Smart Freight Centre India

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Creating Innovative Solutions for a Sustainable Future

Whitepaper

Institutionalizing Freight Emissions Accounting in India: Pathways for Clean Freight Programs and Policy Integration

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Smart Freight Centre India

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List of Abbreviations

BRSR	Business Responsibility and Sustainability Report
CCTS	Carbon Credit Trading Scheme
CDP	Carbon Disclosure Project
CH_4	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DEFRA	Department for Environment, Food and Rural Affairs
EF	Emission Factor
GHG	Greenhouse Gas
GLEC	Global Logistics Emissions Council
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
Kg	Kilogram
MRV	Measurement, Reporting and Verification
N_2O	Nitrous Oxide
NO_x	Nitrogen Oxide
PAT	Perform, Achieve and Trade
PM	Particulate Matter
SBTi	Science Based Targets initiative
SO_x	Sulphur Oxide
TEMT	Transportation Emission Measurement Tool
TJ	Terajoule
TKm	Tonne - Kilometer
TTW	Tank-to-Wheel
UNFCCC	United Nations Framework Convention on Climate Change
WTT	Well-to-Tank
WTW	Well-to-Wheel

1. Background

India's freight transport demand is projected to increase sharply, from 2,682 billion tonne-kilometres (BTKM) in 2019-20 to 7,260 BTKM by 2030-31, with road transport accounting for nearly 85% of the total freight movement in 2030-31.[1] While freight transport is central to India's economic growth and industrial competitiveness, it is also a major contributor to fossil fuel consumption, greenhouse gas (GHG) emissions, and local air pollution. Despite representing a relatively small share of the overall fleet, medium-and heavy-duty trucks contribute a disproportionately large share of transport emissions and urban pollution. Under a business as usual (BAU) scenario, emissions from medium and heavy duty vehicles (MHDVs) are projected to rise significantly, positioning road freight as a critical sector for achieving India's long-term climate and energy security objectives.

At the same time, corporate disclosures and regulatory expectations on value-chain transparency are rising, driven by domestic mandates such as Business Responsibility and Sustainability Reporting (BRSR) requirements and global supply-chain disclosure regimes. However, analysis of disclosures from 127 large Indian organisations indicates limited and inconsistent reporting of scope 3 emissions, underscoring the need for a standardised and credible emissions accounting framework.[2]

A robust freight emissions accounting system is the backbone of any credible decarbonisation strategy. It allows shippers, carriers, logistics service providers (LSPs), policymakers, and financial institutions to quantify emissions consistently; identify high-impact operational levers; track year-on-year progress; and create verifiable pathways for incentives and market mechanisms.

This whitepaper proposes a nationally harmonized approach to institutionalizing freight emissions accounting in India, aligned with ISO 14083:2023[3] and the Global Logistics Emissions Council (GLEC) Framework[4], and adapted using India-specific emission factors. Drawing on the collaborative work undertaken by Smart Freight Centre (SFC) India, The Energy and Resources Institute (TERI), and Indian Institute of Management (IIM) Bangalore, this paper outlines a practical roadmap to operationalise a Clean Freight Program for India, proposed to be anchored under Bureau of Energy Efficiency (BEE) / Department for Promotion of Industry and Internal Trade (DPIIT) with multi-stakeholder governance and a digital Monitoring, Reporting and Verification (MRV) framework.[5]

The paper further examines pathways for integrating a Clean Freight Program with India's Carbon Credit Trading Scheme (CCTS)[6] to enable monetisation of verified freight emissions reductions, while ensuring environmental integrity and avoiding double counting. Collectively, these measures can support the transition to a low-carbon, and efficient freight in India.

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1 Details available at: https://teriin.org/sites/default/files/2024-11/Roadmap%20for%20India%20Energy%20Transition_FINAL%20REPORT.pdf
2 TERI. (2026). Clean Freight Program: Baseline Study (Phase-II). The Energy and Resources Institute.
3 Details available at: https://www.iso.org/standard/78864.html
4 Details available at: https://smart-freight-centre-media.s3.amazonaws.com/documents/GLEC_FRAMEWORK_v3.2_21_10_25_1.pdf
5 Details available at: unfccc.int/files/national_reports/annex_i_natcom_/application/pdf/non-annex_i_mrv_handbook.pdf
6 Details available at: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2198780&reg=3&lang=1

1.1 Importance of Freight Emissions Accounting

Freight transport is economically central to modern economies yet inherently emissions-intensive, making credible measurement a prerequisite for meaningful decarbonisation. Globally, freight accounts for a substantial and growing share of transport emissions around 40% of transport-related CO_2 in 2018, rising to ~42% in 2019.[7] This challenge is amplified by continued growth in freight demand worldwide; without systematic efficiency improvements and fuel switching, rising activity risks locking in high emissions for decades.

In India, the case for prioritising freight emissions accounting is particularly compelling.The transport sector contributed to 9% of total GHG emissions from the energy sector in the country emissions.[8] The road transport sector accounted for 94% of the total GHG emissions from the transport sector, followed by civil aviation 4%, railways 1% and water-borne navigation 1%.8 Trucks represent just 3% of the total vehicle fleet (including both passenger and freight) yet are responsible for a staggering 53% of PM emissions,[9] placing freight at the centre of both climate and air-quality strategies.

At the same time, the global push for emissions transparency across supply chains is increasingly driven by regulation rather than voluntary Environmental, Social, and Governance (ESG) commitments. The EU's Carbon Border Adjustment Mechanism (CBAM), which entered into full implementation from 2026[10], when importers must surrender CBAM certificates linked to embedded emissions. While freight emissions are not directly covered under CBAM, the mechanism signals a broader shift in trade and procurement toward quantified, verifiable, and auditable carbon data, significantly increasing the strategic value of robust shipment- and lane-level freight emissions accounting.

Similar signals can be seen domestically, where India's corporate disclosure landscape is shifting toward quantified and comparable sustainability metrics. SEBI's BRSR framework is now mandatory for the top 1,000 listed companies, while Scope 3 emissions, where freight often sits for shippers and logistics service providers, are positioned as a leadership (voluntary) disclosure.[11] In parallel, India has operationalised the CCTS as the foundation of the Indian Carbon Market, with compliance mechanisms built around GHG emission-intensity (GEI) targets and defined baselines (2023–24) and compliance periods (e.g. 2025–26 and 2026–27). Together, these developments signal a clear direction of travel: **companies that invest early in robust, standardised freight emissions accounting will be better prepared for emerging domestic compliance requirements, evolving trade conditions, and rising expectations from customers, investors, and regulators.**

Beyond compliance, high-quality freight emissions data has become a strategic business asset. **CDP's global supply-chain programme** shows that when buyers require disclosure and actively engage suppliers, measurable outcomes follow: supplier actions supported by disclosure have delivered **tens of millions of tonnes of emissions reductions and billions of dollars in cost savings.**[12]

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[7] Details available at: tcc-gsr.com/wp-content/uploads/2023/09/SLOCAT-Transport-Climate-and-Sustainability-Global-Status-Report-–-3rd-Edition.pdf

[8] Details available at: https://unfccc.int/sites/default/files/resource/India%20BUR-4.pdf

[9] https://www.niti.gov.in/sites/default/files/2023-02/ZETReport09092022.pdf

[10] Details available at: https://taxation-customs.ec.europa.eu/news/cbam-successfully-entered-force-1-january-2026-2026-01-14_en

[11] Details available at: https://www.sebi.gov.in/legal/circulars/jul-2023/brsr-core-framework-for-assurance-and-esg-disclosures-for-value-chain_73854.html

[12] Details available at: https://www.cdp.net/en/insights/strengthening-the-chain

In the freight context, such gains typically arise from improved visibility at lane and shipment level, enabling better route and mode selection, higher load factors, reduced empty running, more effective carrier performance management, and clearer prioritisation of interventions based on emissions abatement per unit cost. These benefits are tangible in practice. For example, Maruti Suzuki's modal shift from road to rail resulted in the dispatch of 5.18 lakh vehicles by rail in FY 2024–25, avoiding approximately 1.8 lakh tonnes of carbon dioxide equivalent (tCO₂e) and saving ~63 million litres of fuel demonstrating how quantified logistics decisions can deliver material climate and efficiency benefits at scale.[13]

To ensure emissions data is decision-useful and credible, **standardisation and assurance readiness** are essential. Frameworks such as the **GLEC Framework,** aligned with **ISO 14083:2023,** provide consistent rules for calculating, allocating, and reporting logistics emissions across multimodal transport chains. By improving methodological consistency and comparability across companies and service providers, such standards help make emissions data more transparent, auditable, and suitable for use in corporate reporting, procurement, and emerging market mechanisms.

Against this backdrop, measuring freight emissions is the critical first step. Institutionalising an India-relevant, standardised approach aligned with global norms but grounded in local operating conditions and data would reduce fragmentation, improve comparability, and create a credible foundation to design targeted decarbonisation interventions, track progress over time, enable transparent value-chain reporting, and participate effectively in emerging compliance and carbon-market mechanisms.

1.2 Objective and Policy Relevance

Freight is one of the hard-to-abate parts of India's transport sector yet emissions measurement today remain fragmented across companies, tools, and reporting standards. This fragmentation constrains data comparability, limits the credibility of emissions estimates, and slows coordinated action by industry and government.

To address this gap, SFC, TERI and IIM Bangalore have collaborated to develop a globally aligned, India-specific freight emissions accounting framework that can be institutionalised through national systems, guidance, and capacity-building.

At its core, the framework is designed to remove three structural barriers to freight decarbonisation:

Standardisation:	Alignment:	Actionability:
Establishing consistent methodologies and India-specific emission factors for measuring freight emissions across modes, vehicle categories, and and supply-chain actors.	Enabling consistency and interoperability across shippers, carriers, tool providers, auditors, and regulators through common definitions and reporting logic.	Ensuring that emissions measurement outputs are decision-useful, supporting transition towards zero-emission freight pathway (through interventions related to efficiency improvement, modal shift, adoption of clean fuels, and deployment of ZETs).

Figure 1: Structural barriers to freight decarbonisation
Source: *SFC & TERI*

[13] Details available at: https://www.marutisuzuki.com/corporate/media/press-releases/2025/june/maruti-suzuki-has-dispatched-over-5-lakh-half-a-million-vehicles-through-indian-railways

This whitepaper synthesises insights from our 18 months of research and stakeholder engagement and has three practical objectives:

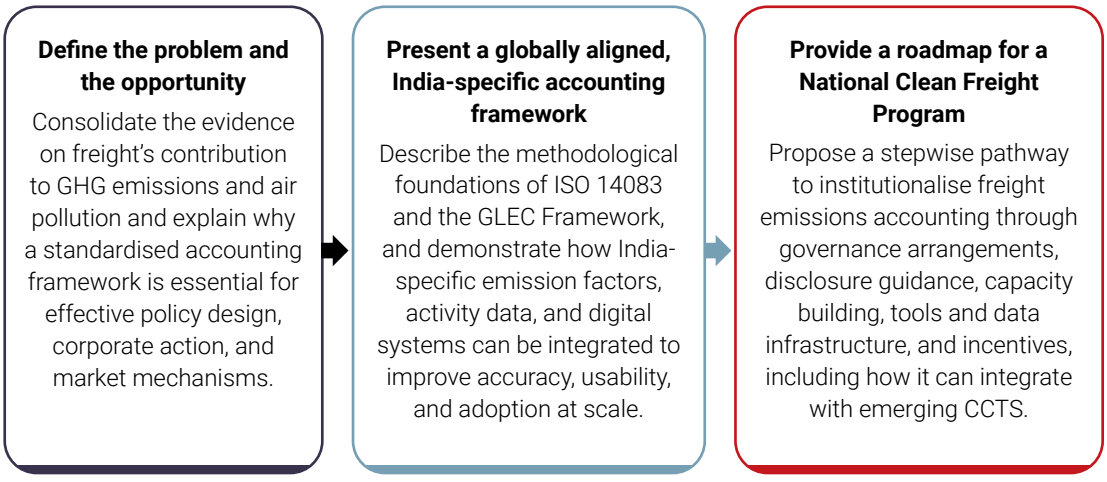


Figure 2: Key objective of the whitepaper
Source: *SFC & TERI*

Why this matters for policymakers and national institutions

Beyond industry benefits, institutionalising freight emissions accounting offers strategic value for India by:

- ✓ Establishing a harmonised MRV foundation for freight that can underpin future policy instruments and credible carbon-market integration (including CCTS readiness).
- ✓ Enabling data-driven governance of logistics efficiency and decarbonisation supporting prioritisation of interventions, targeting of incentives, and monitoring of outcomes.
- ✓ Strengthening international competitiveness by preparing Indian exporters and logistics providers for evolving global disclosure and buyer requirements (e.g., EU CBAM/CSRD and corporate climate targets).
- ✓ Supporting state logistics planning by providing a consistent measurement backbone to develop and track Green Freight Action Plans under the sustainability intent of the National Logistics Policy.
- ✓ Improving transparency and investment readiness by enabling credible, comparable freight-emissions disclosure reducing greenwashing risk and improving confidence for financiers and procurement teams.

In essence, this framework aims to transform freight-emissions accounting in India from a fragmented reporting exercise into a national enabler anchoring the logistics sector in a globally aligned, data-driven, and low-carbon growth pathway.

2. Freight Transport and Emissions In India

Road freight is central to India's economic activity and is projected to remain the primary mode of freight transport domestically and globally. However, the continued dominance of road transport, if not accompanied by corrective policies and clean technology adoption, is expected to sustain high emission levels, undermining India's climate commitments, energy security, and air quality objectives.

2.1 Overview: Road Freight in india

TERI's estimates indicate that, under BAU scenario, road freight transport demand in India could increase nearly tenfold by 2050–51 compared to 2019–20 levels. Further, emissions from MHDVs are expected to rise from 27% of total road transport emissions in 2019-20 to around 35% by 2030-31. MHDVs currently dominate the road freight segment and, in the absence of corrective policy and technological interventions, are expected to continue driving growth in freight-related emissions.

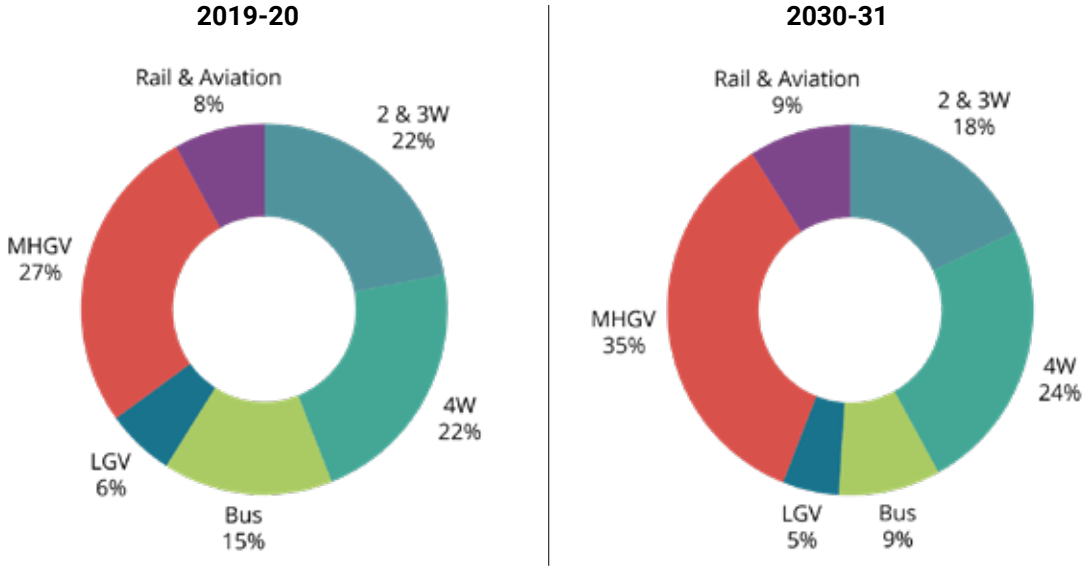


Figure 3: WTW emissions from transport sector (BAU scenario)
Source: *TERI*

HDVs generate significantly higher CO_2 and local air pollutant emissions compared to passenger vehicles, including cars and two-wheelers, largely due to their larger vehicle mass, higher payloads, and lower fuel efficiency per kilometre.[14]

In India, light, medium and heavy-duty trucks account for about 5% of the vehicle stock, yet contribute to more than 35% of the transport CO2 emissions. This stark disparity highlights the high emissions intensity of freight vehicles particularly MHDVs and their outsized role in both climate change and local air pollution relative to other vehicle categories. As a result, road

[14] Details available at: https://efastindia.org/sites/default/files/2023-08/The%20Potential%20to%20Electrify%20Freight%20Transportation%20in%20India_Final_03.06.22.pdf

freight, specially MHDVs emerges as a priority for decarbonisation through interventions such as electrification, efficiency improvements, and modal shifts. However, the effectiveness of these interventions depends on robust freight emissions tracking, with vehicle and activity level emissions accounting essential for identifying high-emission routes, setting credible baselines and assessing emissions-reduction potential.

Road Transport structure and operating realities

A defining feature of Indian road freight is fragmentation. A large share of operators are small fleet owners, with limited access to affordable capital, digital tools, and modern fleet management practices. Freight markets are highly price-competitive, which often leads to deferred maintenance, longer vehicle lifetimes, and slower adoption of cleaner technologies.

Several operational factors have a direct and significant impact on freight emissions:

Empty running: Studies and industry estimates indicate that empty running rates can reach 30–40% in certain freight segments, resulting in substantial vehicle kilometres travelled without payload and avoidable emissions.

Load utilisation: Under-loading is common in less-than-truckload (LTL) operations and in markets with imbalanced return freight, reducing emissions efficiency per tonne-kilometre.

Duty-cycle diversity: Freight operations span a wide range of use cases from short-haul urban distribution to long-haul intercity and corridor movements each with distinct speed profiles, congestion exposure, terrain, and driving behaviour.

Fleet heterogeneity: Vehicle categories, axle configurations, body types, fuel efficiency, and age profiles vary significantly across states, commodities, and operators, complicating emissions estimation and comparison.

Figure 4: Operational factors affecting freight emissions
Source: *SFC & TERI*

Capturing these realities is essential for developing emissions inventories that are both accurate and decision-relevant.

Implications for Corporate Disclosure and Emissions Accounting

Globally, SFC has analyzed the latest CDP disclosures to better understand how transportation emissions are being reported across sectors and where critical gaps remain.[15]

From a corporate reporting and value-chain perspective, freight emissions are equally critical. For most shippers and manufacturers, road freight emissions fall under Scope 3, particularly Category 4 (upstream transportation and distribution) and Category 9 (downstream transportation and distribution).

[14] Details available at: https://efastindia.org/sites/default/files/2023-08/The%20Potential%20to%20Electrify%20Freight%20Transportation%20in%20India_Final_03.06.22.pdf

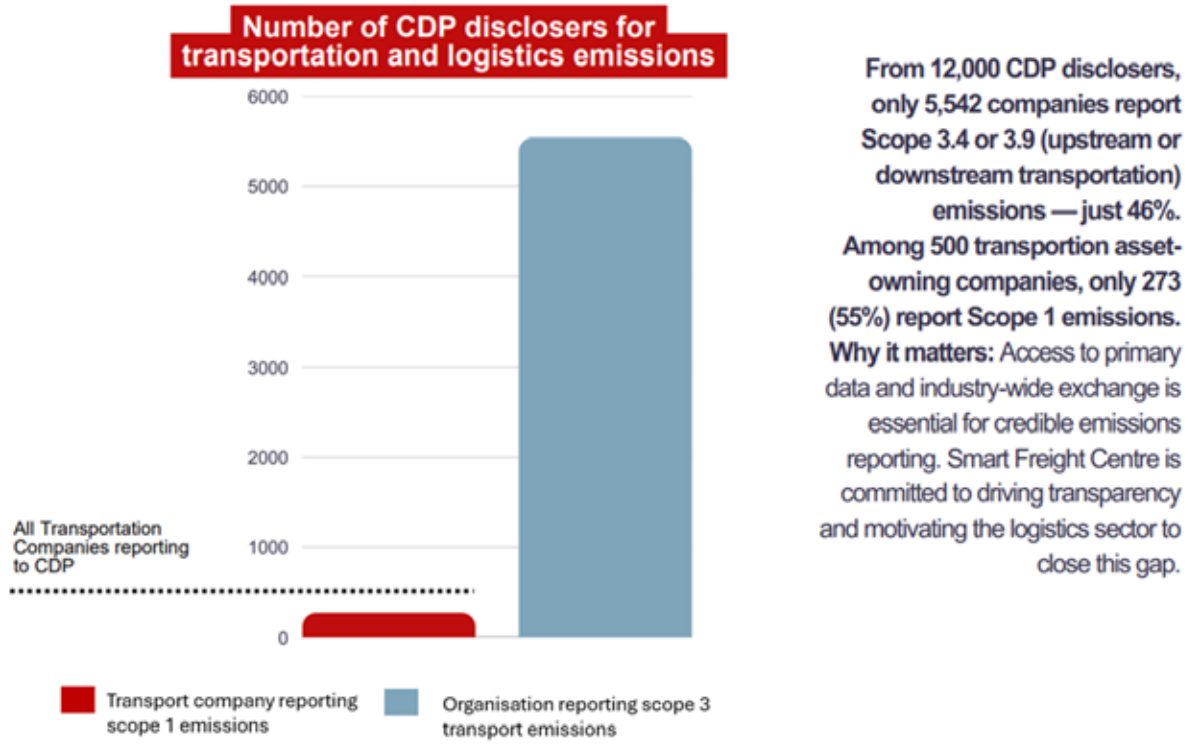


Figure 5: CDP disclosers for transportation and logistics emissions
Source: *SFC*

Parallelly in India, Among the 800 companies reporting under BRSR in India, roughly half disclose Scope 3 emissions. Yet, reporting on Category 4 and Category 9 remains limited to about 7% of firms, with significant variation in methodologies applied.[16]

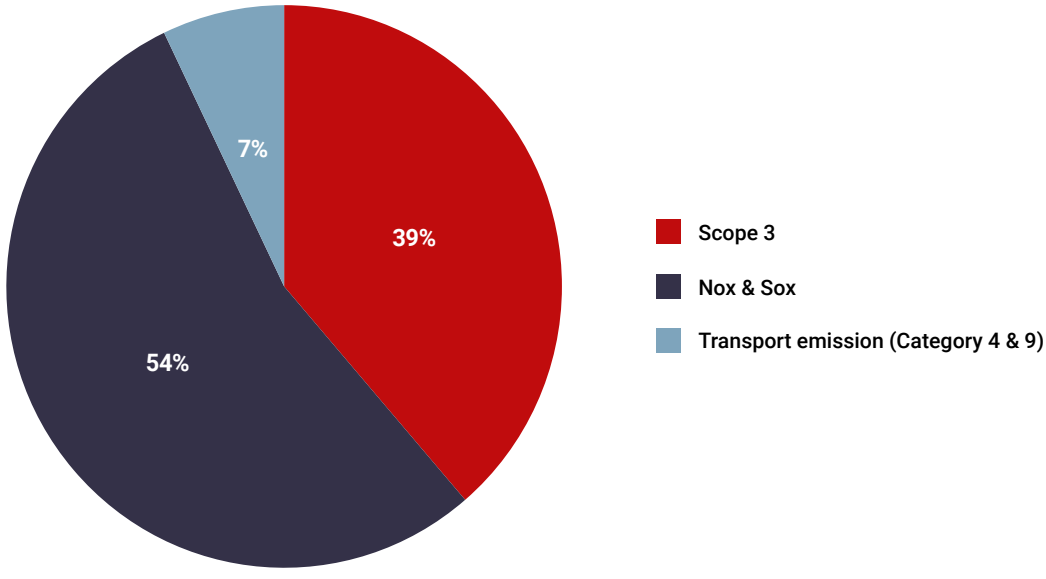


Figure 6: Analysis of 800 companies reporting emissions under BRSR
Source: *SFC*

[16] SFC Analysis (2026)

In the absence of standardized freight emissions accounting, Scope 3 disclosures risk being incomplete, inconsistent, or non-comparable. Below is the analysis of freight emissions that is been reported by a **cement player when compared to the multiple methodology, leading to urgent need to have a defined methodology at national level to Strengthening emissions tracking** in the road freight sector therefore serves a dual purpose: enabling targeted decarbonisation of one of the highest-impact segments of the transport system, while also improving the credibility, comparability, and decision-usefulness of corporate climate disclosures in India.

Emission Reporting (Scope 3) under different Methodology for a Cement Company

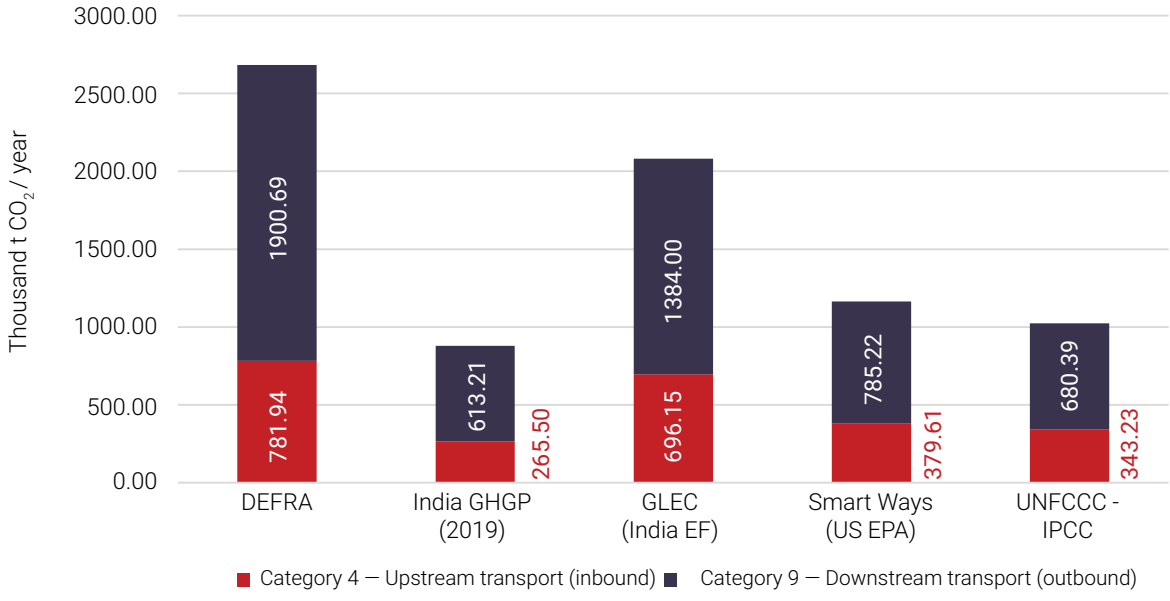


Figure 7: Analysis of scope-3 reporting under various methodologies

Source: *SFC (based on emissions factors from Defra[17], Smartway[18], UNFCC and GLEC)*

2.2 Implications for Air pollution

The air-pollution impact due to freight vehicles is largely shaped by diesel-based fuel type and also the structural characteristics of the MHDV fleet mostly the vehicle age, intensity of use, and special boundaries for freight operations. A significant share is consistently relying on older diesel truck that lacks technologies for controlled emission. Evidence from ICCT shows that although HDVs account for less than 3% of the vehicle market in India, they contribute more than 55% of the Black Carbon, 60% of the PM, and 70% of the NOX emissions, with most of that coming from vehicles more than 10 years old.[19]

This stark imbalance underscores the exceptionally high emissions intensity of aging freight vehicles relative to their share in the vehicle fleet.

[17] Details available at: UK Government GHG Conversion Factors for Company Reporting
[18] Details available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10195XG.pdf
[19] Details available at: https://theicct.org/wp-content/uploads/2021/06/ICCT_HDV-fleet-renewal-India_20160610.pdf

Fleet composition and slow turnover are central to this challenge. Slow fleet renewal further entrenches this imbalance. Older heavy-duty trucks, typically those exceeding 10–15 years of age, represent only a limited share of freight activity, yet they dominate particulate matter and nitrogen oxide emissions from road freight.[20] As a result, tighter emission standards for new vehicles translate only gradually into cleaner air, while high-emitting trucks remain active in the system for extended periods.

The spatial concentration of freight movements has also been amplifying the exposure of risks. Freight traffic is concentrated around cities, industrial clusters, ports, logistics parks, and major transport corridors, placing emissions sources close to ground level and near where people live and work. Previous studies by TERI indicates that diesel road-transport emissions are strongly localised along high-traffic corridors and freight-intensive zones, leading to elevated exposure for nearby communities.[21] Similar assessments by the Centre for Science and Environment reinforce that road-transport pollution, particularly from diesel vehicles, creates localised air-pollution hotspots that are not adequately reflected in city-wide average air-quality indicators .This concentration of emissions creates localized pollution hotspots that are not fully captured by city-wide average air-quality metrics.

Black carbon emissions from freight vehicles add urgency to this challenge. Beyond their contribution to poor air quality, these emissions exert strong near-term warming effects. ICCT's analysis shows that black carbon emissions from road transport are heavily concentrated among older diesel trucks, indicating that action focused on the oldest vehicles can deliver disproportionately large reductions relative to the number of vehicles addressed.19 Reducing emissions from this segment therefore offers immediate co-benefits for public health and near-term climate mitigation.

Taken together, the evidence shows that diesel medium- and heavy-duty trucks sit at the centre of India's air-pollution challenge. Focused action on this segment can meaningfully reduce exposure to particulate matter, nitrogen oxides, and black carbon particularly for communities living and working near freight infrastructure while also supporting longer-term transport decarbonisation goals.

This reinforces the importance of embedding freight emissions accounting, fleet modernisation, and corridor-level interventions within India's clean-air and sustainable transport strategy.

[20] Details available at: https://www.teriin.org/project/baseline-study-non-urban-road-transport
[21] Details available at: https://cdn.cseindia.org/userfiles/India-climate-change-2-Greenhouse-gas-emissions.pdf

3. Global Experience: Freight Emissions Accounting

As discussed in previous section, freight and logistics sector is a significant contributor to fuel consumption and emissions globally, accounting for roughly 8% of CO_2 emissions and a large share of air pollutants.[22] Operational inefficiencies, such as empty backhauls (up to 40% of truck trips in some regions)15 drive up costs and emissions. In response, countries and regions have adopted Clean Freight (or Green Freight) Programs as a policy instrument to improve freight efficiency and mitigate emissions. These programs (voluntary in nature) provide standardised emissions accounting and market-based incentives to deliver emissions reduction while strengthening supply-chain efficiency and competitiveness.

A Clean freight program is a voluntary public-private program designed to create strong market-based incentives for shippers, carriers, and LSPs to improve the environmental performance of their freight operations.

In global practice, these program adopt a holistic, industry-backed approach – setting targets, implementing efficiency measures, tracking emissions, fostering collaboration, and recognizing companies' efforts.

3.1 Clean Freight Program: Key Learnings for India

Clean Freight Programs provide shippers, carriers, and logistics providers with standardized tools and methodologies to measure fuel use and emissions, benchmark performance, and adopt cost-effective technologies and operational strategies to reduce CO_2, black carbon, NO_x, and PM emissions.

At their core, clean freight programs pursue three interlinked objectives:

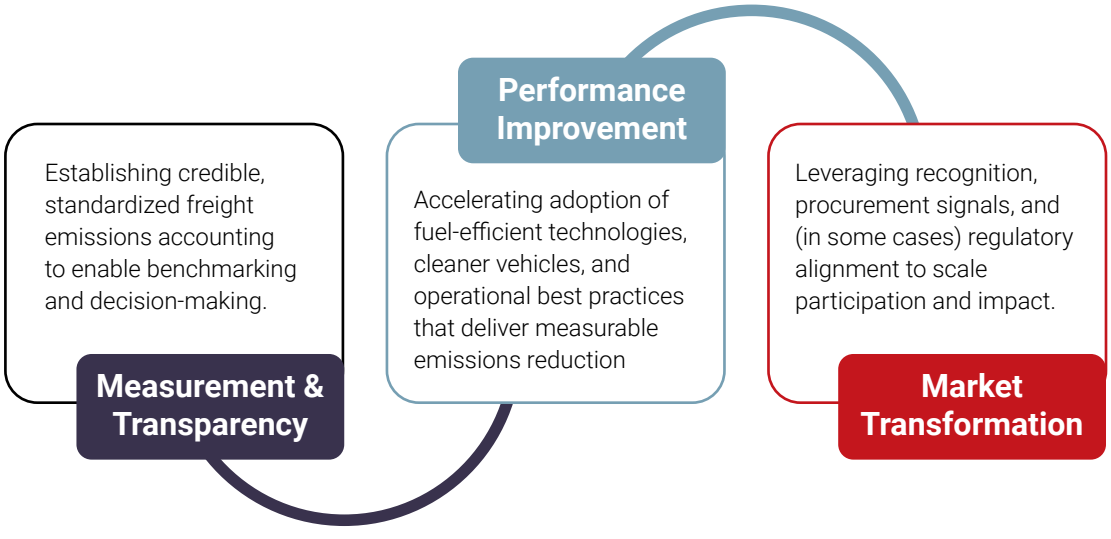


Figure 8: Objectives of a clean freight program
Source: *SFC & TERI*

[22] Details available at: https://doi.org/10.1787/b6cc9ad5-en

Global evidence shows that these programs succeed when they are built around a strong business case for fuel savings, complemented by environmental and health co-benefits. Harmonised approaches aligned with global standards create a coundation for wider adoption, policy integration, and linkage with emerging market-based mechanisms.

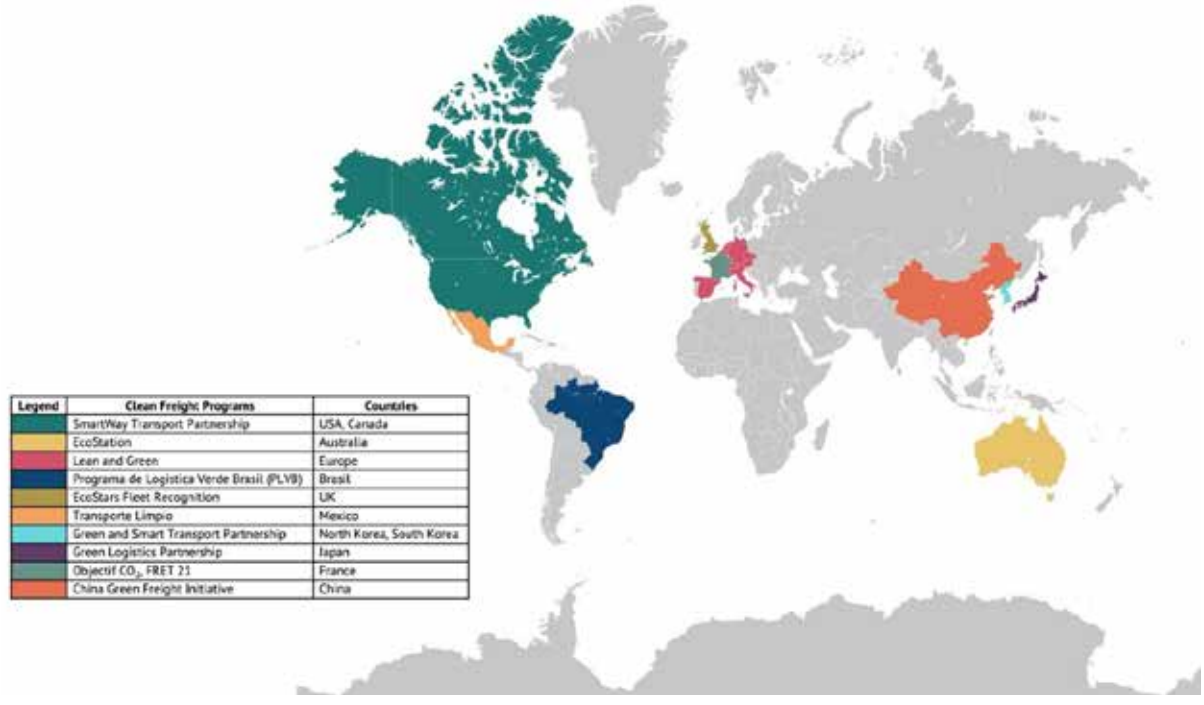


Figure 9: Global clean freight programs
Source: *TERI (map not to scale)*

Overview of Global Clean Freight Programs:

- ✓ **SmartWay Transport Partnership (USA/Canada):** Launched by the U.S. EPA in 2004, SmartWay is the most mature clean freight program globally. It combines standardized emissions accounting tools, technology verification, benchmarking, and public recognition. By enabling shippers and carriers to track and compare performance, SmartWay has delivered large-scale fuel savings and emissions reductions while lowering operating costs for participating companies.
- ✓ **China Green Freight Initiative (CGFI):** A government–industry partnership led by the Ministry of Transport, focusing on cleaner trucks, driver training, fuel efficiency improvements, and alignment with stringent emission standards. CGFI demonstrates the effectiveness of strong government leadership combined with industry participation
- ✓ **Lean & Green Europe / Objectif CO_2 (France):** Programs that combine voluntary commitments with quantified CO_2 reduction targets (often 20% over 5 years), supported by standardized accounting and recognition mechanisms.

Across these programs, despite differences in governance and scope a set of common success factors: standardized metrics, shipper–carrier engagement, trusted data management, stable funding, and phased scaling strategies.

- ✓ **Ecostars Fleet Recognition (United Kingdom):** A city-led voluntary fleet recognition scheme that rates road freight operators based on vehicle performance, fuel efficiency, driver training and provides tailored improvement plans for customers.
- ✓ **Programa de Logistics Verde (PLVB) Brazil:** A voluntary industry-driven program that promotes emissions reduction and operational efficiency across freight and logistics companies. PLVB supports standardized GHG accounting, knowledge exchange, partnerships, and branding benefits to encourage adoption of sustainable logistics practices.

Table 1: Comparative overview of global clean freight programs

Program	SmartWay	EcoStars Fleet Recognition	China Green Freight Initiatives	Objectif CO_2	Lean and Green	PLVB
Geographic Coverage	United States, Canada	United Kingdom	China	France	Europe	Brazil
Inception Year	2004	2009	2012	2008	2007	2016
Institutional Lead	Government-led partnership	Government-led	Government-led	Government-led	Industry-led	Industry-led
Target Scope	All freight transport	Road freight	Road freight	Road freight	All freight transport	All freight transport
Methodology	Fleet Logistics Energy and Environment Tracking (FLEET) model	Emissions assessment toolkit	Freight enterprise and vehicle standards	Web-based tool aligned with Grenelle regulations	GLEC Framework, EN 16258	GHG Protocol, ISO 14064-1, EN 16258
Key Member Benefits	Performance benchmarking, reporting tools, data transparency for stakeholders	Fleet rating, fuel efficiency guidance, tailored improvement roadmap	Dissemination of best practices, annual technical seminars	Capacity-building workshops, networking, operational best practices	Customized efficiency solutions, collaboration and knowledge exchange	Branding support, partnerships, exchange of operational best practices

Note: All programs are voluntary in nature, incorporate phased implementation approaches, and include mechanisms for performance assessment or recognition (ratings).
Source: Smart Freight Centre & The Energy and Resources Institute

Key Learnings for India

1. **Voluntary but market-driven, anchored by shipper demand:** Worldwide, clean freight programs have largely been voluntary in nature, relying on market incentives rather than mandates to drive participation. Their success hinges on clearly defined and complementary roles for freight carriers (who control vehicles and operations) and shippers (who influence demand through procurement and contracting).Global evidence shows that programs scale fastest when large shippers require or prefer participation by their logistics partners, effectively creating a demand-side "pull" that brings carriers into the program. This shipper–carrier dynamic has been central to the success of SmartWay and Green Freight Asia and is especially relevant in markets where regulatory enforcement alone is insufficient to drive fleet modernization.

   Implication for India: Given the fragmented nature of the Indian trucking sector, anchoring a Clean Freight Program around large shippers and cargo owners is essential to create scale and sustained participation. This "pull" mechanism has been central to SmartWay and Green Freight Asia and is particularly relevant for India's cement, steel, FMCG, and e-commerce sector

2. **Centralised program administration strengthens credibility and efficiency:** International programs consistently demonstrate the importance of a central coordinating entity either a government agency, a designated public body, or a trusted neutral institution to manage methodologies, data systems, verification, and stakeholder engagement. Centralisation reduces fragmentation, ensures methodological consistency, and builds trust among participants. Decentralised or purely project-based approaches, by contrast, often struggle to achieve scale or continuity

   Implication for India: A centralised Clean Freight Program administered by a national agency or regulators like BEE would be more effective than multiple uncoordinated initiatives, particularly for ensuring consistency across corridors, sectors, and reporting platforms.

3. **Methodologically aligned with global standards while reflecting Indian conditions:** There is a clear global trend toward harmonisation, driven by supply-chain transparency requirements and the need for comparability across borders.Many leading programs now align with internationally recognised frameworks (e.g., GLEC / ISO-aligned methods), enabling emissions data to be used both for operational improvement and for corporate disclosure.

   Implication for India: While India-specific emission factors and operating conditions must be reflected, aligning the national Clean Freight Program with **globally accepted accounting principles** like ISO 14083/ GLEC is critical to ensure relevance for multinational shippers and export-oriented industries.

4. **Emission intensity is the preferred performance metric:** Across programs, emission intensity metrics most commonly expressed as CO_2 per tonne-kilometre (CO_2/t-km or CO_2e/t-km) are the standard basis for benchmarking performance. Intensity metrics allow fair comparison across fleets of different sizes and enable tracking of efficiency improvements over time, independent of freight volume growth. Several programs also complement CO_2 intensity with fuel-efficiency indicators and, increasingly, air-pollutant metrics such as NO_x and PM to reflect public-health impacts.

   Implication for India: Using CO_2e/t-km as the core metric, with scope to add NO_x and PM as co-benefit indicators, provides a robust and internationally comparable foundation for India's program.

5. **Data collection + benchmarking is the "engine" of the program:** SmartWay's success is closely tied to annual data collection and benchmarking. ICCT's SmartWay white paper highlights that participating fleets complete annual reports capturing fleet composition, activity and fuel consumption; effort varies widely depending on fleet sophistication.

   Implication for India: Design for low administrative burden and provide hands-on support (templates, helpdesk, training, tool kits), especially for mid-size fleets.

6. **Recognisation and scoring systems are instrumental:** Programs use ratings/labels to create competition and credibility. China's Green Freight Initiative, for example, uses a Green Leaf level (1–5) approach and develops standards and branding to drive adoption. Lean & Green uses a verified star framework (e.g., 20% CO_2 reduction per transported unit within five years for Star 1), reinforced by audits and monitoring.

   For India adopt a simple rating/recognition ladder (Bronze/Silver/Gold or Star framework) with transparent rules this creates a procurement signal without immediate regulation.

7. **Expand pollutant coverage beyond CO_2 when feasible air quality co-benefits strengthen policy rationale:** While keeping the core metric CO_2e, but include NO_x/PM (and BC where possible) as co-benefit indicators highly relevant for India's clean air priorities and corridor exposure.

3.2 Emission Accounting Methodology

To establish a credible and harmonized approach for freight emissions accounting in India, it is essential to benchmark against leading global methodologies. Multiple international frameworks (each with distinct scopes, governance structures, and levels of adoption) have shaped how GHG emissions are calculated, reported, and managed across the logistics sector. Frameworks such as the **GLEC Framework / ISO 14083, UNFCCC methodologies, DEFRA/UK conversion factors, SmartWay, and EN 16258** provide diverse perspectives, ranging from industry-led guidance to government-issued reporting tools. Together, they highlight variations in boundary setting (e.g., Well-to-Wheel vs. Tank-to-Wheel), modal coverage, treatment of hubs and empty runs, and applicability across passenger and freight transport.

This benchmarking exercise captures the unique strengths, limitations, and update cycles of each framework, allowing a comparative view on their relevance for India's freight ecosystem. Among them, **ISO 14083/GLEC** emerges as the most current and globally recognized baseline,further it has replaced by EN 16528, harmonizing multi-modal logistics accounting while aligning with corporate disclosure requirements.

The analysis presented here consolidates these insights, identifying opportunities for contextual adaptation in India to ensure both global alignment and local relevance.

GLEC Framework/ ISO 14083	UNFCCC	DEFRA / UK Government Conversion Factors	Smart Way Framework
Standardizes measuring, reporting, and managing climate-warming emissions associated with global goods movement.	International treaty to combat dangerous human interference with the climate system.	Used for reporting greenhouse gas emissions by the UK and international organizations.	EPA program improving supply chain efficiency in freight transportation.
Harmonizes logistics GHG emissions calculation and reporting across multi-modal supply chains.	Aims to stabilize greenhouse gas concentrations.	Last updated in 2022 based on available information.	Reduces transportation-related emissions and environmental risks. Comprehensive system for tracking fuel use and freight emissions.
Designed to inform business decisions for emission reduction and climate goal tracking.			
Used by 200+ global companies with GLEC-accredited tools for emissions accounting.	Limits on GHG emissions in countries, but non-binding with no enforcement mechanisms.	Covers emissions from fuels, industrial processes, and agricultural practices.	
Primary industry guideline for implementing ISO 14083.			

Each of these frameworks has its own unique focus and methodology, but all aim to reduce GHG emissions and promote sustainability. GLEC/ ISO 14083 covers all modes and is constantly being updated as compared to the factors considered for UNFCCC and DEFRA.

Table 2: Comparative assessment of freight emissions accounting methodologies

Methodology/ Framework	ISO 14083:2023 / GLEC	SmartWay (Truck Tool)	UK GHG reporting guidelines	UNFCCC CDM 17
Title	International Standard: GHG - Quantification and reporting of GHG emissions arising from transport chain operations	SmartWay Online Truck Tool: All Carriers	Guidance on measuring and reporting GHG emissions from freight transport operations	Methodological tool: Baseline emissions for modal shift measures in inter-urban cargo transport
Prepared by	Technical Committee (ISO/ TC 207), (CEN/TC 320), based on Vienna agreement between ISO and CEN	EPA and SmartWay	Department for energy security and net zero, UK along-with multiple organisations including CILT, DEFRA, FTA, DFT, RHA, IGD ETC	UNFCCC
Came into force (year)	2023	2003	DEFRA withdrawn on 16 March 2022	2014
Latest update (year)	2024, GLEC Updated annually	2024		2014
Applicability (road/ rail/waterways/ air/pipeline)	Road/Rail/Waterways/ Airways/Pipeline/Cable Car	Road	Road/Rail/ Waterways	Road/Rail/ Waterways
Applicability (passenger/ freight/both)	Both	Freight	Freight	Freight
WTW/TTW approach	WTW, TTW	TTW	WTW	Not mentioned

Source: *SFC & TERI*

Inference:

ISO 14083/GLEC Framework: The most current and internationally recognized framework for harmonizing the calculation and reporting of logistics GHG emissions across various transportation modes.

A crucial standard addressing GHG emissions from transport chain operations, providing a unified method for quantifying and reporting emissions for both passenger and freight transport.

3.3 ISO 14083 / GLEC relevance for India

Establishing a credible baseline for freight emissions accounting in India requires alignment with globally accepted standards while responding to India's unique operational realities. To assess current practices and identify gaps, SFC and TERI, in collaboration with IIM Bangalore, undertook a comprehensive research exercise engaging 50+ shippers and LSPs across India. The research combined a scoping survey, secondary literature review, and structured stakeholder consultations.

These consultations drawing on SFC's global shipper and LSP network and TERI's Council for Business Sustainability members revealed significant variation in the maturity and consistency of freight emissions accounting in India. While approximately 90% of respondents track fuel consumption and 80% capture vehicle and fuel type information, only ~40% systematically record empty trips or journey characteristics (such as urban, regional, or long-haul movement). Stakeholders also highlighted fragmentation in accounting methodologies: around 62% rely on ISO 14083, ISO 14064, or the GLEC Framework, while others use UNFCCC, DEFRA, or proprietary tools. This heterogeneity limits comparability across companies, weakens Scope-3 disclosures, and constrains the use of freight emissions data for policy and market mechanisms.

Why ISO 14083 and GLEC matter for India

ISO 14083: 2023 and the GLEC Framework provide a robust and internationally recognised foundation for harmonising freight emissions accounting in India. Both standards are designed to address the inherent complexity of freight transport multiple modes, fragmented ownership, and diverse operational profiles while enabling consistency, transparency, and audit readiness. Their relevance for India lies in three core attributes:

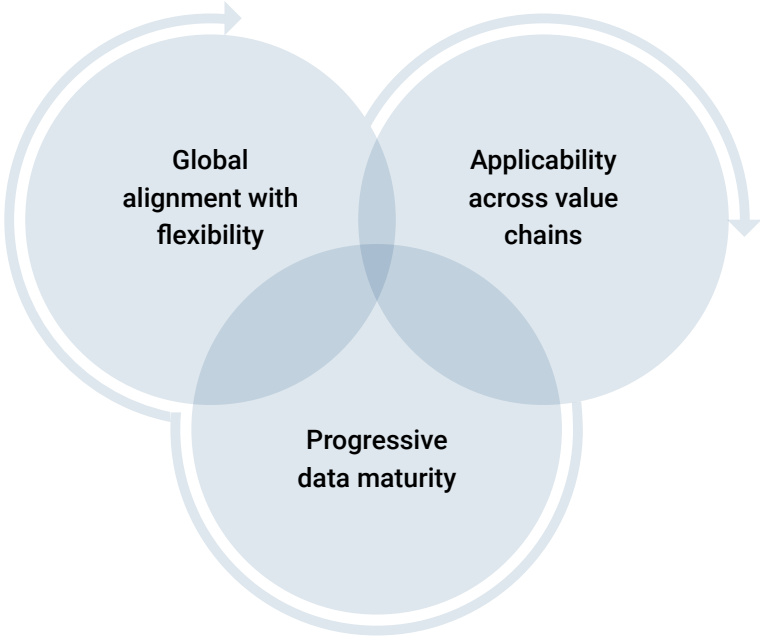


Figure 10: Core attributes of ISO 14083/GLEC Framework
Source: *SFC & TERI*

- ✓ **Global alignment with flexibility:** ISO 14083 and GLEC provide common rules and definitions that ensure comparability across geographies, while allowing adaptation through country-specific emission factors and data hierarchies.
- ✓ **Applicability across value chains:** The standards support emissions accounting for carriers, LSPs, shippers, and other users of emissions data, including policymakers, investors, and green freight programs.
- ✓ **Progressive data maturity:** They enable companies at different levels of data availability from basic activity data to full fuel-level visibility to participate and progressively improve data quality over time.

India Freight Emissions Accounting Framework

Building on ISO 14083 and GLEC guidance, SFC, TERI, and IIM Bangalore jointly developed an India Freight Emissions Accounting Framework that integrates global best practice with India-specific adaptations. The Framework is designed to be practical for Indian operating conditions while remaining fully aligned with international standards, thereby supporting both domestic policy needs and global reporting requirements.

Key foundations of the Framework include:

- ✓ Coverage of all operations across the transport chain
- ✓ Inclusion of all IPCC-defined GHGs and relevant climate pollutants
- ✓ Alignment with Scope 1, Scope 2, and Scope 3 as per the GHG Protocol
- ✓ Consistency with key international standards and reporting programs
- ✓ Full well-to-wheel (WTW) treatment of fuel and energy emissions

Emissions calculation approaches under ISO 14083 and GLEC

Consistent with ISO 14083 and the GLEC Framework, freight GHG emissions can be calculated using two complementary approaches, depending on data availability:

1. Fuel-based method: This method is applied when actual fuel or energy consumption data are available (e.g., owned fleets or fleets with fuel monitoring systems).
   - Emissions are calculated by multiplying the quantity of fuel consumed by the appropriate WTW emission factor.
   - Emissions = Fuel consumed (litres/kg) × Fuel emission factor (CO_2e per litre/kg)
2. Distance-based (activity-based) method: This method is typically used for Scope-3 transport emissions, where shippers or contracting parties do not have access to fuel consumption data.
   - Tonne-kilometres (t-km) are calculated by multiplying shipment weight by distance travelled for each transport chain element.
   - Emissions are derived by applying India-specific emission intensity factors (CO_2e/t-km).
   - Emissions = Distance (km) × Shipment weight (tonnes) × Emission intensity factor (CO_2e/t-km)

In line with ISO 14083 and GLEC guidance, Great Circle Distance (GCD) is recommended for air transport, and Shortest Feasible Distance (SFD) for all other modes. India-specific emission intensity values are provided through the India GLEC dataset, while detailed methodological rules follow GLEC v3.2.

Key parameters influencing emission intensity in India

The Framework explicitly recognises the operational diversity of Indian freight. Emission intensity factors are therefore differentiated based on:

- ✓ Vehicle or vessel type, size, payload capacity, and utilisation
- ✓ Distance travelled and journey profile (urban, mixed, long-haul)
- ✓ Mode of transport and hub/terminal operations
- ✓ Fuel or energy type (diesel, LNG, electricity, biofuels, etc.)
- ✓ Service configuration (FTL/LTL, FCL/LCL)
- ✓ Freight characteristics (dry, bulk, containerised, temperature-controlled, hazardous)
- ✓ Trade lanes (for maritime transport)

4. Way forward: Desigining a Clean Freight Program

Institutionalising freight emissions accounting in India requires a coordinated approach that aligns global standards, national policy objectives, and industry-led implementation mechanisms.

4.1 Recommendations for Institutionalizing Emissions Accounting and Clean Freight Program

Based on global experience and India's freight ecosystem, the following recommendations are proposed.

1. **Adopt ISO 14083 as the national reference standard for freight emissions accounting**

   India should formally recognise ISO 14083 as the reference methodology for freight transport emissions accounting, with India-specific emission factors and guidance layered on top. ISO 14083 has emerged as the globally accepted standard for transport emissions accounting and is increasingly referenced by regulators and market mechanisms. The European Commission explicitly recognises ISO standards,[23] as a cornerstone for harmonised emissions reporting across sectors, reinforcing their role in ensuring comparability, auditability, and cross-border acceptance. Aligning India's approach with ISO 14083 will future-proof freight emissions reporting against evolving global trade, disclosure, and compliance requirements.

2. **Establish a centrally administered Clean Freight Program**

   Global clean freight programs demonstrate that centralised administration by a government body or a designated neutral institution is essential to ensure methodological consistency, data integrity, and long-term continuity. For India, a centrally administered Clean Freight Program can act as the institutional backbone for:

   - ✓ Standardised emissions accounting using ISO 14083/GLEC-aligned methods
   - ✓ Data aggregation and benchmarking across shippers and carriers
   - ✓ Coordination with national policy instruments and market mechanisms

This central platform should function as an **enabling mechanism,** not a compliance burden, especially in early phases.

3. **Implement a phased, shipper-led rollout**

   Given the fragmented nature of India's trucking sector, institutionalisation should follow a **phased implementation strategy,** starting with **large shippers and fleet operators** who already report emissions and have greater access to data and capital. These actors can establish credible baselines, demonstrate value, and create procurement-led demand signals that gradually pull smaller carriers into the program.

4. **Integrate emissions accounting with policy and market instruments**

   A standardised freight emissions accounting framework should be explicitly linked to emerging Indian policy instruments, including:

   - ✓ Corporate disclosure frameworks (e.g., BRSR and Scope-3 reporting mandatory).
   - ✓ **Market-based mechanisms such as the CCTS.**
   - ✓ Sectoral roadmaps for freight decarbonisation.

[23] https://transport.ec.europa.eu/news-events/news/commission-welcomes-political-agreement-new-rules-harmonise-transport-emissions-calculations-eu-2025-11-06_en

Clean freight programs globally function most effectively when they **complement regulation,** providing real-world data, readiness pathways, and implementation support rather than operating in isolation.

5. **Build an industry collaboration platform to drive action beyond reporting**

   Institutionalisation should go beyond measurement and reporting to enable **collective action.** Establishing a **Shippers Alliance** or industry platform within the Clean Freight Program can support:

   ✓ Shared learning on efficiency measures and low-emission technologies,
   ✓ Development of decarbonisation roadmaps for priority corridors and sectors,
   ✓ Alignment between shippers, logistics providers, financiers, and policymakers.

4.2 India Specific Emission Factors

The Fuel emission factors and Emission Intensity factors are co-developed by the TCI-IIMB Supply Chain Sustainability Lab at IIM Bangalore, with methodology guidance and support from SFC. The calculation of road emission intensity factors follows mainly the 2006 IPCC Guidance, GHGP, and GLEC Framework.

Fuel Emission Factors

Table 3: Fuel Emission Factors

Fuel Type	Common UOM in India	IPCC - Kg of greenhouse gas / TJ on Net Calorific Basis				IPCC Netcalorific value (TJ/Gg)	Kg CO_2e / Kg of Fuel (TTW)	Density - BPCL Conversion from Litre/ kg	Kg CO_2e / litre of Fuel (TTW)	Uplift Factor	Kg CO_2e / litre of Fuel (WTT)
		CO_2	CH_4	NO_2	CO_2e						
		A	B	C	D = A +27.9*B + 273*C					TTW / WTW Ratio	
Road Transportation											
Diesel	Litre	74100	3.9	3.9	75,273.5	43	3.237	1.21	2.675	1.301	0.8058
Petrol	Litre	69300	33	3.2	71,094.3	44.3	3.149	1.411	2.232	1.320	0.7137
CNG	Kg	56100	92	3	59,485.8	48	2.855			1.373	1.0656
Ethanol	Litre	70800	260	41	89,247.0	27	2.410	1.411	1.708		
Rail Transportation											
Diesel	Litre	74100	4.15	28.6	82,023.6	43	3.527	1.21	2.915	1.301	0.878

Source: *SFC (fuel conversion factors sources from BPCL and IPCC)*

Road Emission Intensity Values

The following are the final emission intensity values obtained for all the categories of vehicles based on the fuel type: The emission factors have been derived on a Kg CO2e per tonne-km basis. The emission factor is the sum of WTT and TTW Emissions as calculated above. The distance between the origin and destination is calculated using the Google distance matrix API, with the travel mode being driving, additionally a Distance Adjustment Factor (DAF) uplift of 5% is considered for out of route deviations.

Table 4: Road Emission Intensity Values

Vehicle Type	Fuel Type	Load Characteristics	Empty Factor	Average Utilization of Vehicles in %	Fuel Efficiency (Average Fuel Consumed in Litres Per Km of Trip (Average Laden)	Emission Intensity ($kgCO_2e$/ tkm)WTT	Emission Intensity ($kgCO_2e$/ tkm) TTW	Emission Intensity ($kgCO_2e$/ tkm) WTW
Small Commercial Vehicles | GVW < 3.5 MT | Payload Capacity 0.5 to 2 MT	Diesel	Average	10.9%	83.0%	0.0841	0.0879	0.2916	0.3795
	Petrol	Average	10.9%	83.0%	0.0813	0.0999	0.3124	0.4124
	CNG	Average	10.9%	83.0%	0.0855	0.1337	0.3583	0.4920
Medium Commercial Vehicles -1 |GVW 3 to 5 M| Payload Capacity 2 to 3.5 MT	Diesel	Average	10.9%	82.7%	0.1193	0.0514	0.1707	0.2222
Medium Commercial Vehicles -2 |GVW 5 to 12 MT | Payload Capacity 3.5 to8 MT	Diesel	Average	10.8%	78.8%	0.1494	0.0324	0.1075	0.1400
	CNG	Average	10.8%	78.8%	0.1497	0.0459	0.1229	0.1689
Heavy Commercial Vehicles -1 |GVW 12 to 20 MT | Payload Capacity 8 to12 MT	Diesel	Average	12.4%	76.8%	0.17317	0.0209	0.0692	0.0902
Heavy Commercial Vehicles - 2 | GVW 20 to 30 MT | Payload Capacity 12 to 20 MT	Diesel	Average	12%	69.4%	0.2823	0.0191	0.0632	0.0823
Heavy Commercial Vehicles - 3 | GVW 30 to 50 MT | Payload Capacity 20 to 40 MT	Diesel	Average	14.4%	68.3%	0.2988	0.0154	0.0509	0.0663
Tractor Trailer Commercial Vehicles - Trailers | GVW 30 to 60 MT | Payload Capacity 20 to 50 MT	Diesel	Average	13.3%	67.21%	0.3080	0.0128	0.0423	0.0551

EV Road Emission Intensity Values

The following are the final emission intensity values obtained for the categories of vehicles currently available in Indian market.The emission factors have been derived on a Kg CO_2e per tonne-km basis. The emission factor is the sum of WTT and TTW Emissions, it considers the upstream emissions, grid emission factor[24], Transmission and Distribution losses[25] and charging losses[26].

Table 5: EV Road Emission Intensity Values

S. No.	Vehicle Type (GVW)	Fuel Type	WTT Emission factor in ($KgCO_2e$ / Tonne -Km)	TTW Emission factor in ($KgCO_2e$ / Tonne -Km)	WTW Emission factor in ($KgCO_2e$ / Tonne -Km)
1	**< 3.5 MT**	EV	0.134	0.00	0.134
2	**3.5-12 MT**	EV	0.133		0.133
3	**14 MT**	EV	0.100		0.100
4	**18.5 MT**	EV	0.078		0.078
5	**55 MT**	EV	0.037		0.037

[24] CEA Grid Emission Factor https://cea.nic.in/wp content/uploads/baseline/2025/12/User_Guide_V_21.0.pdf
[25] NITI Climate and Energy Dashboard: https://iced.niti.gov.in/energy/electricity/distribution/pages/operational-performance#transmission-and-distribution-loss
[26] https://smart-freight-centre media.s3.amazonaws.com/documents/240129_EV_Emissions_reporting_v3.0_FINAL.pdf

4.3 Actionable Roadmap for Clean Freight Program in India

India's Clean Freight Program should be operationalised through a 3M framework - Measure, Mitigate, Monetize, that enables a structured transition from emissions visibility to emissions reduction and, eventually, value creation. This approach reflects global best practice while responding to India's fragmented freight ecosystem and emerging policy landscape.

This should include:

- ✓ Designing and operationalizing a nationally anchored, voluntary framework for freight emissions accounting based on ISO 14083/ GLEC in India. The program should be institutionally structured under a Bureau of Energy Efficiency / Department for Promotion of Industry and Internal Trade–led governance model, with clear roles for regulators, industry, and technical partners. Core activities include formalizing an India-specific freight emissions accounting methodology aligned with ISO 14083 and GLEC, developing standardized reporting templates for shippers, carriers, 3PLs, and LSPs, and designing the architecture of a national data platform and interoperable tools to enable consistent data capture
- ✓ Once emissions are consistently measured, Clean Freight data can be used to drive targeted mitigation actions across operations, technology, and infrastructure. Benchmarking and performance bands enable shippers and logistics service providers, further At a system level, aggregated emissions data can inform policy design for zero-emission freight, including prioritization of high-impact corridors, vehicle segments, and use cases for electrification or alternative fuels
- ✓ In the final step, verified freight emissions data becomes a market-enabling asset that can unlock financial value for early movers. Clean Freight performance metrics can be linked to green procurement preferences, sustainability-linked contracts, and recognition programs, allowing low-emission fleets to differentiate themselves commercially.

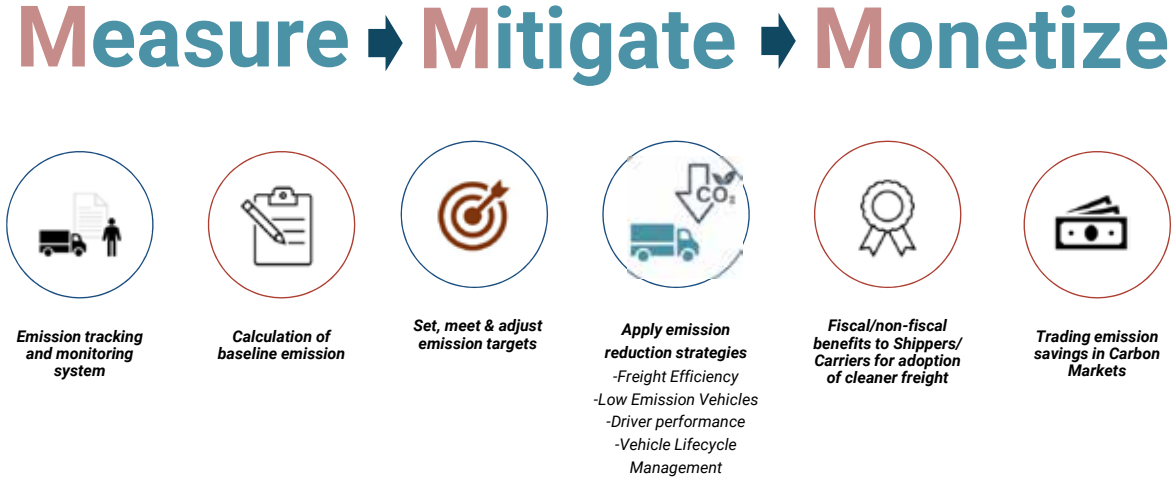


Figure 9: Actionable roadmap for Clean Freight Program in India
Source: *SFC & TERI*

5. Integrating Clean Freight Program with Carbon Credit Trading Scheme

While Scope 3 emissions are not under the direct operational control of shippers, they remain a significant component of overall sectoral emissions. Shippers can play an important role in driving reductions in these emissions through structured engagement with freight carriers, supported by a clear business case and effective coordination mechanisms. Given the objective of achieving sector-specific emissions reductions, shippers (being the obligated entities under relevant regulatory frameworks) are the primary stakeholders for such interventions.

Indian industries have achieved measurable progress in emissions reduction through compliance-based mechanisms such as the Perform, Achieve, and Trade (PAT) scheme, as well as through voluntary instruments, including the Clean Development Mechanism (CDM). Building on these efforts, India has introduced the Carbon Credit Trading Scheme (CCTS) as a market-based instrument to enable cost-effective emissions reductions across key sectors. The scheme aligns with the BEE mandate and supports India's commitments under the Paris Agreement.

The Carbon Credit Trading Scheme was notified by the Ministry of Power in 2023. At present, the CCTS covers Scope 1 and Scope 2 emissions of obligated entities. However, indirect emissions (Scope 3), including those arising from freight and logistics operations, are currently not included within its scope.

A recent report by TERI indicates that a phased implementation of a Clean Freight Program may be considered, beginning with priority sectors such as cement, iron and steel, fertilisers, and aluminium. These sectors are already covered under the PAT scheme, making them suitable candidates for initial implementation. In addition, cement, iron and steel, and fertilisers together account for approximately 84% of the gross value added (GVA) of PAT-covered industries, highlighting both their economic importance and emissions reduction potential.

In summary, the Clean Freight Program has the potential to improve fleet-level efficiency, reduce logistics-related operational costs, and enhance service delivery. Furthermore, it would promote competition among freight carriers, driven by shipper demand for more efficient, reliable, and environmentally sustainable transport solutions.

Integrating Clean Freight Program with CCTS would create incentives for **investment in clean and efficient freight technologies,** particularly encouraging carriers to adopt fuel-efficient and zero-emission vehicle technologies, thereby contributing to the decarbonisation of road freight operations. Participation in CCTS would also allow shippers to generate an **additional revenue stream through carbon credits,** while supporting overall emissions reduction objectives.

6. References

- CDP. (2024). Strengthening the chain: Driving supply-chain action for net zero. https://www.cdp.net/en/insights/strengthening-the-chain
- GLEC 3.2 https://smart-freight-centre-media.s3.amazonaws.com/documents/GLEC_FRAMEWORK_v3.2_21_10_25_1.pdf
- Government of India. (2024). India's fourth biennial update report (BUR-4) to the United Nations Framework Convention on Climate Change. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/India%20BUR-4.pdf
- Maruti Suzuki India Limited. (2025). Maruti Suzuki has dispatched over 5 lakh (half a million) vehicles through Indian Railways. https://www.marutisuzuki.com/corporate/media/press-releases/2025/june/maruti-suzuki-has-dispatched-over-5-lakh-half-a-million-vehicles-through-indian-railways
- Smart Freight Centre. (2017). Green freight programs worldwide. https://smart-freight-centre-media.s3.amazonaws.com/documents/Green-Freight-Programs-Worldwide-SFC-Final-May2017.pdf
- The Energy and Resources Institute. (2024a). Baseline study for non-urban road transport. https://www.teriin.org/sites/default/files/2024-06TERI%20Baseline%20Report_LD.pdf
- The Energy and Resources Institute. (2024b). Roadmap for India's energy transition in the transport sector. https://teriin.org/sites/default/files/2024-11/Roadmap%20for%20India%20Energy%20Transition_FINAL%20REPORT.pdf

About TERI

The Energy and Resources Institute (TERI) is an independent, not-for-profit research organization with over five decades of experience in advancing sustainable development through research, policy engagement, and capacity building across the developing world, particularly in Asia. Established in 1974 as the Tata Energy Research Institute, TERI has evolved into a globally respected institution working at the intersection of energy, environment, climate change, and sustainability.

TERI undertakes multidisciplinary, action-oriented research spanning climate change, urban development, mobility, renewable energy, energy efficiency, sustainable agriculture, green buildings, and eco-friendly transport systems. Through rigorous research and policy analysis, TERI supports the design of policies, regulations, and institutional mechanisms that foster sustainable, smart, and climate-resilient development, particularly within complex urban systems.

The institute works in close collaboration with a wide range of stakeholders, including national and international governments, bilateral and multilateral agencies, industry, civil society organizations, and sector experts. TERI has contributed to ministerial committees and supported policy development and implementation in areas such as sustainable urban development, urban transport, green buildings, and climate action, while also conducting capacity-building and stakeholder engagement programmes.

Headquartered in New Delhi, TERI has a strong national presence through its regional centres in Gurugram, Bengaluru, Guwahati, Mumbai, Panaji, and Nainital, along with several project and field offices across India. Powered by a multidisciplinary team of over 1,000 professionals, including scientists, engineers, economists, and social scientists. TERI combines global perspectives with local insights to deliver practical, scalable solutions. Through its work, TERI continues to influence stakeholders ranging from policymakers to grassroots practitioners, enabling evidence-based decision-making and sustainable development outcomes with a global vision and local impact.

About SFC

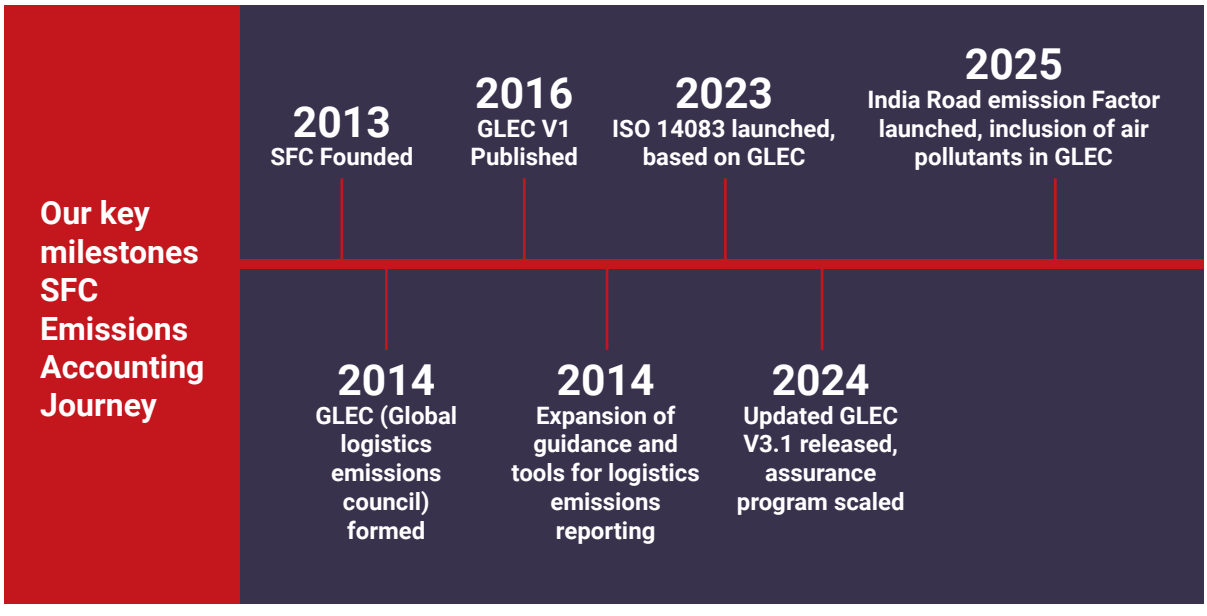
Smart Freight Centre (SFC) is a globally active non-profit organization driving climate action in the freight sector. Our mission is to mobilize the logistics ecosystem- industry, policymakers, and partners- to measure, report, and reduce greenhouse gas (GHG) emissions across the global supply chain, enabling a transition to zero-emission logistics by 2050 in line with 1.5°C pathways.

A cornerstone of this mission is credible emissions accounting.

In 2016, SFC launched the GLEC Framework, the first globally recognized methodology to calculate logistics emissions. The framework has since formed the basis of ISO 14083, now the international standard for transport-chain GHG emissions accounting. Today, the GLEC Framework remains the primary industry guideline for implementing ISO 14083 and is fully aligned with major international disclosure and target-setting platforms, including the GHG Protocol, CDP, SBTi, and the Climate & Clean Air Coalition. The GLEC's partnerships with global green freight programs, such as the United States Environmental Protection Agency (US EPA), SmartWay, Clean Cargo, Lean & Green, Clean Air Transport, Sea Cargo Charter, Smart Freight Alliance China and Programa de Logística Verde, are essential for streamlining carbon accounting and emission reduction on a global scale

Building on this global expertise, SFC has undertaken a range of freight decarbonization initiatives in India, one of the world's largest and fastest-growing freight markets, where CO_2 emissions are projected to rise by nearly 400% by 2047 if left unchecked. Under its India Program, SFC works closely with the freight industry, national and state-level policy offices, academia, research institutions, and other ecosystem partners to adapt global accounting methodologies to the Indian context and accelerate freight decarbonization.

As part of this effort, SFC is deeply engaged with NITI Aayog's e-FAST India program, collaborating with knowledge partners to advance critical aspects of the Zero-Emission Truck (ZET) ecosystem—while also leading on freight emissions guidance development and industry adoption in India. This dual focus—strengthening emissions accounting and enabling practical decarbonization pathways—positions SFC as a key enabler of India's clean freight transition.



> **"What Gets Measured, Gets Managed, What Gets Managed, Can be Decarbonised"**

Smart Freight Centre India

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