenger services.

By moving over 14 million tons of freight and 1.5 million passengers, EDR has shifted major traffic from road to rail – displacing 350,000 diesel trucks and avoiding 178,000 tons of CO_2 annually.

With a freight capacity of 3.8 million tons per year, it boosts trade, mobility, and tourism while advancing the fight against climate change and improving regional integration.

Photo Credits: Ethio-Djibouti Railway



INCREASING DRIVE: RENEWABLE ENERGY IN RAIL

RSI DATA SHOWS A SUBSTANTIAL RISE IN RENEWABLE ENERGY TARGETS, FROM 53% IN 2021 TO 89% IN 2023.

ON THE OTHER HAND, THE ACTUAL SHARE OF RENEWABLE ENERGY USE SLIGHTLY FELL FROM 59% IN 2021 TO 47% IN 2023.

Railways in China: How shifting activity from road and aviation to rail reduces the demand for oil

With over 70% of non-urban rail activities electrified, China is a global leader in non-urban railway passenger transport, which is 80 times less oil-intensive per passenger-kilometre than aviation, 90 times less than cars, and 10 times less than buses.

Moreover, transporting freight by rail is 30 times less oil-intensive than by road. Without this expansion in rail, the demand for oil would be 1.5 million barrels per day higher. This is more than the total worldwide savings from electric vehicles.

Since 2015, China's non-urban rail has helped avoid using nearly 12 million barrels per day of oil, in addition to 1.7 gigatonnes of CO_2 emissions, which is equivalent to the country's annual emissions from transport, buildings, and light industry combined. Without this progress, the Chinese transport sector's demand for oil would have remained near its 2021 emissions peak [40]

Electrified rail offers multiple advantages across the energy and transport sectors, supporting energy access in remote regions, improving energy security, and providing a stable baseload to facilitate renewable energy integration [14]. In Europe, energy efficiency improvements continue: energy consumption per passenger-km and per tonne-km of freight has dropped by 26.6% and 21.2% respectively since 2005, while total energy consumption from train operations has decreased by 24% over the same period, as shown in Figure 3 [15]

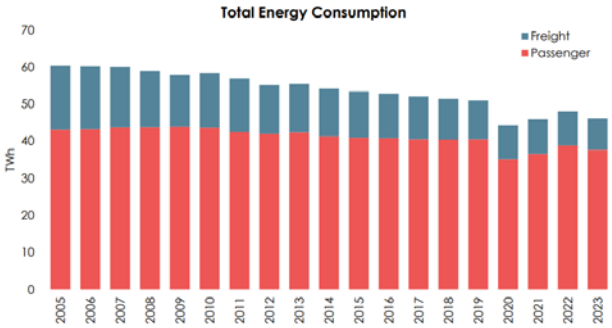
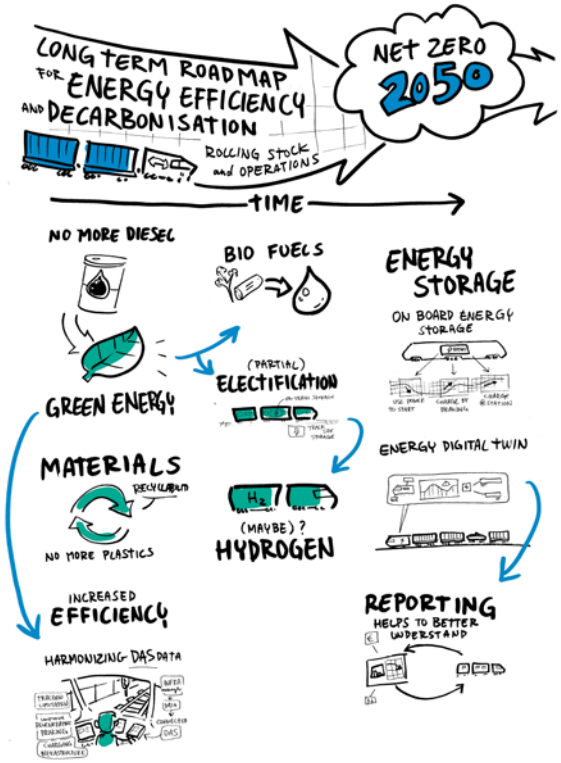
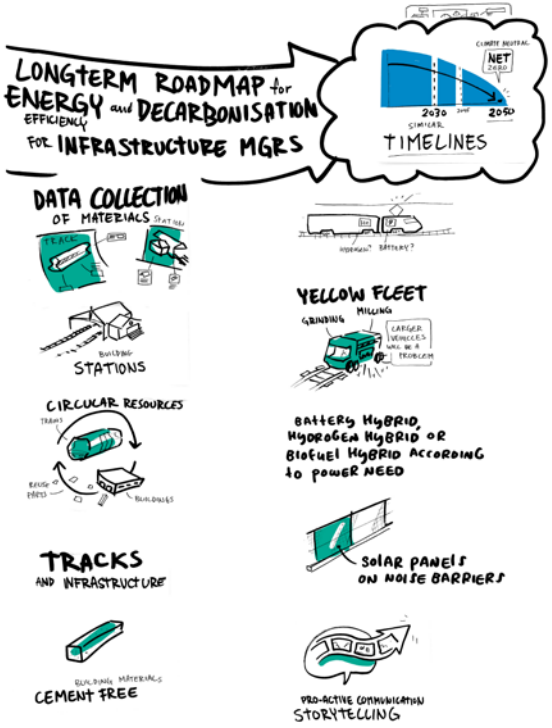


Figure 3: Total Energy Consumption (UIC TED, 2025)





Advanced operational tools, such as the Smart communications for efficient rail activities (SFERA) Driver Advisory Systems (DAS) and Digital Instructions, are being deployed to further optimise energy consumption in real time, including adjusting timetables and train profiles according to the energy and battery charge available. The transition to electrified and more energy-efficient rail networks is crucial for phasing out fossil fuels, enabling renewable energy deployment, and supporting the global goal of net-zero transport emissions by 2050. Moreover, measures such as regenerative braking, eco-driving, smart heating and lighting systems, and the use of alternative fuels complement electrification to maximise the energy and environmentally friendly benefits of rail.

Driving Efficiency: SNCF's low-energy journeys

SNCF Voyageurs is deploying eco-driving and eco-parking to reduce energy use. Eco-driving, supported by the SIRIUS next tool, enables up to 10% energy savings per journey. By 2024, 100% of passenger train drivers were trained, using nearly 5% less energy savings than in 2019. At SNCF Fret (now Hexafret), all drivers were trained in 2023, with deployment scheduled from 2025.

Eco-parking targets energy use during parking phases, which can account for up to 30% of total consumption, with reduction objectives of 5-20%. Launched in 2021 for freight locomotives, eco-parking aims to cut energy use by 3–5% by 2025. In 2024, these actions reduced emissions by 22,000 t CO_2e at SNCF Voyageurs.

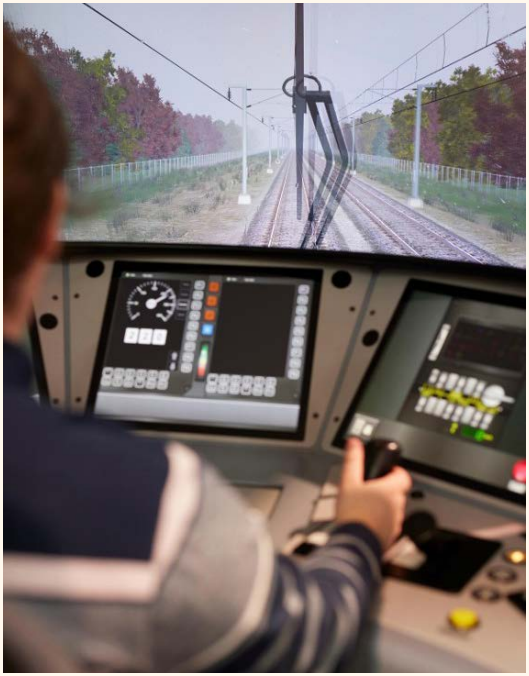


Photo Credits: SNCF

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

SUSTAINABLE PRACTICES ALONG RAILWAY SUPPLY CHAINS

Target 12.2: By 2030, achieve the sustainable management and efficient use of natural resources.

Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

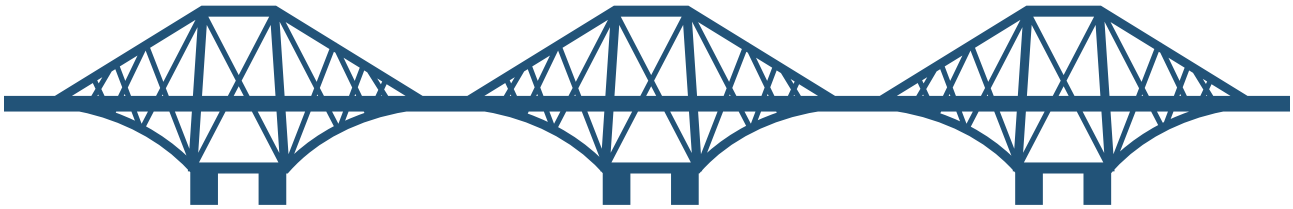
Target 12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.

Railway supply chains are inherently international, sourcing steel, concrete, aggregates, and a wide range of manufactured components from across the globe. This global reach makes it crucial to assess and mitigate environmental externalities along the value chain to maintain rail's advantage regarding sustainability. Historically, railways have operated with relatively closed-loop systems, reusing and extending the life of assets such as rails, sleepers, and ballast. Nowadays, this is also being complemented by circular economy strategies to reduce waste and material use throughout the infrastructure lifecycle.

Indian Railways' large-scale scrap management

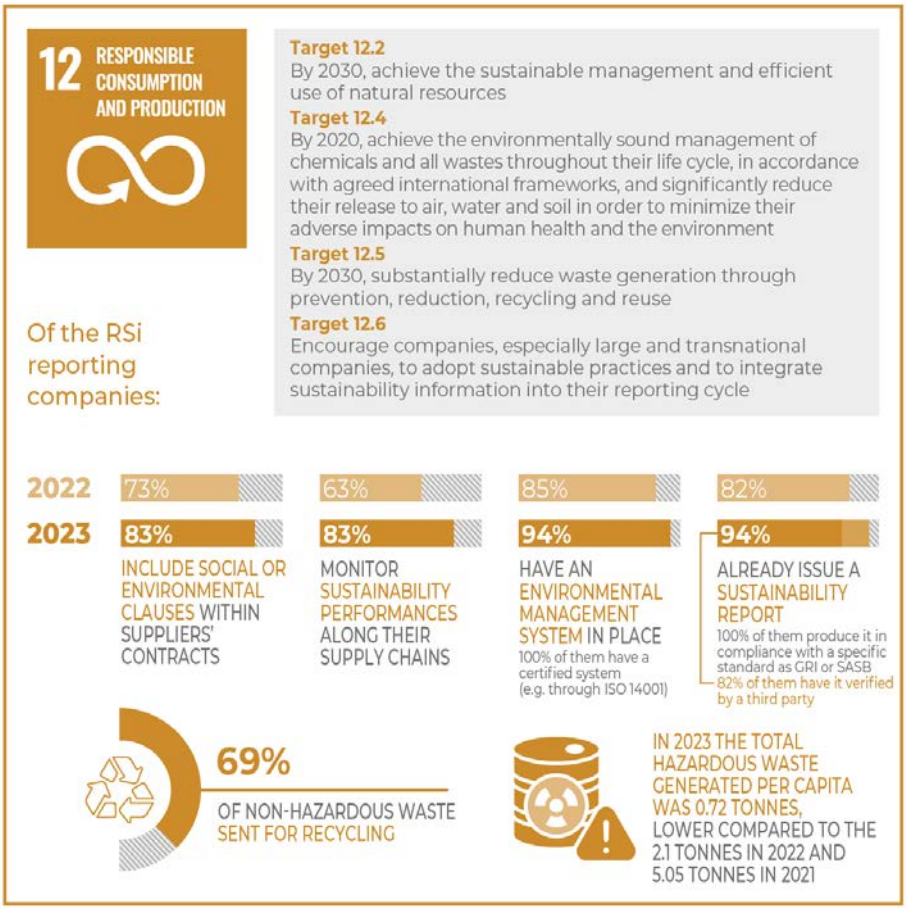
Part of its circular economy strategy, this initiative focuses on the collection, sorting, and auctioning of scrap materials, such as steel, from decommissioned coaches and infrastructure. This system enables millions of tonnes of material to be recycled annually, diverting waste from landfills and lowering demand for virgin resources while generating substantial revenue and reducing the environmental impact. Digitally managed auctions ensure transparency, making this a model for sustainable material recovery in large public infrastructure systems.

Photo Credits: Indian Railways



STRONGER SUPPLY CHAIN AND REPORTING PRACTICES IN RAIL

SINCE 2021, RAIL COMPANIES HAVE STEADILY STRENGTHENED SUPPLY CHAIN SUSTAINABILITY AND REPORTING: MORE COMPANIES ARE EMBEDDING SOCIAL AND ENVIRONMENTAL CLAUSES IN SUPPLIER CONTRACTS, MONITORING SUPPLIER PERFORMANCE, AND IMPLEMENTING CERTIFIED ENVIRONMENTAL MANAGEMENT SYSTEMS. SUSTAINABILITY REPORTING HAS ALSO SURGED, WITH ALL REPORTS IN 2023 NOW ALIGNED WITH RECOGNISED STANDARDS LIKE THE GLOBAL REPORTING INITIATIVE (GRI) OR SUSTAINABILITY ACCOUNTING STANDARDS BOARD (SASB).



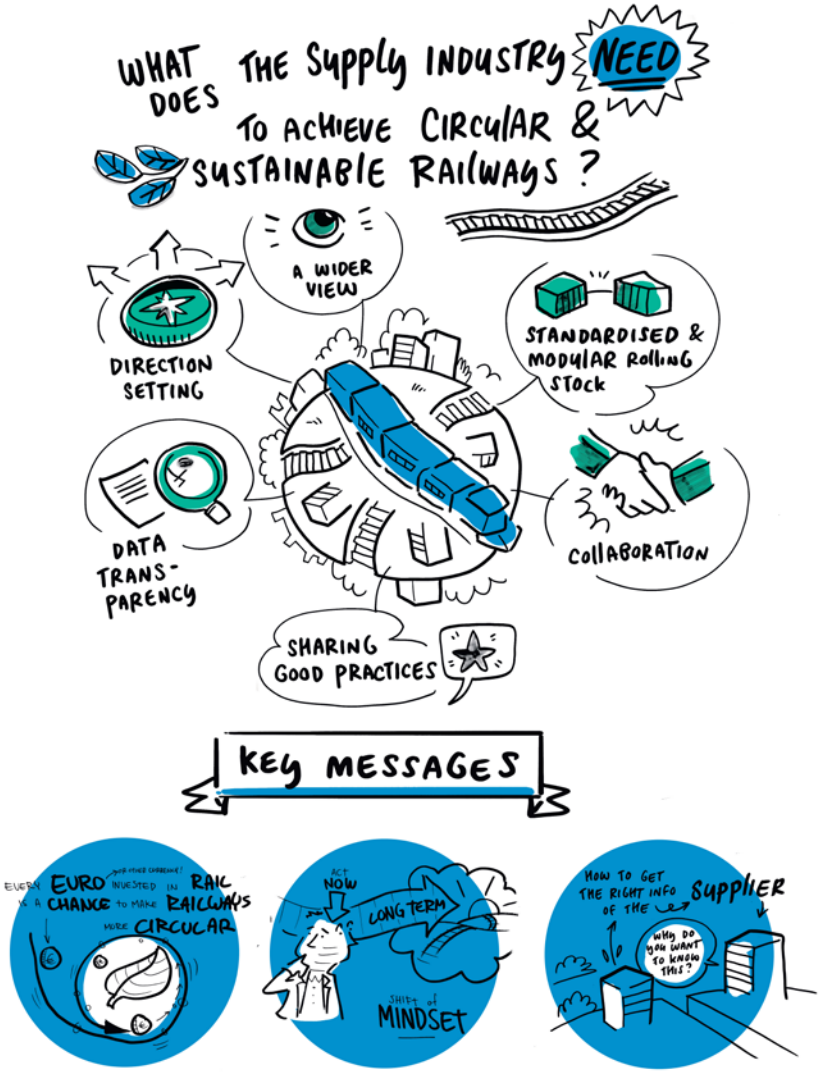
THE TREND REFLECTS A CLEAR SHIFT TOWARD TRANSPARENCY, ACCOUNTABILITY, AND RESPONSIBLE OPERATIONS.

Sustainable station design with local timber – DB InfraGO

In 2024, Holzbau Semmler GmbH received the DB Supplier Award for Environment for developing modular, reusable station buildings constructed from locally sourced timber. Supporting DB InfraGO's small sustainable stations strategy, the pilot project in Zorneding (opened 2023) demonstrates a scalable, low-carbon building concept based on prefabricated wooden modules produced with regional materials. The 180 m² structure integrates visible truss systems and natural lighting through roof light bands, ensuring both durability and comfort. Energy systems include a roof-mounted photovoltaic array with storage and a heat pump, enabling near-autonomous operation. The project exemplifies resource-efficient, circular station design with reduced embodied carbon and simplified end-of-life reuse. [23]

Photo Credits: Holzbau Semmler GmbH

Steel and concrete dominate the material footprint of rail infrastructure. Global demand for steel rails reached an estimated 16.5 million tonnes in 2024. Additionally, international trade in track construction steel remains significant, with around 2.9 million tonnes exported in 2023, although volumes have declined from a 2019 peak of nearly 5 million tonnes [24]. Concrete sleepers represent another major material flow with the global market being valued at $12.8 billion USD in 2024, and the Asia-Pacific region accounting for nearly half of global demand [25]. In response, the sector is advancing circularity through initiatives such as the UIC Circular Ballast and Circular Sleeper projects. These aim to establish technical and regulatory frameworks for the reuse and recycling of key track components, supporting the EU's target of circularity for 2050 while providing internationally applicable roadmaps.



RAIL AS AN INCLUSIVE EMPLOYER AND GENDER-SAFE MODE OF TRANSPORT WITH A DIVERSE WORKFORCE

5 GENDER EQUALITY

Target 5.1: End all forms of discrimination against all women and girls everywhere.

Target 5.c: Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.

Rail transport plays an important role in advancing SDG 5 by improving women's mobility, safety, and economic opportunities, as well as by promoting gender equality within the transport workforce. In general, women rely more than men on public transport, including rail, for access to employment, education, and essential services due to differences in travel patterns and lower access to private vehicles. Inadequate transport systems can therefore disproportionately restrict women's ability to choose and to participate in the economy. Improving the accessibility, affordability, and security of rail systems can therefore enhance women's mobility and help reduce structural inequalities [26].

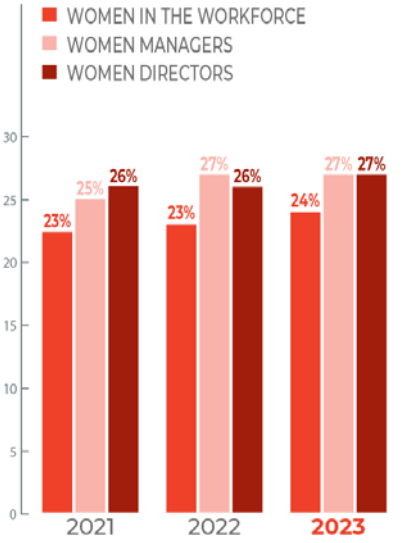
5 GENDER EQUALITY

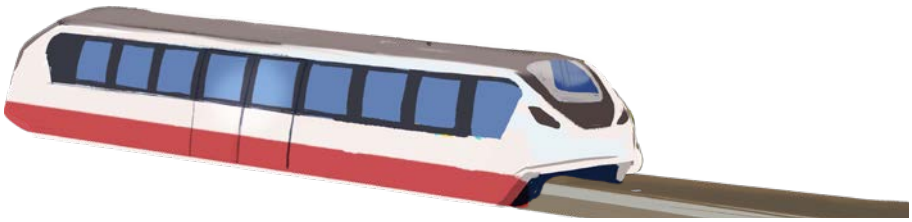
Target 5.1
End all forms of discrimination against all women and girls everywhere

Of the RSi reporting companies:

100%
HAVE A WRITTEN NON-DISCRIMINATION CODE OR POLICY IN PLACE

100%
ACTIVELY MONITOR THE EFFECTIVENESS OF THE CODE ITSELF





PROGRESS ON GENDER EQUALITY AND NON-DISCRIMINATION

FEMALE REPRESENTATION CONTINUES TO RISE STEADILY, BOTH IN TERMS OF THE OVERALL WORKFORCE AND IN MANAGERIAL AND DIRECTOR ROLES, REFLECTING STABLE, SECTOR-WIDE PROGRESS TOWARD AN IMPROVED GENDER BALANCE.

HOWEVER, WOMEN REMAIN SIGNIFICANTLY UNDERREPRESENTED IN THE RAIL AND TRANSPORT WORKFORCE. TO COMBAT THIS, RAIL COMPANIES HAVE STRENGTHENED THEIR COMMITMENT TO INCLUSIVE WORKPLACES, WITH ALL RESPONDENTS NOW HAVING FORMAL NON-DISCRIMINATION POLICIES IN PLACE, WITH SYSTEMATIC MONITORING OF THEIR EFFECTIVENESS.

Equal opportunities at Jernhusen AB

Jernhusen

Jernhusen AB is committed to creating an equal and inclusive workplace where everyone can enjoy the same opportunities in terms of pay, career development, training, and working conditions. The company ensures fair recruitment through competence-based processes and annually reviews salaries to eliminate unjustified gender pay gaps.

Measures for 2025–2027 include regular employee surveys, training all managers in fair hiring, and supporting having a work–life balance through flexible hours, working from home, and structured parental leave planning.

Jernhusen AB also promotes awareness of gender-related health topics, such as menopause, to foster a more supportive and understanding work environment.

Photo Credits: Jernhusen AB

Compared to transport on a broader level, in general, rail has a higher representation of women in the workforce. Women account for around 12-15% of transport and storage workers, and around 20% of rail sector employees [21] [26]. Nevertheless, the gender gap is especially pronounced in technical and leadership roles. Addressing these gaps can unlock significant economic potential: if women participated equally in labour markets, global GDP could increase by up to 26% (equal to USD 28 trillion) [27].

15 LIFE ON LAND

ENVIRONMENTAL IMPACT: PROTECTING BIODIVERSITY

Target 15.5: Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.

Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Global biodiversity is declining at unprecedented rates, with wildlife populations down by 73% since 1970 and 32 million ha of forest lost between 2010 and 2015 [28] [29].

Railways, however, remain the most land and energy-efficient form of mass transport, easing pressure on ecosystems while enabling sustainable mobility [30] [31].

DID YOU KNOW?

IN EUROPE ALONE, RAIL LINES INTERSECT WITH AROUND 2,500 PROTECTED SITES, WITH OVER 400,000 KM² OF PROTECTED LAND LOCATED WITHIN 1 KM OF THE NETWORK [31].

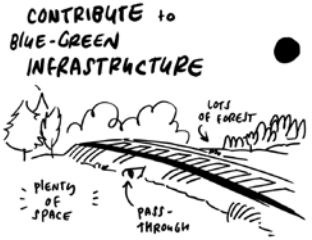
Rhaetian Railway: Managing nature-related risks in the Swiss Alps

Rhaetian Railway

In 2024, the Rhaetian Railway (RhB) adopted the Taskforce on Nature-related Financial Disclosures (TNFD) framework to better manage nature-related risks in the Swiss Alps. Operating through UNESCO-listed landscapes, RhB applies the Locate, Evaluate, Assess, and Prepare (LEAP) approach to identify where its assets interact with sensitive ecosystems. This process revealed key dependencies for safe, reliable operations on healthy forests, alpine meadows, and waterways. By integrating biodiversity data into decision-making, RhB enhanced its risk management, set new environmental targets, and reinforced its commitment to preserving mountain ecosystems.

Photo Credits: Rhaetian Railways (RhB), Andrea Badrutt

Despite requiring a certain level of physical space, rail uses far less land than road transport, as around 7 m² per passenger versus 100 m² for cars [31]. Therefore, railways present both challenges and opportunities for biodiversity: on the one hand, they can fragment habitats and disturb wildlife, on the other, their linear corridors can serve as valuable ecological networks and refuges for native species.



Managed effectively, railway verges and embankments can enhance connectivity between fragmented landscapes. To this end, infrastructure managers are increasingly applying nature-based solutions (such as wildlife crossings, vegetation buffers, and eco-engineering for slopes) to mitigate their impact, restore habitats, and strengthen resilience to climate change [32]. With strategic planning, rail can be a key ally in achieving global biodiversity targets.

15 LIFE ON LAND

Restoring the River Lavant: ÖBB's nature-based approach to flood resilience and biodiversity

ÖBB INFRA

While constructing the Koralmbahn on the Baltic-Adriatic Corridor, ÖBB, Austria's rail infrastructure manager, restored 1.4 km of the River Lavant. The project re-established the natural river flow and also created 20 ha of connected wetlands that act as flood retention areas, protecting nearby rail infrastructure. Moreover, artificial barriers were removed, improving ecological connectivity.

One year after completion, the restored site withstood flooding without damage. The landscape intervention enhanced biodiversity, supported the return of native species, and provided public access through a cycling path and nature trail, contributing to local recreation and tourism while showcasing how rail infrastructure can integrate nature-based flood management.

Photo Credits: ÖBB -Infrastruktur AG

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

13 CLIMATE ACTION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

11 SUSTAINABLE CITIES AND COMMUNITIES

RAILWAYS AND WILDLIFE MORTALITY

Collisions between trains and wildlife represent a critical interface between rail operations and ecosystems. Though rarer than road collisions, they can cause significant ecological and operational damage [33]. Large mammals (such as deer, wild boar, and moose) often trigger costly delays and safety risks [34], while accidents also contribute to population declines in vulnerable species [35]. Hotspots typically align with migration routes and poorly connected habitats [36]. Therefore, the UIC Safety Platform has developed a global wildlife-train collision database across 20 railway networks, helping to standardise reporting and understand the key challenges in this domain.

24,064 EVENTS RECORDED

66% ACCIDENTS (COLLISIONS)

34% INCIDENTS (SIGHTINGS)

EVENT RATIO PER TRAIN-KM DECLINED FROM 4.59 → 4.32, SIGNALLING IMPROVED MONITORING AND PREVENTION.

WHERE AND WHEN DO ACCIDENTS OCCUR?

- DAYLIGHT: 47 %
- TWILIGHT: 41 %
- NIGHT: 12 %
- MOSTLY ON SINGLE-TRACK AND CONVENTIONAL LINES
- PASSENGER TRAINS INVOLVED IN 84% OF CASES, REFLECTING THEIR HIGHER FREQUENCY AND COVERAGE.

MAIN CONSEQUENCES OF ACCIDENTS

58% CAUSE DELAYS

41% CAUSE TRAIN DAMAGE

HUMAN HEALTH AND WELL-BEING: REDUCING NOISE AND IMPROVING AIR QUALITY

Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Noise pollution is one of the most significant negative externalities of transport, with rail being the second largest emitter after road traffic. Noise presents both public health challenges and social acceptance concerns and therefore effective management is important to maintaining community support for rail.

TRANSPORT NOISE

TOTAL EXTERNAL COSTS IN THE EU

RAIL: €7 BILLION IN TOTAL EXTERNAL NOISE COSTS (2022)

ROAD: €61.5 BILLION, NEARLY **NINE TIMES HIGHER** THAN RAIL

In the EU, noise-related externalities rose by approximately 20% for both rail and road transport modes since 2016. However, data updates rely on 2016 noise maps, which limits the possibility for direct year-to-year comparison. Even so, the picture is clear: road traffic remains the loudest polluter, while rail continues to offer a quieter path toward sustainable and people-friendly mobility.

Noise abatement on Germany's Federal Railways

DB InfraGO

Aligned with SDG 3 on health and well-being, Germany's *Noise Abatement Programme*, run by DB InfraGO since 1999, reduces environmental noise along existing rail lines through active (barriers) and passive (soundproofing) measures. Over €2 billion has been invested, upgrading 2,300 km of track, installing 880 km of noise barriers, and protecting 70,000+ homes. Noise levels have dropped by up to 11 dB(A), supported by retrofitting freight cars with quieter brake blocks. The programme's long-term goal is to halve the number of residents exposed to rail noise by 2030, safeguarding communities while supporting the shift to sustainable rail transport. [37]

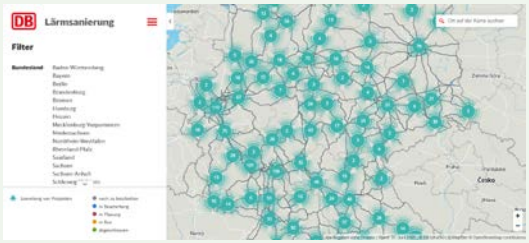
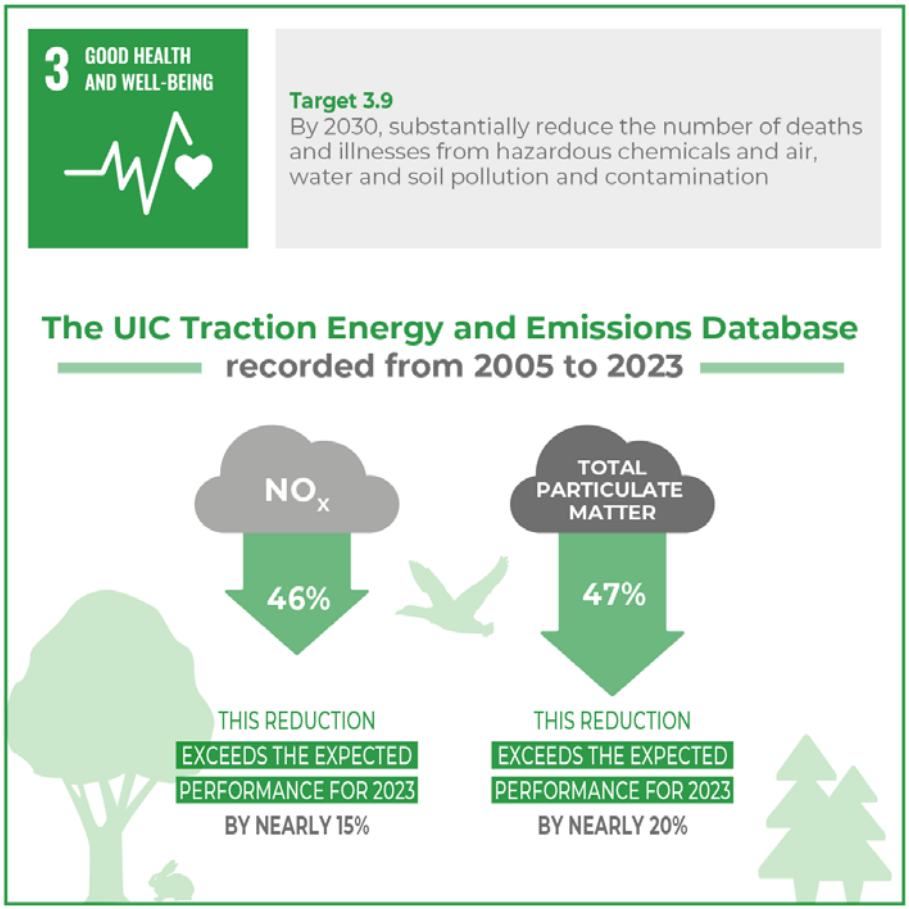


Photo Credits: DB InfraGo



At the same time, European railways have made significant progress in cutting air pollutant emissions. By 2030, the sector aims to reduce total exhaust emissions of nitrogen oxides (NO_x) and particulate matter (PM_{10}) by 40% in absolute terms compared to 2005, despite expected traffic growth [15].

TOTAL EXTERNAL COST OF AIR POLLUTION

FROM TRANSPORT IN THE EU

RAIL: €1 BILLION IN TOTAL EXTERNAL AIR POLLUTION COSTS (2022) – DOWN 7% SINCE 2016.

ROAD: €50 BILLION IN AIR POLLUTION COSTS (2022) – THOUGH IMPROVED, ONLY **DOWN 22%** SINCE 2016.

RSSB air quality monitoring and emissions mapping in rail

The UK Rail Safety and Standards Board (RSSB) has launched the CLEAR programme to establish a baseline of pollution across stations and rail environments in the UK. The Air Quality Monitoring Network now systematically measures NO_2 and particulate matter at 72 key stations across Great Britain, using diffusion tubes, sensors and reference monitors to support targeted Air Quality Improvement Plans. Complementing this, the Rail Emissions Mapping Tool provides high-resolution data on NO_x, PM_{10} and $PM_{2.5}$ emissions across the network. This digital platform identifies pollution hotspots and supports evidence-based mitigation, investment planning and policy development [38] [39].

Photo Credits: Rail Safety and Standards Board

CONCLUDING MESSAGE FROM THE UIC SUSTAINABILITY PLATFORM CHAIR

This report reaffirms that rail is not only the backbone of sustainable mobility, it is a catalyst for climate action, resilience, and inclusive growth. The data, case studies, and innovations shared here reflect our global rail community's collective drive in this respect. But this drive must now translate into acceleration.

Let this report serve as both a benchmark and a call to action: to scale what works, to invest in what matters, and to ensure that rail continues to lead the way toward a more sustainable, equitable, and resilient future for all.

Lia Talarico, Chair, UIC Sustainability Platform

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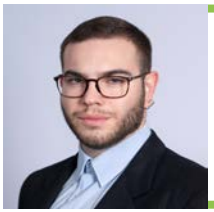

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SDG PROGRESS ASSESSMENT: REPORTING METHOD

The reporting method adopted for each SDG for the 2023 edition of the report follows its predecessor's structure, relying on the following key components:

1. **Data and information gathering** from internal UIC sources: the UIC RAIL Information System and Analyses (RAILISA), the Rail Sustainability Index (RSi), the Rail Safety database, the Traction Energy and Emissions Database (TED), and the UIC Sustainability Impact Awards.
2. **Analysis** on progress towards achieving the United Nations SDGs within the rail sector. The SDGs included in the report reflect those selected in the member collaborative materiality assessment for the RSi.
3. **Geographic coverage,** while striving to gain a global overview, the majority of TED and RSi data comes primarily from European UIC members.

UIC MEMBERS DELIVERING SDGS – THE RAIL SUSTAINABILITY INDEX

Rail Sustainability index

Rail delivering the SDGs

In 2022, the UIC Rail Sustainability index (RSi) was introduced as a benchmarking tool to measure rail's contribution to achieving the SDGs.

Materiality assessment

A comprehensive materiality analysis was conducted by the project working group on all 17 SDGs, aiming to identify those most relevant to the rail sector and the objectives of the UIC Sustainability Platform. This led to the selection of seven SDGs, representing areas where rail can make a significant contribution.

Key performance indicators (KPIs) and variables

Based on the shortlist of 7 SDGs, a set of more than 70 Key Performance Indicators (KPIs) and more than 100 quantitative and qualitative variables was developed. Quantitative indicators are benchmarked on the last year, considered against the average, and calculated with data from participating companies. These indicators are also benchmarked considering their trends within the considered company across the two previous years. Each qualitative indicator is assessed through two yes/no questions and one open text question.

Scoring and benchmarking

The working group assigned a weighting to each SDG based on a prioritisation exercise, leading to a performance assessment which was balanced out across all relevant areas as shown in Table 1.

SDG Rail Index	SDG weight
SDG 5 - Achieve gender equality and empower all women and girls	10%
SDG 7 - Ensure access to affordable, reliable, sustainable and modern energy for all	20%
SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	10%
SDG 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	15%
SDG 11 - Make cities and human settlements inclusive, safe, resilient and sustainable	10%
SDG 12 - Ensure sustainable consumption and production patterns	15%
SDG 13 - Take urgent action to combat climate change and its impacts	20%
Company SDG Rail Index Core	**100%**

Table 1: SDG Rail Index, UIC

RSi participants can compare their performance with the average scores of other members around the world. This allows for insight to be gained on areas of strength and opportunities for improvement.

Participation

In total, 36 companies participated in RSi in 2024:

- 9 companies are infrastructure managers, passenger operators, and freight operators combined (i.e. integrated companies), representing 25% of the total
- 9 companies are infrastructure managers only, representing 25% of the total
- 7 companies are passenger operators only, representing 19% of the total
- 5 companies are freight operators only, representing 14% of the total
- 3 companies are infrastructure managers and passenger operators, representing 8% of the total
- 2 companies are both freight and passenger operators (railway undertakings), representing 6% of the total
- 1 company is station manager and infrastructure manager, representing 3% of the total.

The RSi participants were based in three different world regions, with 30 from Europe, 4 from Asia-Pacific, and 2 from North America.

UIC members have exclusive access to this system at no extra charge, and participation is voluntary. The data used to draft this report was reported by individual companies and was collated into totals, averages and ranges.

UIC RAIL INFORMATION SYSTEM AND ANALYSES (RAILISA)

Railisa is a UIC online tool allowing members to visualise and download the data provided by more than 100 railway companies worldwide. Some of the indicators reported in the tool have been documented since 1995 with continuous updates. Railisa includes parameters such as the size of the infrastructure network, electrification, level crossings, fleets, traffic volumes, train punctuality, financial results, staff, energy consumption and accidents. For more detailed information, readers are encouraged to refer to IRS 30398 on UIC Railway Statistics and the user guide for data queries through the Railisa web interface and API.

TRACTION ENERGY AND EMISSIONS DATABASE (TED)

The Traction Energy and Emissions Database (TED) was developed to facilitate monitoring, reporting, and benchmarking for UIC Members regarding energy consumption and emissions in relation to UIC-CER defined targets.

This database offers insights into energy consumption and emissions within the railway market, encompassing traction energy usage, auxiliary systems, and heating, ventilation, and air conditioning (HVAC).

In 2024 TED, 22 companies provided data covering their 2023 activity, (while for 8 companies the data were estimated based on previous years values).

As the database was initiated as a European initiative, the data still comes predominantly from European UIC members. The database provides a comprehensive overview of the European railways' achievements against the collectively determined targets in reducing traction energy consumption and related emissions. In 2021, TED data covered approximately 84% of passenger traffic and 47% of freight traffic in the EU reported by Eurostat. Nonetheless, 2022 was the first year that the data collection cycle was promoted to non-European members, reflecting its significance in tracking environmental performance worldwide. TED is now open to all UIC members around the world.

Since the beginning, the database has evolved to address changing environmental goals, with targets initially being set for 2020 and then revised for 2030 and beyond. For example, the 2025 campaign introduced the enlarged scope to cover the use of main alternatives to diesel, namely Hydrotreated Vegetable Oil (HVO) and Fatty Acid Methyl Esters (FAME) fuels.

For this edition of the UIC Global Rail Sustainability Report, the data from the 2024 TED were used, providing information on 2023 activities. UIC Members are invited to review and contribute to the TED dataset. Contributions allow to showcase rail's decarbonisation role in the transport sector.

THE UIC SUSTAINABILITY PLATFORM

The platform has three key objectives

- Connect the sustainability community
- Global Advocacy
- Provide practical solutions

Working in 5 technical sector groups

- Noise and Vibration
- Circular Economy
- Air Quality
- Energy & GHG Emissions
- Sustainable Land Use

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