



PROJECT REPORT CLEAN FREIGHT PROGRAM: BASELINE STUDY **(PHASE-II)**

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Internal Reviewers

Mr Shri Prakash, Distinguished Fellow

Dr AR Sihag, Distinguished Fellow

Mr IV Rao, Distinguished Fellow

Mr Sanjay Seth, Senior Director

Principal Investigator

Mr Sharif Qamar, Fellow and Associate Director

Co-Principal Investigator

Mr Piyush Saxena, Associate Fellow

Team Members

Mr Arun Kumar, Project Associate

Mr Arun Babu, Research Associate

Secretarial Assistance

Ms Nidhi Verma

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List of Abbreviations

AMNS	ArcelorMittal Nippon Steel
BALCO	Bharat Aluminium Co. Ltd
BEE	Bureau of Energy Efficiency
CAGR	Compound Annual Growth Rate
CCTS	Carbon Credit Trading Scheme
CDM	Clean Development Mechanism
CFCL	Chambal Fertilizers and Chemicals Ltd
CFL	Coromandel International Ltd.
DAP	Diammonium Phosphate
DC	Designated Consumer
DEF	Distance-Based Specific Emission Factor
DFC	Dedicated Freight Corridor
Escerts	Energy Savings Certificates
ESG	Environmental, Social and Governance
EV	Electric Vehicle
FAI	Fertiliser Association of India
FCI	Fertilizer Corporation of India Limited
FGD	Focused Group Discussion
GHG	Greenhouse Gas
GVA	Gross Value Added
HFCL	Hindustan Fertilizer Corporation Limited
HINDALCO	Hindustan Aluminium Corporation Limited
ICM	Indian Carbon Market
IFFCO	Indian Farmers Fertilizer Cooperative Ltd.
INDAL	Indian Aluminium Company Ltd.
ISO	International Organization for Standardization
JSW	Jindal South-West
KRIBHCO	Krishak Bhartiya Cooperative Ltd
LNG	Liquefied Natural Gas
MT	Million Tonne
Mtoe	Million Tonnes of Oil Equivalent
MTPA	Million Tonne Per Annum
NALCO	National Aluminium Company Limited
NDC	Nationally Determined Contribution
NMEEE	National Mission for Enhanced Energy Efficiency
OPC	Ordinary Portland Cement
PAT	Perform, Achieve and Trade
PBFS	Portland Blast Furnace Slag Cement
PIB	Press Information Bureau
PPC	Portland Pozzolana Cement
RCF	Rashtriya Chemicals and Fertilizers
SAIL	Steel Authority of India Limited
SEF	Specific Emission Factor
SSP	Single Super Phosphate
TPP	Thermal Power Plant
UNFCCC	United Nations Framework Convention on Climate Change

Glossary

Carrier	Any person, organization or government undertaking the carriage or part thereof, of goods by road, rail, inland waterways, sea or air.
Designated Consumer (DCs)	Designated Consumers (DCs) are energy-intensive industries with specific energy consumption targets and are required to meet these targets within a three-year cycle under PAT scheme.
Distance-based emission factor (DEF)	DEF measures the amount of greenhouse gas emitted for every kilometre of payload movement.
GHG Emissions Intensity (GEI)	Amount of greenhouse gases (GHG) that are emitted per unit of product output. It is expressed in tCO ₂ e/equivalent output or product.
Heavy-duty Vehicles (HDVs)	Vehicles with gross vehicular weight (GVW) greater than 12 tonnes.
Shipper	Any person or a company responsible for organizing and transporting goods from one point to another.
Specific Emission Factor (SEF)	Specific Emission Factor (SEF) indicates the amount of GHG emission from moving 1 tonne of payload by 1 kilometre.
Tank to wheel (TTW)	TTW emission of a vehicle refers to a part in the entire energy chain that extends from the point where energy is absorbed (refuelling the tank) to its discharge point (movement of the vehicle, wheel).
Well to wheel (WTW)	WTW emission of a vehicle assesses the emissions of GHG through the entire life cycle of fuel used in a vehicle, from its extraction point (well) to the absorption point (fuel tank) and finally to discharge point (movement of the vehicle).

Executive Summary

India's freight transport demand is witnessing a significant rise, projected to increase from 2,682 billion tonne-kilometres [BTKM] in 2019–20 to 7,260 BTKM by 2030–31. Road freight is expected to account for approximately 85% of this movement, reinforcing its dominant role in the country's logistics landscape (TERI, 2024). This continued reliance on road-based transport, coupled with the sector's dependence on fossil fuels, poses critical challenges for India's long-term energy security and climate mitigation goals.

In 2023–24, India's oil import dependency stood at 87.8%, and is anticipated to rise to 93% by 2031 (IEA, 2024). Greenhouse gas [GHG] emissions from medium and heavy-duty vehicles [MHDVs] under a Business-as-Usual [BAU] scenario are projected to grow tenfold by 2070–71 (TERI, 2024). Addressing these emissions is essential for achieving the objectives of India's Long-Term Low Emission Development Strategy [LT-LEDS], which identifies road freight as a high-impact sector for decarbonisation.

While the Perform, Achieve and Trade [PAT] scheme, launched in 2012, has contributed to enhancing energy efficiency across industrial sectors, it primarily addresses Scope 1 and Scope 2 emissions. Scope 3 emissions, particularly those arising from freight operations, remain underreported and largely outside the purview of current regulatory frameworks.

In 2023, the Ministry of Power notified the Carbon Credit Trading Scheme [CCTS], with plans to include the transport sector by 2026. This study builds upon the experiences of the PAT scheme and aligns with the forthcoming CCTS framework (as highlighted in Figure). It seeks to support the design and implementation of a Clean Freight Program that targets Scope 3 emissions from road freight, leveraging market-based mechanisms for emissions reduction.

A methodological framework was developed to identify priority sectors with substantial freight demand and emissions impact. Four sectors, Cement, Iron & Steel, Fertilizers, and Aluminium were shortlisted based on production intensity and reliance on road transport. Within these sectors, TERI identified major shippers and reviewed their public disclosures, particularly ESG [Environment, Social and Governance] reports, to assess the extent of emissions reporting. An analysis of 127 member organizations under TERI's Council for Business Sustainability [CBS] revealed limited category-wise Scope 3 emissions disclosure.

The study further examines global methodologies for freight emissions accounting, including:

- **UNFCCC CDM 17** [Tool for estimating baseline emissions for modal shift measures in inter-urban cargo transport]
- **EN 16258:2013** [Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)]
- **ISO 14083:2023** [International standard: GHG quantification and reporting of GHG emissions arising from transport chain operations]
- **SmartWay (For trucks)** [Online truck tool for all carriers]
- **UK GHG reporting guidelines** [Guidance on measuring and reporting GHG emissions from freight transport operations]

Drawing insights from these international practices, the report recommends the launch of a dedicated Clean Freight Program for India, modelled on successful initiatives such as SmartWay [USA], Lean & Green [EU], and PLVB [Brazil]. Such a program could be linked to CCTS to enable emissions reduction through structured incentives and carbon credit trading.

Key recommendations include:

- **Inclusion of Scope 3 emissions**, specifically from upstream and downstream transport operations, under the CCTS framework. By setting voluntary emissions reduction targets, large shippers can drive carriers to adopt fuel-efficient or zero emission technologies, leading to reduced emissions. Integrating the emissions reduction with CCTS can create an additional revenue stream for shippers and carriers, while encouraging competition and fleet level performance among carriers.

- **Focused sectoral entry** through the top five shippers in each priority sector to maximise emissions reduction potential. Regulatory body may initiate the inclusion of Scope 3 emissions reduction under the priority sectors identified in this study (Cement, Iron & Steel, Fertilizers, and Aluminium).
- **Establishment of a carrier rating system** to encourage adoption of fuel-efficient technologies and enhance transparency. While the focus would be on shippers for emission reduction targets, the actual reduction potential lies with their carriers. Shippers may be encouraged to collaborate with their carriers and prioritize those demonstrating strong fleet efficiency measure. Establishing a carrier rating system linked to clean freight program can incentivize carriers to adopt cleaner practices, as higher-rated carriers would gain preferential business and recognition. This approach would enable shippers to lower their Scope 3 emissions and foster a mutually beneficial ecosystem that rewards sustainability efforts.
- **Strengthening corporate emissions reporting requirements**, particularly for Scope 3, under Business Responsibility and Sustainability Reporting (BRSR) guidelines. Currently, the Securities and Exchange Board of India (SEBI) has mandated top 1,000 listed organizations to report emissions through BRSR framework. However, the analysis showed that very few organizations report category-wise Scope 3 emissions, highlighting the need for mandatory Scope 3 emissions (category-wise) reporting to ensure comprehensive emissions data.

By operationalizing these recommendations, India can accelerate its transition to a low-carbon freight ecosystem that balances economic growth with environmental responsibility.



Figure A: Conceptual framework of Carbon Credit Trading Scheme in India

Source: Compiled by TERI



1

Introduction

Global energy consumption has been steadily increasing, with the transportation sector accounting for a significant share of this increase. In 2023, the final energy consumption of the transport sector reached 120 exajoules (EJ), marking a 4% rise from 2022 levels (IEA, 2024). Road transport contributed to 2% of this increase. The transport sector's energy demand is met by oil, with over 90% consumption relying on fossil fuel (IEA, 2024). This heavy dependence on oil poses challenges in achieving sustainability and mitigating emissions. In response, global efforts are underway to accelerate transport decarbonization through various measures and strategies.



Oil dependence is not just a global challenge; it is a critical concern for major economies like India. In 2023–24, India’s oil dependency was 87.8% and is projected to rise to 93% by 2031 [IEA, 2024]. Freight transport demand is expected to increase from 2,682 billion tonne kilometre [BTKM] in 2019–20 to 7,260 BTKM in 2030–31. The share of road freight would increase from 73% in 2019–20 to 85% in 2030–31 [TERI, 2024]. Under the Business as Usual [BAU] scenario, GHG emissions from medium and heavy-duty vehicles [MHDVs] are projected to grow by 10x, from the year 2019–20 to 2070–71 [TERI, 2024]. India’s Long-Term Low-Carbon Development Strategy [LT-LEDS] projects that emissions from heavy-duty vehicles [HDVs] would account for majority of emissions coming from transport sector, under BAU scenario. This rapid growth underscores the urgent need to reduce dependence on fossil fuel imports.

To tackle these challenges, India has undertaken several initiatives aimed at improving energy efficiency in various energy-intensive sectors.¹ One of these initiatives is the Perform, Achieve and Trade [PAT] scheme, launched in 2012 to improve energy efficiency across sectors by setting energy-saving targets for energy-intensive industries. While PAT scheme has demonstrated the potential of energy-efficiency measures to reduce consumption and emissions, its focus has largely been on Scope 1 and Scope 2 emissions.

The growing emissions from the transport sector (especially road freight) develop a pressing demand to prioritize emissions mitigation measures within the energy-intensive sectors, particularly HDVs. Going forward, the Carbon Credit Trading Scheme [CCTS],² notified in 2023, which is set to expand to include road transport by 2026, will provide further opportunities for emissions reduction in the freight sector [Ministry of Power, 2024].

This report draws learnings from global methodologies for freight emissions estimation, lessons learnt from PAT and identifies priority sectors for implementing clean freight program. The identified priority sectors within the road freight have high potential for Scope 3 emissions reductions, such as long-haul trucking for reducing their emissions footprint. By promoting the adoption of energy-efficient technologies, alternative fuels, and better fleet management practices, the recommendation of this study aims to support India’s transition to a more sustainable and low-carbon freight system.

1.1 Scope of the Study

The key objective of this study is to facilitate the rollout of emission estimation by large shippers through CCTS.³ As part of “Baseline Study for Non-Urban Road Transport”, in the year 2023, TERI conducted a pan-India pilot survey to assess the fleet-level specific emission factors [SEFs] and distance-based specific emission factors [DEFs]. Leveraging key learnings from global clean freight programs, TERI devised an implementation strategy to implement a clean freight program in India, in alignment with market-based mechanisms [like trading in the PAT scheme].

¹ Including Chlor-Alkali, Fertilisers, Petroleum refinery, Iron & Steel, Textile, Aluminium, Railways, DISCOMs, Pulp & Paper, Commercial Buildings [Hotels], Petrochemical, Railways, Thermal Power Plant

² Notified by the Ministry of Power via Gazette notification dated 28.06.2023 [<https://beeindia.gov.in/sites/default/files/CCTS.pdf>]

³ The Carbon Credit Trading Scheme, 2023 establishes the Indian Carbon Market [ICM], enabling entities to trade carbon credits for reducing or avoiding greenhouse gas emissions.

This study is focused on identifying the priority sectors for inclusion under CCTS, leading to enhanced fleet-level efficiency. Currently, the CCTS does not consider indirect emissions [Scope 3] from road freight operations generated by the obligated entities; however, it does include Scope 1 and Scope 2 emissions.⁴

Figure 1 outlines the major tasks carried out in this study. TERI conducted secondary and primary research to enhance sector identification and devise recommendations. Workshops and discussions were organized with shippers and carriers to refine the methodology. Insights for India were drawn from a comparative evaluation of global emissions estimation methodologies. Additionally, TERI floated an online scoping survey (using MS forms) and reviewed ESG reports from various organizations to better understand the reporting landscape in India.

TERI developed a methodology for identifying priority sectors to be included under CCTS. After identifying the sectors, TERI conducted in-depth analysis to gain sector-specific insights, focusing on the role of Scope 3 emissions reduction within these sectors. Information related to more than 200 companies was accessed and assessed. Further, major organizations [top 5] were identified using various parameters, facilitating the regulatory body to prioritize these organizations for maximizing emissions reduction. ESG reports and emissions profile of these organizations were thoroughly analyzed to gain a deeper understanding of Scope 3 emissions trends.

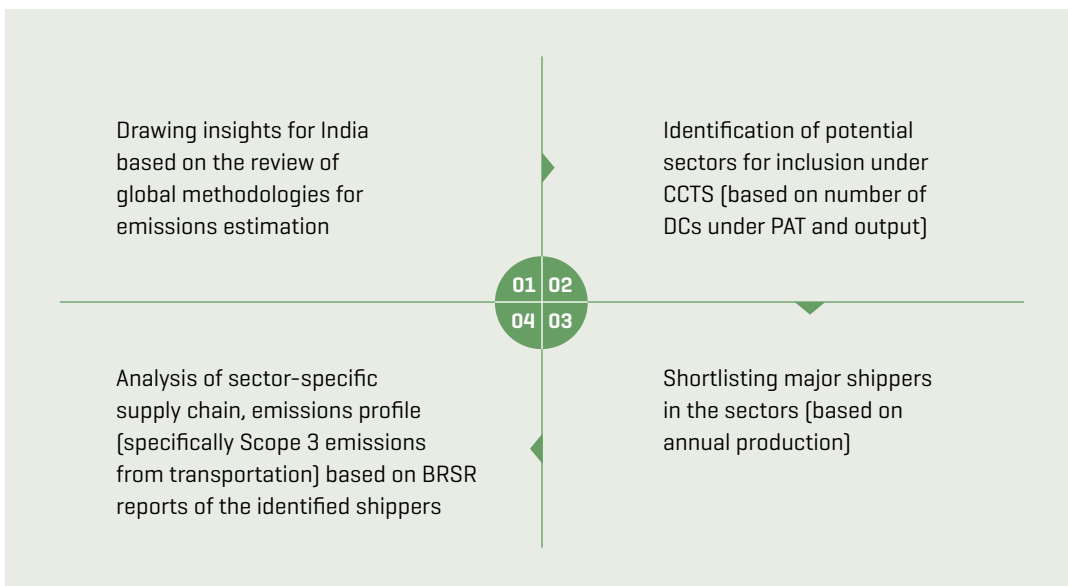


Figure 1: Tasks carried out in the study

Source: TERI

Moving forward, the regulatory body, Bureau of Energy Efficiency (BEE), could include the identified sectors in CCTS to reduce Scope 3 emissions from road freight operations.

⁴ Categories of emissions based on GHG Protocol: Scope 1: GHG emissions from operations that are owned or controlled by the reporting company (direct emissions); Scope 2: GHG emissions from the generation of purchased or acquired electricity, steam, heating or cooling consumed by the reporting company (indirect emissions); Scope 3: All indirect GHG emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream GHG emissions.





2

Incentivizing Emissions Reduction in India: Glimpse of PAT Scheme and CCTS

To tackle growing GHG emissions from energy-intensive industries and sectors, several measures have been introduced. This section explores key progress under India's PAT and CCTS scheme, outlining the potential to enhance incentives for deeper emissions reductions.

2.1 Perform, Achieve, and Trade (PAT) Scheme

Launched in 2012 by BEE, PAT scheme is a regulatory initiative under the Energy Conservation [EC] Act, 2001 aimed at improving energy efficiency in energy-intensive industries by reducing their Specific Energy Consumption [SEC] [BEE, n.d.]. It is a part of the National Mission for Enhanced Energy Efficiency [NMEEE]. PAT scheme sets energy-saving targets for industries based on their historical consumption, offering incentives in the form of Energy Savings Certificates [ESCerts] to industries that exceed their targets, while imposing penalties on those that fail to meet them. Industries can trade ESCerts, creating a market-driven mechanism to encourage energy efficiency.

Figure 2 outlines the thirteen energy-intensive sectors. Designated consumers [DCs] within these sectors are required to comply with the targets set by BEE for that cycle.

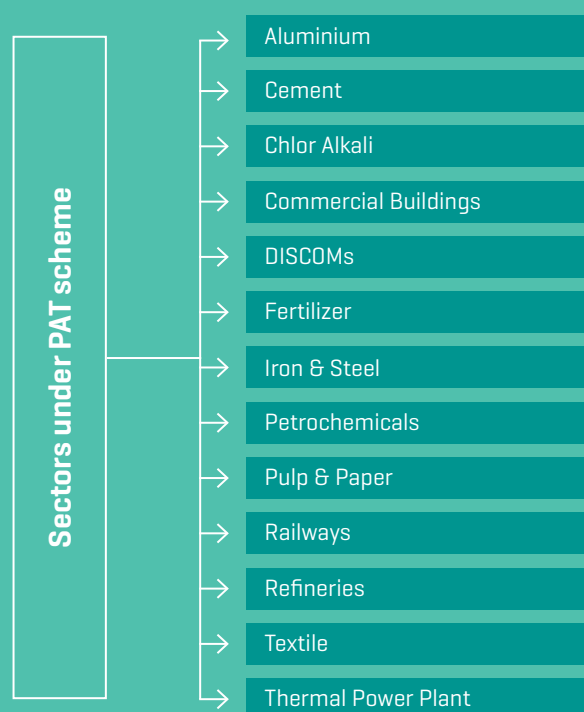


Figure 2: Sectors under PAT scheme

Source: BEE

Table 1 highlights the performance of PAT cycles, along with the number of DCs, sectors considered, and energy savings achieved in each cycle. PAT Cycle-I [2012–2015] covered 478 DCs across 8 sectors, achieving a total energy savings of 8.67 million tonnes of oil equivalent [Mtoe] and a reduction of 30 MT of CO₂ emissions. PAT Cycle II [2016–2019] expanded the scope to 621 DCs across 11 sectors, resulting in 14.08 Mtoe of energy savings and a significant CO₂ reduction of 66.01 MT.

Table 1: Performance and energy savings achieved under PAT cycles

PAT Cycle	Period	Number of DCs (Nos.)	Sectors (Nos.)	Energy Savings Achieved (Mtoe)	CO ₂ Reduction (MT)
I	2012–2015	478	8	8.67	30
II	2016–2019	621	11	14.08	66.01
III	2017–2020	116	6	1.594	5.59
IV	2018–2021	109	8	0.6998*	-
V	2019–2022	110	8	0.5130*	-
VI	2020–2023	135	6	1.277*	-
VII	2022–2025	707	9	6.627*	-
VIII	2023–2026	138	6	0.3370*	-

*Targeted energy savings that have to be achieved as per the corresponding cycle.

Sectors covered: Aluminium, Cement, Chlor Alkali, Commercial Buildings, DISCOMs, Fertilizer, Iron & Steel, Petrochemicals, Pulp & Paper, Railways, Refineries, Textile, and Thermal Power Plants.

Source: Compiled by TERI

In PAT Cycle III (2017–2020), the focus was narrowed to 116 DCs across 6 sectors, achieving energy savings of 1.594 Mtoe and reducing CO₂ emissions by 5.59 MT. For PAT Cycle IV (2018–2021), there were 109 DCs across 8 sectors, but the targeted energy savings are lower at 0.6998 Mtoe, with no CO₂ reduction data reported. PAT Cycle V (2019–2022) involved 110 DCs across 8 sectors targeted energy savings of 0.5130 Mtoe, though CO₂ reduction figures remain unreported.

PAT Cycle VI (2020–2023) focused on 135 DCs across 6 sectors, delivering 1.277 Mtoe in targeted energy savings. The ongoing PAT Cycle VII (2022–2025) covers 707 DCs across 9 sectors and Cycle VIII (2025–26) focuses on 138 DCs across 6 sectors.

The PAT scheme started with 8 sectors in Cycle I, expanded to 11 in Cycle II, then fluctuated between 6 and 9 sectors in later cycles. Cycle VII saw the highest coverage (9 sectors, 707 DCs), but Cycle VIII scaled back to 6 sectors, indicating the adoption of energy efficiency measures in India's industrial landscape.

The PAT scheme has driven significant energy savings, with Cycle I achieving 8.67 Mtoe and 301 MT CO₂ reduction. Cycle II recorded the highest savings at 14.08 Mtoe. Later cycles set targeted savings, with Cycle VII aiming for 6.627 Mtoe.

The PAT scheme has contributed significantly to energy efficiency improvements and CO₂ emission reductions (scope 1 and 2). Going forward, CCTS is expected to further complement these efforts in curbing GHG emissions.



2.2 Carbon Credit Trading Scheme (CCTS)

In 2016, India ratified the Paris Agreement, committing to reduce its GHG emission intensity by 33–35% by 2030, compared to 2005 levels. In 2022, India raised its ambition, aiming for a 45% reduction in GHG emission intensity by 2030 (BEE, 2024). Indian industries have made significant strides in emission reductions through both compliance markets [PAT-ESCCerts and Renewable Energy Certificate (REC)] as well as voluntary mechanisms like the Clean Development Mechanism (CDM).

To further support GHG reductions, India is focusing on initiatives like the CCTS, a market-based approach for reducing emissions in key sectors. It encourages industries to reduce their carbon footprints, aligning with the BEE's efforts to help India meet its emission reduction targets under the Paris Agreement.

BEE, designated by the Ministry of Power as the administrator for the Indian Carbon Market (ICM), plays a central role in the scheme. As highlighted in Figure 3, identification of energy-intensive sectors with high potential for emissions reduction, setting emissions reduction trajectories and assigning targets comes under the ambit of BEE's responsibility under the compliance mechanism.

A carbon credit represents the reduction, removal, or avoidance of GHG emissions achieved and is equivalent to one tonne of carbon dioxide equivalent (tCO₂e) (Ministry of Power, 2023). Entities that meet these targets earn carbon credits, which can be traded with other entities seeking to meet their own targets or seek financial gain.



Figure 3: Role of BEE in CCTS

Source: Ministry of Power [2023]

The carbon credit certificates issued have a defined crediting period and renewal schedule, which BEE manages, alongside an IT infrastructure and secure database to track credits and ensure smooth operations [Ministry of Power, 2023]. In April 2025, the Ministry of Environment, Forest and Climate Change [MoEFCC] notified the [Greenhouse Gases Emission Intensity \[GEI\] Target Rules 2025](#) for public consultation. These draft rules set GEI targets [in tCO₂e per tonne of equivalent product] for the compliance year 2025–26 and 2026–27, considering 2023–24 as the baseline year. The sectors covered include Aluminium, Cement, Chlor Alkali, Pulp & Paper.

CCTS is not only crucial for India’s domestic GHG reduction goals, but it also contributes to global climate efforts, supporting India’s transition to a low-carbon economy. By facilitating carbon credit trading, the scheme fosters sustainable practices and helps attract investments in energy-efficient and low-carbon technologies, further enhancing India’s role in global climate action.

2.3 Comparative Assessment of PAT and CCTS

CCTS, notified in 2023, is a more recent and enhanced initiative compared to the PAT scheme, which has been in place since 2012. Unlike PAT scheme, CCTS allows both compliance-based participation for obligated entities and voluntary participation through its offset mechanism. While PAT set targets based on specific energy consumption (measured in tonnes of oil equivalent per tonne of product), CCTS establishes targets based on GHG Emissions Intensity (GEI), defined in terms of tonnes of CO₂e per tonne of product, as notified by the MoEFCC.










Both schemes include penalties for non-compliance based on EC Act. However, the PAT scheme primarily focuses on industrial and energy-intensive sectors, whereas CCTS offers broader sectoral coverage, including agriculture, waste management, and transportation. Another key difference is in the instruments used: PAT issues Energy Saving Certificates (ESCerts), while CCTS enables the trading of carbon credits. A detailed comparison between the two schemes is provided in Table 2.



⁵ <https://beeindia.gov.in/en/programmes/perform-achieve-and-trade-pat>

⁶ <https://beeindia.gov.in/en/programmes/carbon-market>

Table 2: Comparison between PAT and CCTS scheme

Parameter		Perform, Achieve, and Trade (PAT) ⁵	Carbon Credit Trading Scheme (CCTS) ⁶
	OBJECTIVE	Reduce Specific Energy Consumption (SEC) in energy-intensive industries	Reduce GHG emissions through a market-based carbon credit system
	SCOPE	Energy-intensive industries (DCs)	Obligated Entities (Compliance Mechanism) and Voluntary Participants (Offset Mechanism)
	TARGET SETTING	Specific Energy Consumption (Tonnes of Oil Equivalent/tonne of equivalent product)	GHG Emissions Intensity (Tonne of CO ₂ e/tonne of equivalent product)
	REGULATORY FRAMEWORK	Energy Conservation Act, 2001	Energy Conservation (Amendment) Act, 2022
	GOVERNING BODY	BEE	BEE, MoEFCC
	TRADABLE UNIT	Energy Savings Certificates (ESCerts)	Carbon Credit Certificates (CCCs)
	TRADING PLATFORM	Indian Energy Exchange (IEX) and Power Exchange India Ltd (PXIL)	Indian Carbon Market, managed by Central Electricity Regulatory Commission (CERC)
	SECTOR COVERAGE	Energy-intensive sectors only [e.g., Aluminium, Cement, Fertilizer, Iron & Steel, Paper, Refining, Textiles]	Broader coverage including industries, forestry, agriculture, waste management, and transportation
	PENALTY FOR NON-COMPLIANCE	Present	Present

Source: TERI

In conclusion, while both schemes aim to reduce carbon emissions, they operate under different frameworks and address different aspects of climate change mitigation and energy efficiency. The PAT scheme is tailored to improve energy efficiency within India's industrial sectors, focusing on domestic emission reductions. The CCTS offers the potential for India to not only reduce emissions domestically but also to generate revenue by participating in international carbon markets.

The inclusion of road freight (HDV sector) under CCTS could drive significant emissions reduction in hard-to-abate sectors, while also addressing challenges such as the need for a robust regulatory frameworks/methodologies and technological adaptation for monitoring emissions reduction effectively.





3

Global Methodologies: Freight Emissions Accounting

Globally, various methodologies are in place that allow organizations to account for emissions from road freight operations. While the basics of emissions accounting remain the same across various methodologies, the framework/emission factors and other factors differ in these methodologies.

This section highlights a comparative assessment of five major methodologies, namely:

UNFCCC CDM 17 [Tool for estimating baseline emissions for modal shift measures in inter-urban cargo transport]: This methodology is developed within the CDM by the United Nations Framework Convention on Climate Change (UNFCCC).

EN 16258:2013 [Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)]: European standard providing a framework for calculating and reporting GHG emissions from transport activities. It covers various modes of transport, including road transport, which could be relevant to the trucking sector.

ISO 14083:2023 [International standard: GHG quantification and reporting of GHG emissions arising from transport chain operations]⁷: This standard by the International Organization for Standardization (ISO), deals with the quantification and reporting of GHG emissions from transport activities. This standard acknowledges other frameworks in place and is the newest of all other methodologies considered.

SmartWay (For trucks) [Online truck tool for all carriers]: Led by the Environmental Protection Agency (EPA), USA, this tool is aimed at improving fuel efficiency and reducing emissions from freight transport.

UK GHG reporting guidelines [Guidance on measuring and reporting GHG emissions from freight transport operations]: These guidelines by the United Kingdom (UK) provide specific methodologies for calculating GHG emissions, tailored to their national requirements in-line with UKs reporting regulations.

⁷ ISO 14083:2023 acknowledges Global Logistics Emissions Council (GLEC) framework for accounting and reporting emissions from freight transport.

3.1 Comparative Assessment of Methodologies

Table 3 presents the comparative assessment of global methodologies, along with the limiting factors to scope the best suited methodology for Indian context.

Table 3: Comparative assessment of methodologies

Methodology/ Framework	UNFCCC CDM 17	EN 16258:2013	ISO 14083:2023	SmartWay (Truck Tool)	UK GHG reporting guidelines
Title	Methodological tool: Baseline emissions for modal shift measures in inter-urban cargo transport	Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)	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
Prepared by	UNFCCC	Technical Committee (CEN/TC 320), Netherlands	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 organizations including CILT, DEFRA, FTA, DFT, RHA, IGD, etc.
Came into force (year)	2014	2012	2023	2003	DEFRA withdrawn on March 16, 2022
Latest update (year)	2014	Withdrawn	2023	2024	
Clean freight programs running on these methodologies	-NA-	EcoTransIT (till 2022)	Lean and Green (Europe); EcoTransIT [replaced earlier used EN 16258]	SmartWay (USA, Canada)	Used by multiple organizations in the UK
Any reference to ISO?	-NA-	DIN ISO 8217:2010	Aligned with ISO 14064; Acknowledges GLEC, UNFCCC, and GHG protocol;	-NA-	GHG protocol
Applicability (road/rail/waterways/air/pipeline)	Road/Rail/Waterways	Road/Rail/Water/Airways	Road/Rail/Waterways/Airways/Pipeline/Cable Car	Road	Road/Rail/Waterways
Applicability (passenger/freight/both)	Freight	Both	Both	Freight	Freight
WTW/TTW approach	Not mentioned	WTW, TTW	WTW, TTW	TTW	WTW
Potential users for road freight	Transport operators	Transport operators (freight & passenger), users (freight & passenger), and transport organizers (freight forwarders, travel agencies, carriers subcontracting transport operations)	Carriers, Shippers, LSPs	Shippers, logistic companies (including 3PL/4PL), truck carriers	Transport operators
No. of accredited tools	-NA-	-NA-	Total - 47 Tools available	1	-NA-
Outcomes (CO₂/CO₂e)	CO ₂	CO ₂ e	CO ₂ e	CO ₂	CO ₂ e
Scope of multi-modal integration (Y/N)	Y	Y	Y	N	Y
Limiting factors	Outdated; no integration with ISO	Officially withdrawn	Emission factors for Indian context	Regional applicability; uses only TTW; utilizes only EPA emission factors which are applicable to the USA, Canada	Regional applicability; uses only WTW

Source: TERI

3.2 Key Takeaways for India

Each methodology is unique and has its own strengths and weakness, as well as specific applicability to the Indian context. It is essential to consider factors such as data availability, ease of implementation, and alignment with local regulations and reporting requirements while scoping methodology for Indian context.

Based on the comparative assessment of various methodologies for quantifying and reporting GHG emissions in road freight transport, **ISO 14083:2023 stands out as the most comprehensive and globally applicable standard.** As the latest international standard, it reflects the most current understanding of GHG emissions quantification in transport operations across multiple transport modes. Additionally, ISO 14083:2023 incorporated flexibility to address diverse transport activities beyond road freight, extending to other modes of transportation such as rail, air and maritime, which enhances its **scalability and relevance for multi-modal logistics operations.**

Unlike region-specific tools such as the UK GHG reporting guidelines or Smartway's truck tool, ISO 14083:2023 is designed for global applicability. This would be particularly **valuable for businesses operating in multiple regions or those looking to standardize their sustainability reporting practices across their entire supply chain.**

While some minor adaptations may be required to align the standard with specific regional conditions, such as those in India, its core framework remains robust and adaptable, positioning it as a leading choice for companies aiming for internationally recognized GHG emissions reporting in the road freight sector.

ISO 14083:2023 currently provides default emission intensity values and fuel emission factors for regions such as Europe, North America, and China. To ensure the standard's relevance for India, it is essential to integrate India-specific emission intensity values. This will support Indian shippers in using ISO 14083:2023 and related accredited tools for more accurate emissions estimation.

The recent release of India-specific GLEC Emission Intensity values offers an opportunity for alignment with the ISO framework, paving the way for harmonized and standardized emissions accounting practices in India.





A photograph of an industrial facility, likely a refinery or chemical plant, with several tall distillation columns and storage tanks. The scene is set against a hazy, orange-tinted sky, suggesting a sunset or sunrise. The foreground is dark, and the overall image has a blue and orange color palette.

4

Snapshot: ESG Reporting Frameworks in India

To gain insights on the corporate emissions reporting practices in India, TERI conducted a snapshot analysis and reviewed Environment, Social and Governance (ESG) reports from 127 member organizations (see Annexure-I) under TERI's Council for Business Sustainability (TERI CBS). This section outlines the key reporting frameworks currently in use and emphasizes the importance of including Scope 3 emissions in annual disclosures.

4.1 Insights from 127 Member Organizations

To explore the landscape of corporate emissions reporting in India, a total of 127 organizations across five sectors were analyzed. These sectors include energy & manufacturing, consumer & chemicals, technology & logistics, construction & engineering, and financing & consulting. These sectors were considered to analyze the GHG emissions reporting practices, particularly for road freight operations. This case study focused on assessing the frameworks used by companies to report emissions and identify potential gaps.

Secondary data collection was conducted based on nine key parameters as follows:



Notably, the data revealed that while many companies adopt some form of emissions reporting, only one subset is fully engaged in accounting for Scope 3 emissions. Figure 4 highlights the percentage distribution of the 127 companies selected for the study.

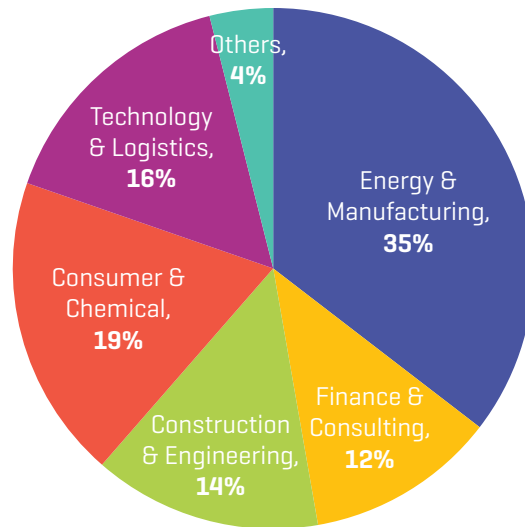


Figure 4: Sectoral distribution of 127 companies
Source: TERI

Further, the organizations utilize various frameworks to report emissions as highlighted in Figure 5.

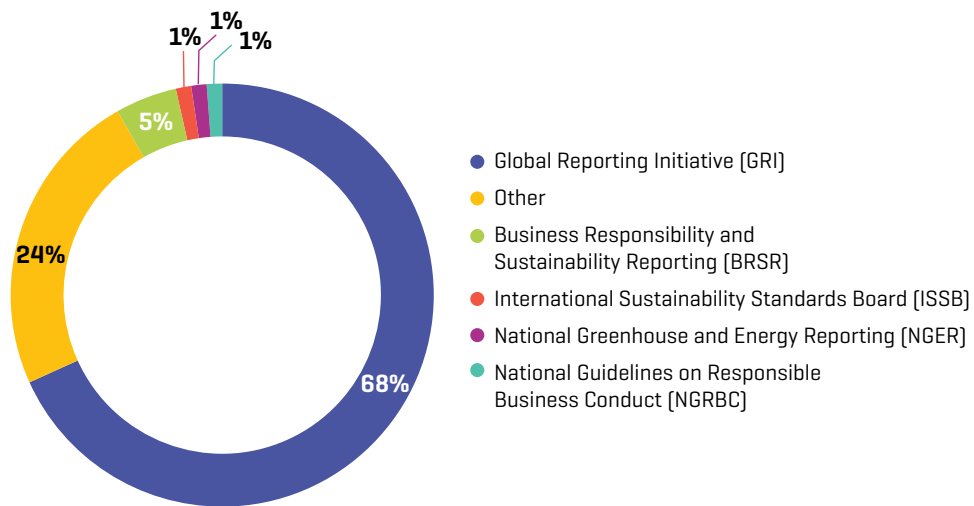


Figure 5: ESG frameworks used by organizations
Source: TERI

Key inferences from the data sets are:

<p>Extent of Operations: 59% of the companies operate globally, while the rest 41% companies operate nationally</p>	<p>GHG Emissions from Hub Operations:* 55% of the companies report hub emissions (e.g., trans-shipment/warehousing activities, etc.)</p>	<p>Reporting Unit: 79% of the companies report emissions in tCO₂e</p>
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* Emissions from hub operations refer to the emissions from energy use during handling, sorting, temporary storage of goods at logistics hubs such as warehouses, excluding vehicle-related emissions.

4.1.1 Organizations reporting Scope 3 emissions

Based on the secondary analysis, it was found that only 40% [51 out of 127] of the total organizations report Scope 3 emissions. Within this group, only 36 organizations [28% of the total] disclose GHG emissions from road freight activities, showcasing a significant gap in data availability within annual disclosures. This highlights the need for enhanced transparency and depth in emissions reporting, specifically from the transport sector.

Table 4: Insights from secondary analysis

Category	Count	Percentage
Total Companies	127	
Companies Reporting Scope 3 Emissions	51	40% of total companies
Companies Reporting Scope 3 & Road Freight GHG Emissions	36	71% of companies reporting Scope 3
Other Companies [Reporting but not Road Freight]	15	29% of companies reporting Scope 3
Other Companies [Not Reporting Scope 3]	76	60% of total companies

Source: TERI

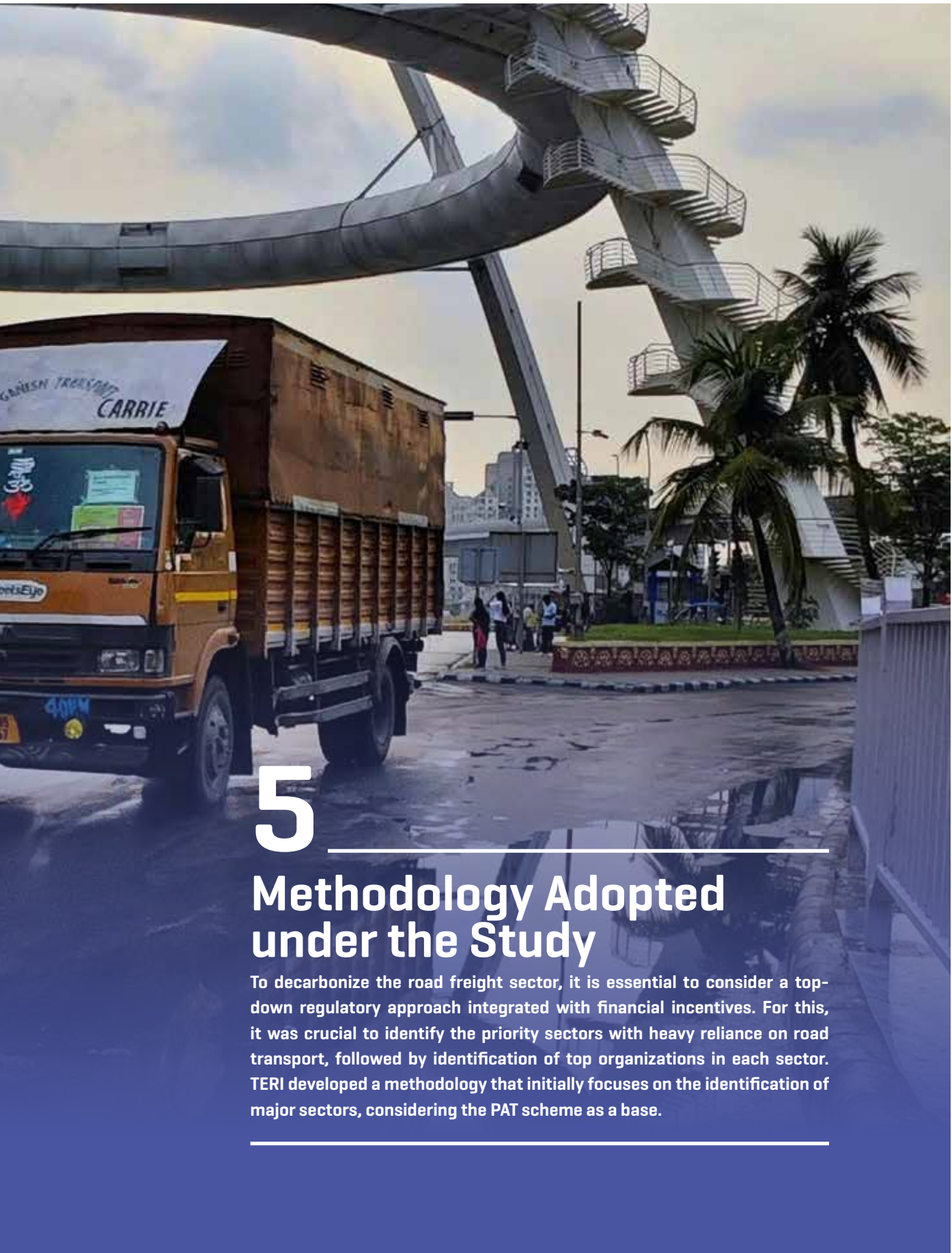
Further, various organizations involve different reporting standards which focus on the environment, finance, management, labour and several other components of reporting. Out of 35 organizations, 83% use GRI framework for reporting their emissions. As GRI does not always provide compliance guidelines for reporting for every sector, companies generally employ multiple reporting standards to enhance the robustness of their reporting practices.

The other major standards used in conjunction with GRI include Business Responsibility Sustainability Reporting [BRSR], Task Force on Climate-Related Financial Disclosures [TCFD], GHG Protocol, Science-based Targets Initiative [SBTi], etc. It is important to note that these primary inferences are derived from publicly available documents of the organizations, primarily their ESG reports and annual statements.









5

Methodology Adopted under the Study

To decarbonize the road freight sector, it is essential to consider a top-down regulatory approach integrated with financial incentives. For this, it was crucial to identify the priority sectors with heavy reliance on road transport, followed by identification of top organizations in each sector. TERI developed a methodology that initially focuses on the identification of major sectors, considering the PAT scheme as a base.

Further, major producers in the identified sectors were identified based on production data. These major producers/shippers create demand for freight transport and are responsible for the movement of freight from sourcing raw material to production plant, intermediate movements within the production plants, and movement of finished products to the warehouse.

Initially, four sectors including Cement, Iron & Steel, Fertilizers, and Aluminium were identified followed by the identification of the major shippers from all the four selected sectors for further study.

5.1 Identification of Major Sectors

This section outlines the methodology adopted for identifying major sectors relevant to the study and their significance in India's industrial landscape. It provides sector-specific insights, including production, state-wise production capacity, major players, supply chain mechanism, and their distribution network.

Methodology for Sector Identification

The PAT scheme served as the foundation for sector identification as it targets the sectors with high energy consumption and significant potential for energy savings and emissions reduction. Figure 6 outlines the step-by-step approach used to determine primary sectors for the study. The identification process starts with the 13 obligated sectors under the PAT scheme as the base, followed by a compilation of detailed list of DCs within these sectors.

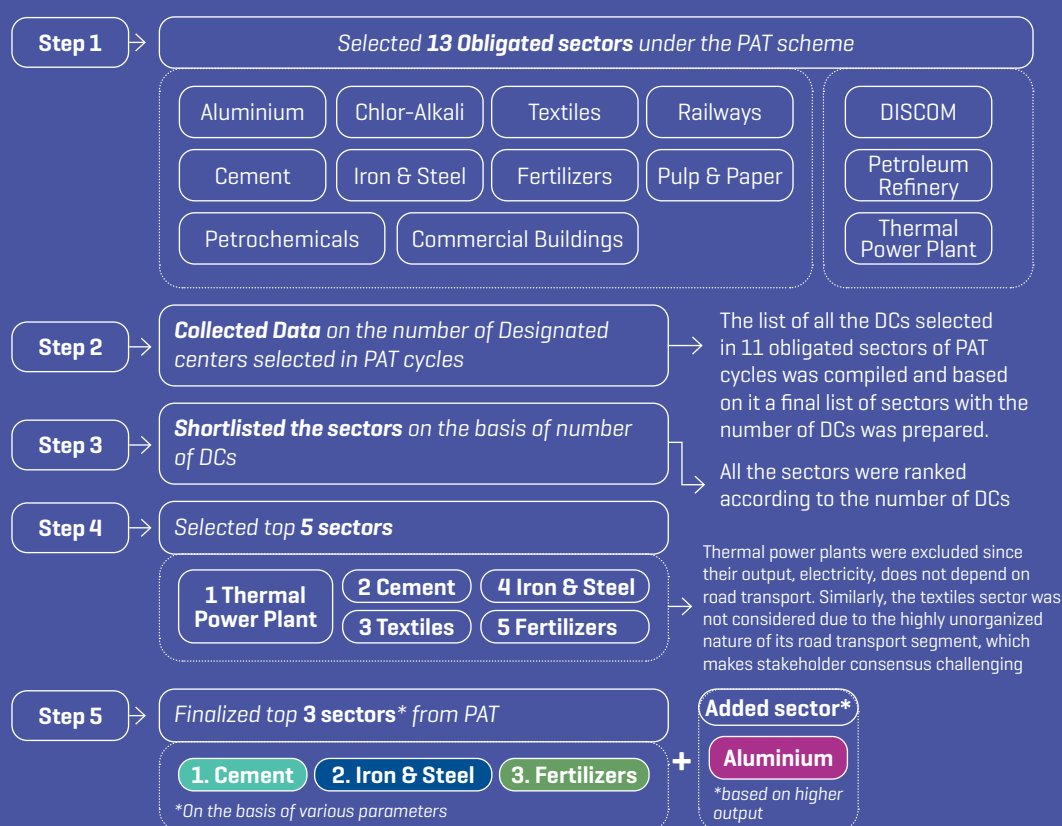


Figure 6: Methodology for sector selection

Source: TERI

The sectors were then narrowed down and ranked based on the number of DCs. Table 5 highlights the ranking and number of DCs in each sector.

Table 5: Percentage of PAT-eligible entities with respect to the number of DCs

Rank	Sector under PAT	No. of DCs	Sector-wise share in total no. of DCs
1	Thermal Power Plant	103	25%
2	Cement	82	20%
3	Textile	76	19%
4	Iron & Steel	48	12%
5	Fertilizers	25	6%
6	Pulp and Paper	21	5%
7	Chlor Alkali	17	4%
8	DISCOM	13	3%
9	Petroleum Refinery	10	2%
10	Aluminium	9	2%
11	Railway	6	1%
	Total	410	100%

Source: TERI

Initially, the top five sectors were considered based on their ranking. However, Thermal Power Plants and Textiles, ranked first and third with 103 and 76 DCs respectively, were not selected. Thermal Power Plants were excluded because they do not rely on road transport, as their final product is electricity. The textile sector was excluded due to its lower overall energy consumption, with most energy being used in manufacturing processes rather than transportation. Moreover, the textile industry is highly fragmented, making large-scale improvements in logistics more challenging.

As a result, three sectors, including Cement, Iron & Steel, and Fertilizers were selected based on the number of DCs listed in the PAT scheme. Additionally, Aluminium was included in the priority sector due to its high production output.

The cement industry has 83 DCs [20%], Iron & Steel have 48 DCs [12%], Fertilizers have 25 DCs [6%], and Aluminium has 9 DCs [2%]. Together, these four sectors represent 40% of the total DCs under the PAT scheme. **The identified sectors are characterized by the transportation of heavy materials, making logistics a key factor in energy consumption, and offering greater potential for reducing emissions from freight transport.**

Economic Significance of Selected Sectors

The selected sectors are energy-intensive and play a significant role in the economy as evidenced by their Gross Value Added (GVA) and large number of DCs. As shown in Table 6, **these four sectors generate a combined GVA of ₹3,97,092 cr. This accounts for 84% of the total GVA of seven sectors under PAT [Textile, Pulp & Paper, Refined Petroleum Products, Cement, Iron & Steel, Aluminium, Fertilizers] which stands at ₹4,74,691 cr.**

Table 6: Sector-wise GVA contribution in PAT

Sectors under PAT*	GVA (in ₹ cr)	Sector-wise GVA share	Combined % share of GVA
Textile	984	0%	16%
Pulp & Paper	11,626	2%	
Refined Petroleum Products	64,989	14%	
Cement	51,737	11%	84%
Iron & Steel	2,56,491	54%	
Aluminium	63,340	13%	
Fertilizer	25,524	5%	
Total GVA	4,74,691		100%

Source: TERI

*Only considered PAT eligible entities which were available in the Annual Survey of Industries 2021-22 for the GVA analysis.

The significance of these sectors can also be drawn from parameters like total output and fuel consumption. Table 7 highlights sector-wise insights, which are summarized below.

Table 7: Characteristics of identified sectors

Attribute	Cement	Iron & Steel	Fertilizers	Aluminium
Total output (₹ cr)	1,93,393	8,39,500	1,82,647	3,88,370
Fuel consumption (₹ cr)	38,311	91,537	21,592	30,158

Source: Annual Survey of Industries (2022)

<p>Cement: It plays a vital role in construction, with a total output of ₹1,93,393 crore and significant fuel consumption of ₹38,311 crore, due to the energy required for cement production.</p>	<p>Iron & Steel: It is a major industrial player, with the highest total output of ₹8,39,500 crore, underscoring its importance in industrial manufacturing. It also has a notable fuel consumption of ₹91,537 crore.</p>
<p>Fertilizers: It is essential for agriculture and generated a total output of ₹1,82,647 crore and consumed fuel of ₹21,592 crore.</p>	<p>Aluminium: It is the second most widely used metal and the fastest-growing metal globally, with a total output of ₹3,88,370 crore, surpassing both iron & steel and fertilizers. Its fuel consumption was ₹30,158 crore for the year 2022.</p>

These sectors exhibit distinct characteristics in terms of products, supply chain structures, major industry players, transportation of raw materials & finished products and distribution networks. A comprehensive analysis of these sectors has been undertaken to provide a deeper understanding, explained in the following sections.



5.1.1 Cement

The cement industry plays a key role in nation-building, being the backbone for sectors such as construction, transportation, coal, and power. India is the second largest producer of cement in the world. In 2023, India produced 427 MT of cement with an installed capacity of 622 MTPA, reflecting capacity utilization of 60–65%. As of 2023, Indian cement industry has a network of 159 integrated large cement plants, 120 grinding units, and 62 mini cement plants in 2023 [Economic Survey, 2024].

The Indian cement industry produces several types of cement, including Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC), Portland Blast Furnace Slag Cement (PBFS), Oil Well Cement, Rapid Hardening Portland Cement, Sulphate Resisting Portland Cement, and White Cement.

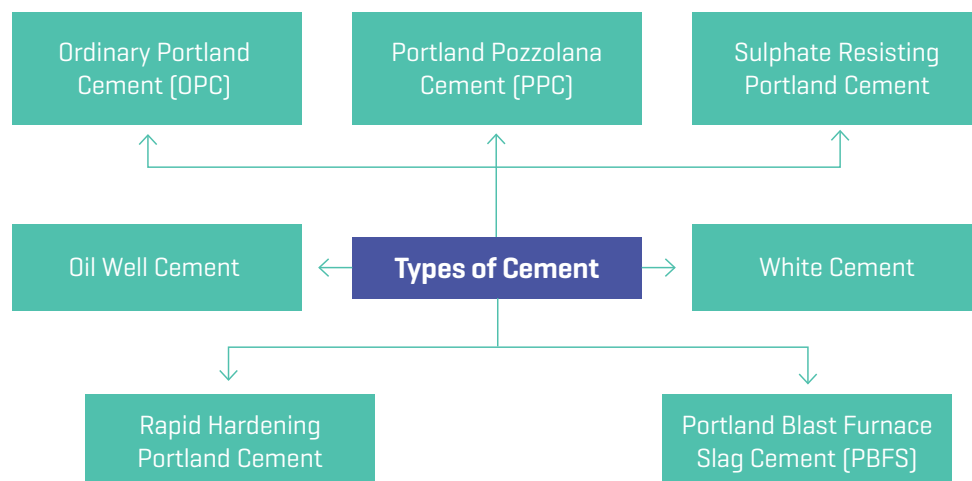


Figure 7: Types of cement produced in India
 Source: Ministry of Mines [2020]

Cement Manufacturing in India

Most of the cement plants are concentrated in Rajasthan and Andhra Pradesh owing to the availability of limestone, a key ingredient used in cement production. Figure 8 shows the State/UT-wise production capacity across the country. Five states, including Rajasthan [89.2 MTPA], Andhra Pradesh [78.14 MTPA], Karnataka [55.5 MTPA], Maharashtra [52.88 MTPA], and Gujarat [51.88 MTPA] can produce 46.1% of total cement production in India [Industrial Chronicle, 2024].

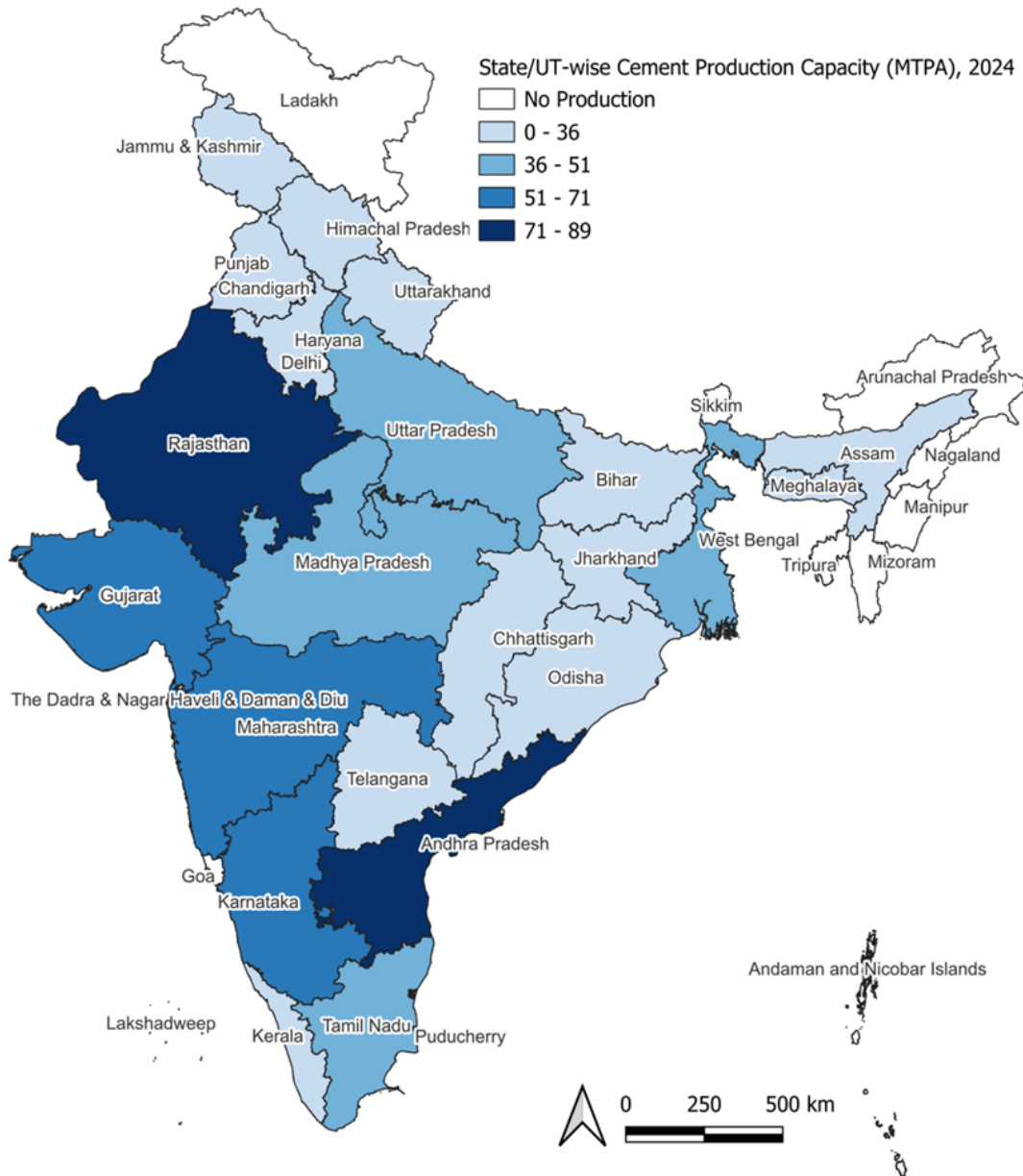


Figure 8: State/UT-wise cement production capacity
 Source: Industrial Chronicle [2024]

Major Producers in India

Ultratech Cement leads the cement business in India, dominating the market with a production share of 21.3%. Figure 9 shows the production share of major players, with Shree Cement holding 11.1%, Ambuja Cement (9.7%), ACC Cement (7.9%), and Dalmia Cement (3.9%). The remaining 46.1% share is collectively shared by JK Cement, Birla Cement, Chettinad Cement, and other companies [Ministry of Mines, 2022].

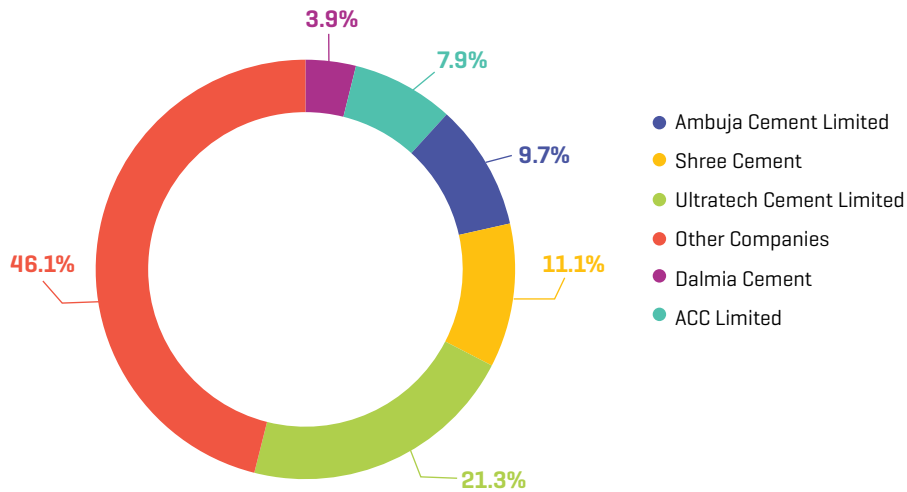


Figure 9: Production share of cement companies in India
 Source: Ministry of Mines [2022]

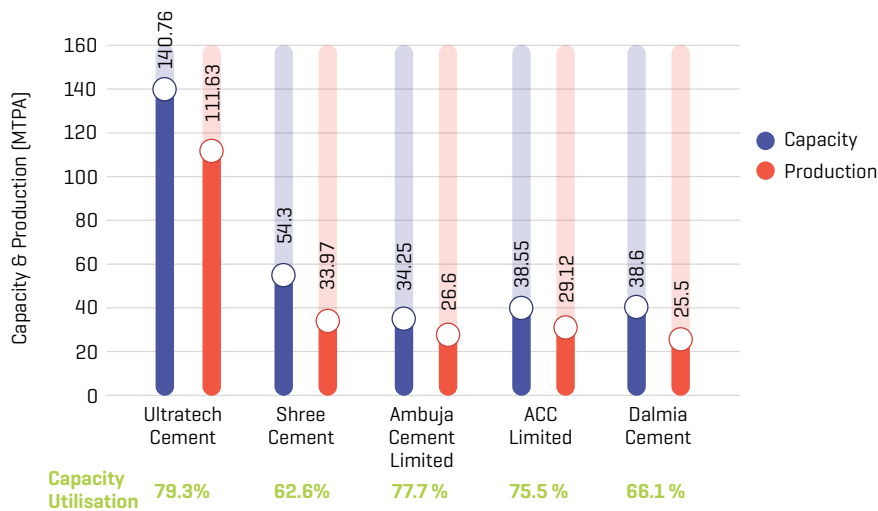


Figure 10: Production and capacity of major cement companies
 Source: TERI analysis based on the data from Ultratech Cement, Shree Cement, Ambuja Cement, ACC Cement, and Dalmia Cement [2023-24]

As of 2024, these companies have a combined production capacity of 206.46 MTPA, representing 49.3% share of the total. Figure 10 illustrates the Cement producing capacity / production capacity and production of the largest cement-producing companies in India, and it can be interpreted that all these companies are fairly utilizing the production capacity, with production capacity exceeding 60%.

Supply Chain

- **Raw material sourcing:** The supply chain of the cement industry in India originates with the sourcing of raw materials like limestone, clay, gypsum, and additives such as fly ash and slag.
- **Mining & procurement:** These materials are either mined or procured and then transported to cement plants, primarily using road transport (trucks) for short distances and rail or sea freight for longer distances.
- **Manufacturing & processing:** Once the materials reach the cement plant, they are crushed, blended, and heated in kilns to produce clinker. This clinker is then ground together with gypsum and other additives to create cement.

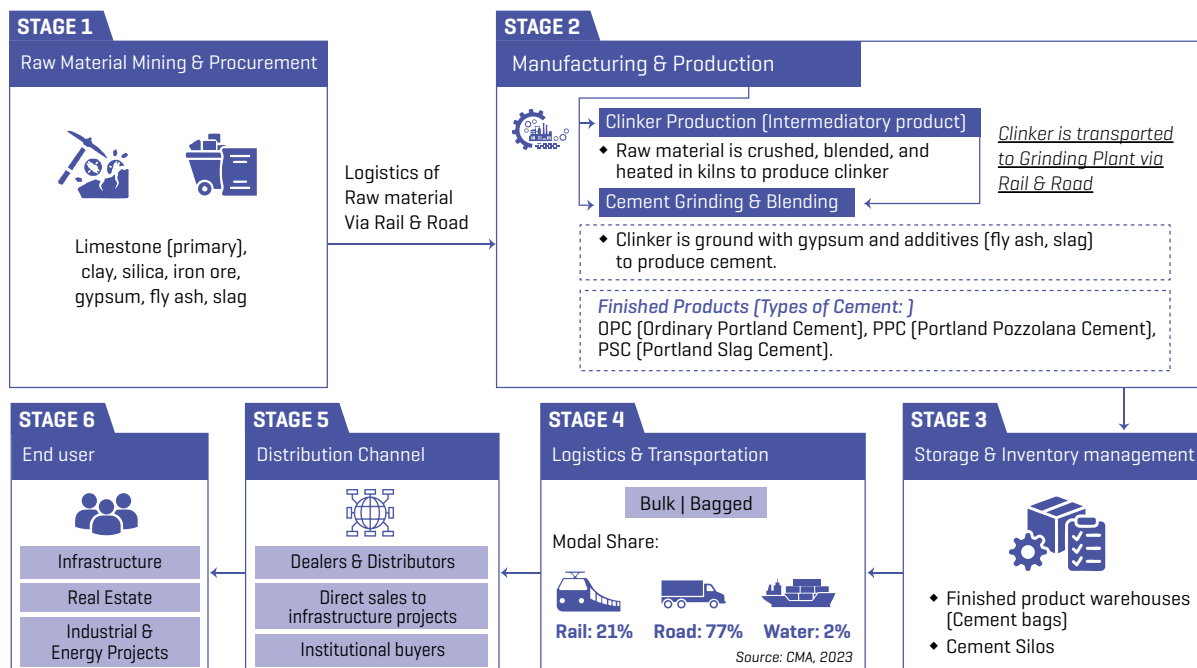


Figure 11: Supply chain of the cement industry
Source: TERI

- **Storage & inventory management:** After manufacturing, the cement is stored in silos, ready for distribution. In some cases, the clinkers are stored in silos at manufacturing plants and are transported to crushing plants at different locations.
- **Transportation:** The transportation of cement or clinker can be of two forms, in bulk or in bags. The finished cement is transported using trucks for local and regional markets or rail for long-distance movement. Cement is a low-cost high-volume commodity, and its distribution plays a key role in deciding its price for the end customer.
- **Distribution channel:** Cement’s distribution channel depends on the market of the region. Cement producers sometimes deliver the products directly to the construction companies. The most common chain of distribution of cement is through wholesalers and retailers. A large area is covered by a wholesaler who sells the product to the retailer in that area. The export of cement to other countries goes through international trade channels including shippers and international distributors.

Transport Modes and Modal Share

The flexibility of scheduling, and affordability for short-distance delivery have contributed to an increase in road share for cement. It increased to 77% in 2019–20 from 43% in 1989–90, while the rail's share declined from 57% to 21% in the same period. However, rail share again increased to 39% in 2023.

The modal share varies across companies and is dependent on factors including affordability, delivery schedules, and catchment area. For instance, Ultratech Cement transported 69% of its finished goods by road, 29% by rail, and 2% by sea in 2023 [Ultratech, 2024], while Dalmia Cement relies primarily on road [83%], with rail contributing to 17% of finished goods transportation [Dalmia, 2024].

5.1.2 Iron & Steel

India is the second-largest producer of crude steel in the world followed by China according to the World Steel Association. India achieved crude steel production of 144.29 MT in 2023 and is growing at a CAGR of 13.4%. India has also expanded its domestic production capacity from 142.3 MTPA in 2019–20 to 179.5 MTPA in 2023 [MoS, 2024].

Steel can be categorized based on form, composition, and end-use.

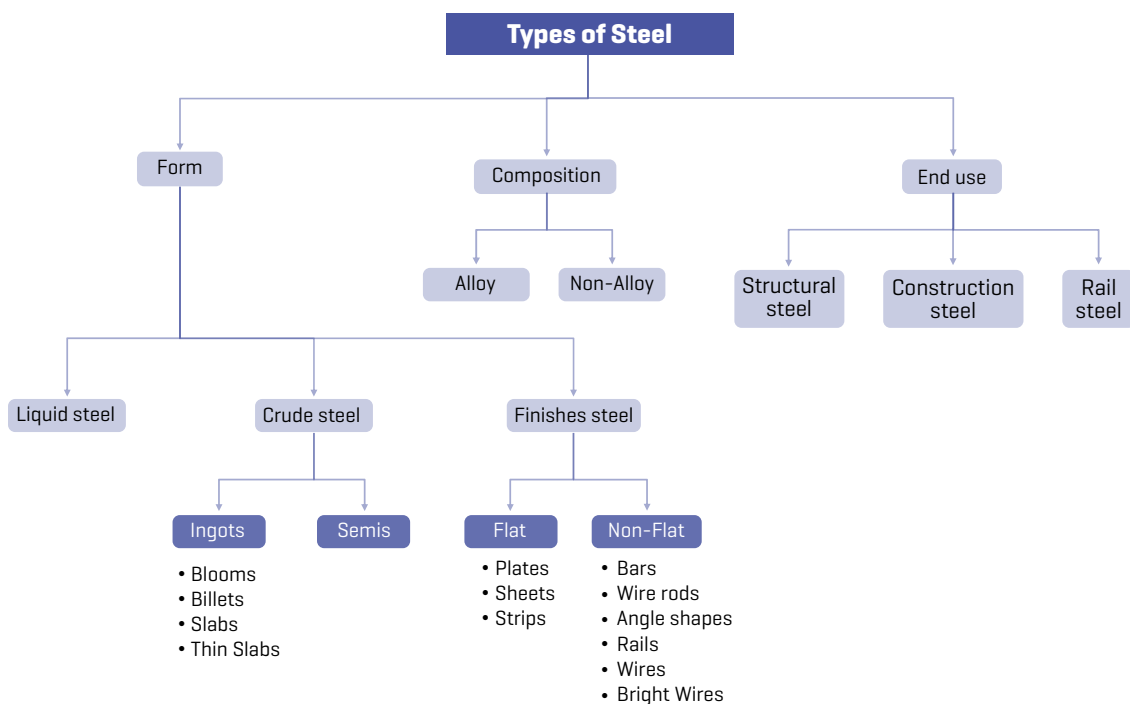


Figure 12: Types of steel produced in India
Source: MoS [2023]

There are three types of steel available based on the form, i.e., liquid steel, crude steel, and finished steel. Ingots and semis are made from crude steel and finished steel is available in flat and non-flat form. Based on composition, it can be categorized as alloy and non-alloy, alloys consist of stainless, silicon electrical, and non-alloy steel consists of low-carbon, medium-carbon, and high-carbon steel. Structural steel, construction steel, and rail steel are the types of steel categorized based on end-use.

Iron & Steel Production in India

Iron and steel industries are established in and around the Chota Nagpur plateau encompassing states such as Jharkhand, Odisha, and Chhattisgarh owing to the availability of raw materials. Figure 13 shows the Iron & Steel production capacity in India. The top five states can produce up to 66.2% of countries' steel production.

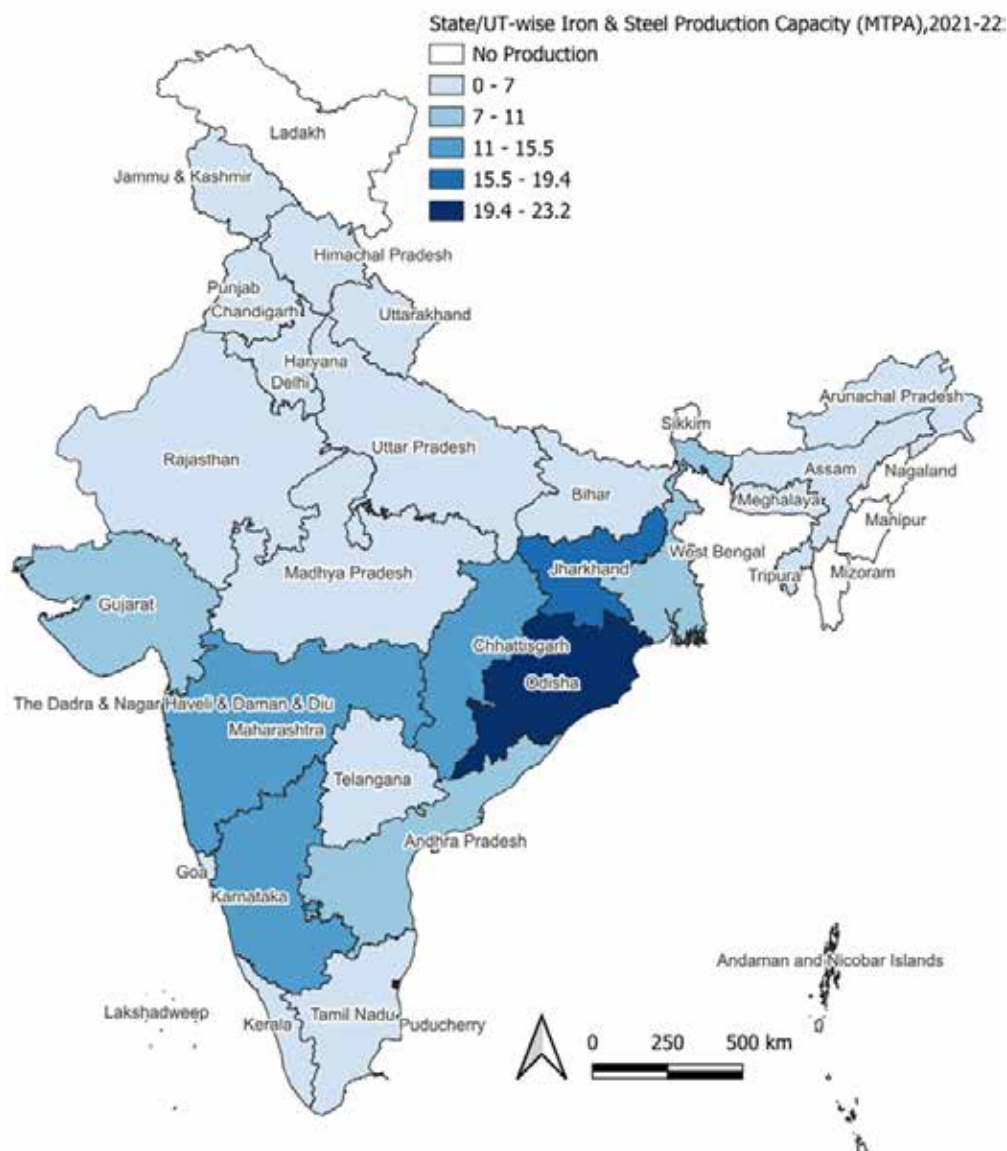


Figure 13: State/UT-wise iron & steel production capacity
 Source: MoS [2023]

States with maximum production capacity include Odisha [23.2 MTPA], Jharkhand [17.1 MTPA], Chhattisgarh [14.9 MTPA], Karnataka [13 MTPA], and Maharashtra [11.37 MTPA] (MoS, 2023).

Major Producers in India

The Iron & Steel sector is dominated by five major players, including JSW, TATA Steel Limited, SAIL, Jindal Steel & Power Limited (JSPL), and ArcelorMittal Nippon Steel India (AMNS), and contributed to 88% of the total steel production of India in 2023.

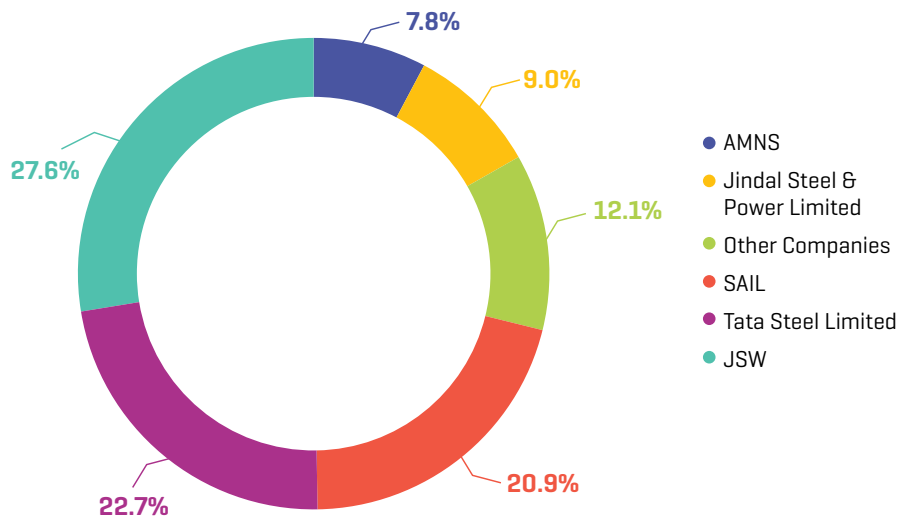


Figure 14: Production share of iron & steel companies in India
 Source: MoS [2023]

In 2023, JSW led the steel production in India, at 27.6% of total production, followed by TATA Steel Limited at 22.7%, SAIL at 20.9%, JSPL at 9%, and AMNS at 7.8%. Other companies including RINL, Jai Balaji Industries Limited, etc., collectively produced 12.1% of countries’ steel production.

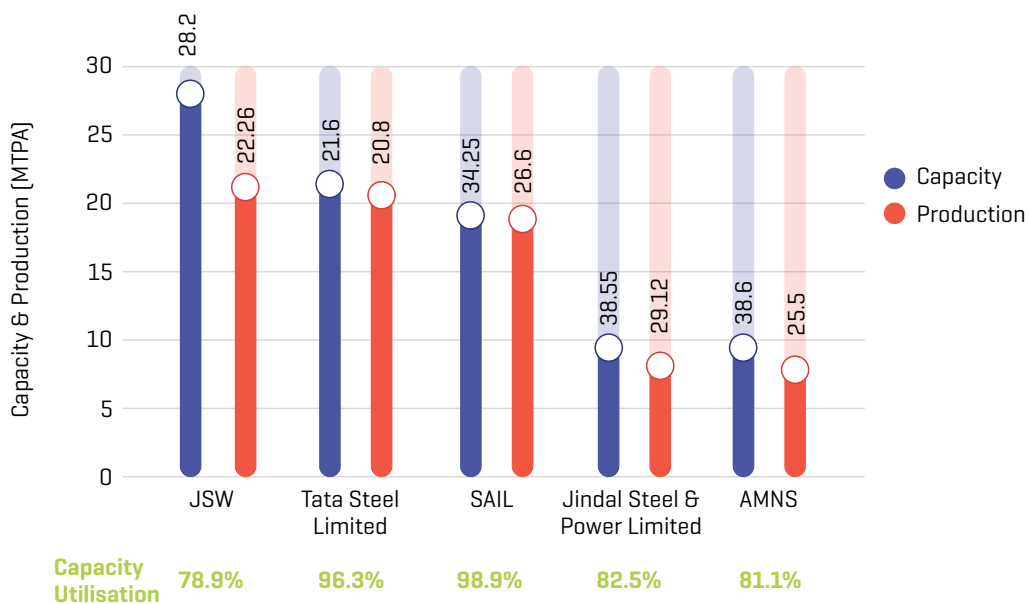


Figure 15: Production and capacity of major iron & steel companies
 Source: TERI analysis based on the data from integrated reports of JSW, Tata Steel, SAIL, Jindal Steel & Power Limited, and AMNS [2023-24]

Iron and Steel companies in India are decently efficient, according to Figure 15. It can be interpreted that all the large producers have a capacity utilization of more than 80% except JSW Steel. This shows the competitiveness and operational efficiency of the companies.

Supply Chain

→ Raw material sourcing:

The supply chain in the Iron & Steel industry originates with the sourcing of raw materials from mines such as iron ore, coking coal, non-coking coal, limestone, dolomite, manganese ore, chromite ore, ferroalloys, natural gas, nickel, and ferrous scrap.

→ Logistics of raw materials:

Steel and iron ore together account for approximately 12% of the total freight movement in the country [MoS, 2023]. The logistics of raw materials to the manufacturing plants involve the movement of raw materials over long distances, often using trucks as a mode of transport, contributing significantly to overall transportation logistics.

→ Manufacturing:

At the manufacturing stage, the raw materials are processed into steel, by heating iron ore and coal in a blast furnace to produce molten iron, which is refined into steel by blowing oxygen into it. The molten steel is then cast into shapes and further processed into finished products like sheets or beams as per the consumer's needs. Steel logistics involves several key steps to ensure efficient management and distribution.

→ Storage and inventory management:

After production, steel is transported to warehouses using trucks, trains, or ships. In the Iron & steel industry logistics, distribution, coordination, and transportation are crucial for efficient operations.

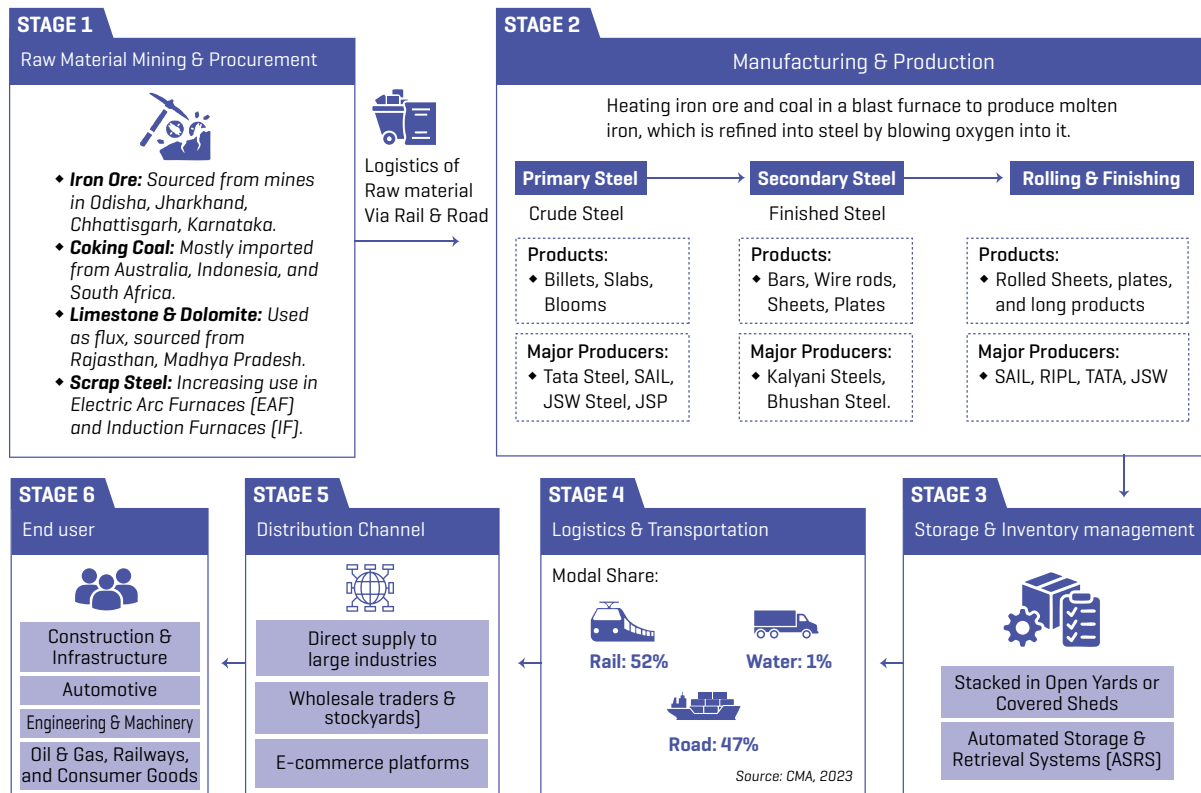


Figure 16: Supply chain of the iron & steel industry

Source: TERI

→ **Distribution:**

Steel flows through various distribution channels, including warehouses and distributors, which handle the storage and movement of steel to ensure it reaches the right location.

→ **Retail and end-use:**

Steel is purchased by retailers or directly by end users, such as construction companies or manufacturers, etc. The Indian steel industry is split into two main parts: large companies that make basic products like billets and hot-rolled coils, and smaller companies that produce more specialized items like cold-rolled coils and galvanized coils. This set-up requires a lot of long-distance transport from East and West India to North India.

Transport Modes and Modal Share

In India, ~47% of steel is transported by road as compared to the global average of ~20–30%. [MoS, 2023].

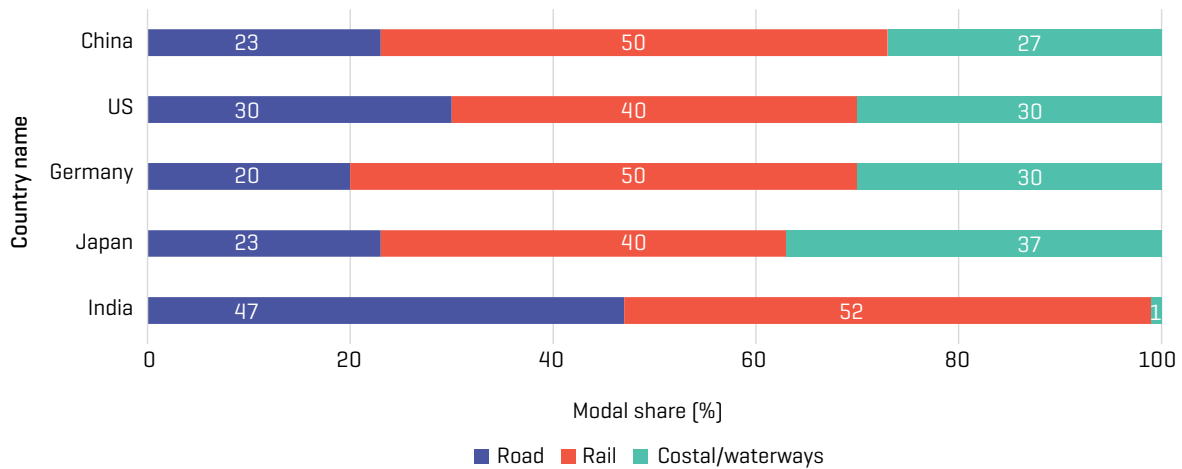


Figure 17: Country-wise modal share for iron & steel products
 Source: MoS [2023]

Figure 17 shows the country-wise modal share for iron & steel products. In India, steel is transported using only two modes, rail and road, but globally a decent share of steel is transported through coastal/ waterways along with rail and road.

The choice of mode depends on distance and affordability. Roads are considered most viable for regional deliveries with 400–500 km. Trains are preferred for delivering goods between the cities up to a distance of 1200–1300 km. Beyond 1200–1300 km, movement of goods via sea is preferred. Large players on average move 60–80% of their steel through rail because of large catchment areas, while small players move 80–90% by road due to smaller catchment areas [MoS, 2023].

Rail share varies for companies depending upon the catchment area and ownership, SAIL has the maximum rail share of 85% followed by RINL [70%]. In private companies, TATA Steel has a maximum rail share of 60% followed by JIPL [20%] and AMNS [5%].

5.1.3 Fertilizers

India is an agriculture-based economy with over 47% [PIB, 2023] of the population dependent on agriculture, placing significant importance on the fertilizer industry. With a growing population, increasing agricultural output is crucial for food security. In 2023, India stood at 2nd position in both, Urea production and DAP production in the world and produced 11.38 MT of urea and 1.76 MT of DAP [FAI, 2023].

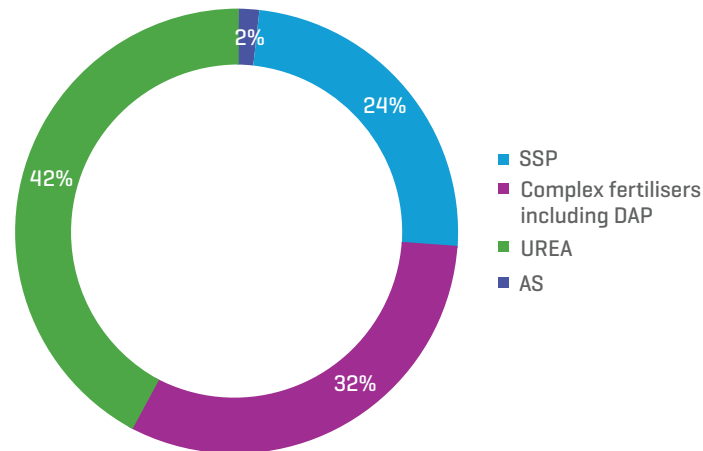


Figure 18: Product-wise production capacity
Source: FAI [2023]

In 2022–23, India had a production capacity of 60 million tonnes of fertilizers including 31.3 MT of Urea, 16 MT of DAP, and 12.3 MT of Single Super Phosphate [SSP] [FAI, 2023]. Figure 18 highlights that three major types of fertilizers are produced in India including Urea (52%) followed by DAP [with other complex fertilizers] and SSP [20%] [FAI, 2023].

Classified into nitrogen-based, phosphate-based, potassium-based, and complex fertilizers.

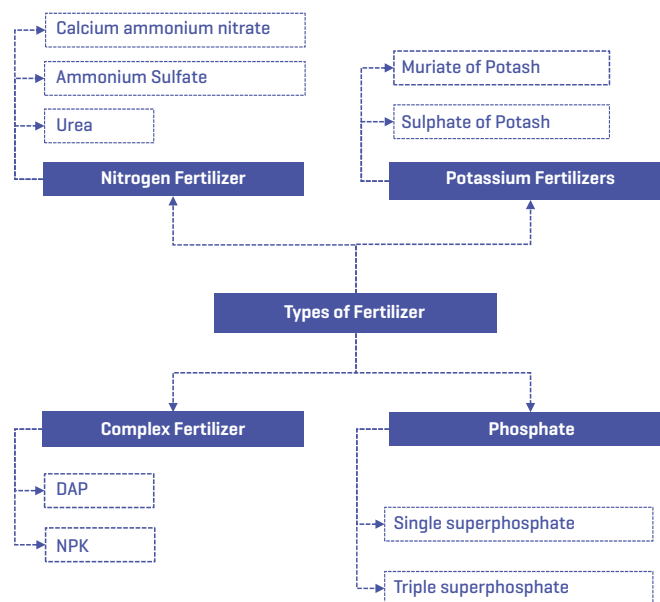


Figure 19: Types of fertilizers produced in India
Source: TERI

Nitrogen-based fertilizers, such as urea, ammonium sulphate, and calcium ammonium nitrate, are widely used in the agriculture sector. Phosphate-based fertilizers include single superphosphates and triple superphosphates. Potassium-based fertilizers like muriate of potash and sulphate of potash provide potassium and complex fertilizers include multiple nutrients, such as 18-46-0 [DAP] and 20-20-0. Different types of fertilizers have different applications in the agriculture sector increasing the nitrogen content in the soil for faster growth of plants and increased productivity.

Fertilizer Production in India

Fertilizer industries are located along the major gas pipelines and in the vicinity of ports.

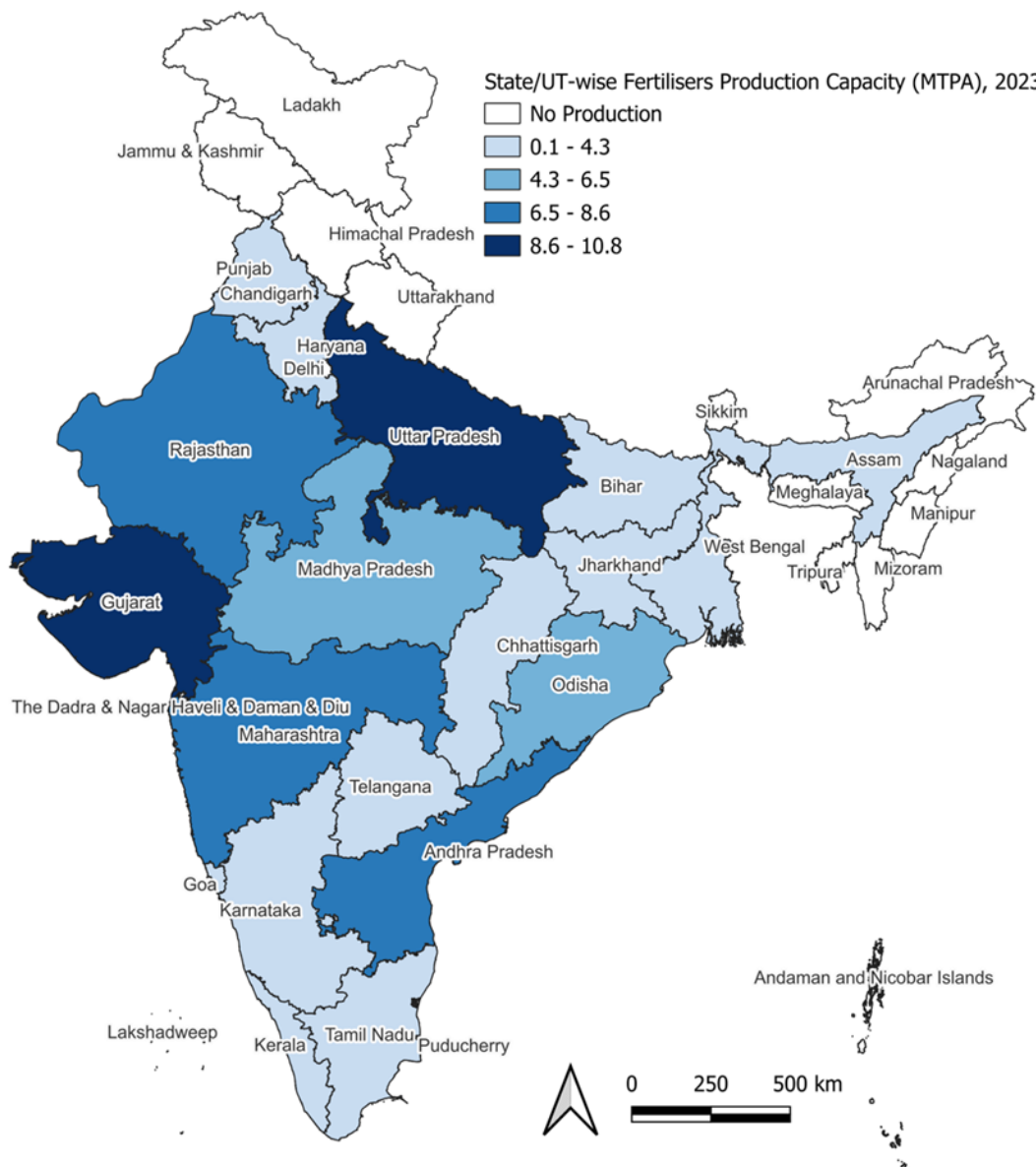


Figure 20: State/UT-wise fertilizers production capacity
Source: FAI [2023]

As per Figure 20, Gujarat [10.78 MTPA], Uttar Pradesh [9.48 MTPA], Maharashtra [7.15 MTPA], Andhra Pradesh [6.89 MTPA], and Rajasthan [6.83 MTPA], have the maximum production capacity. Collectively, these five states can produce about 60% of total fertilizers production of the country.

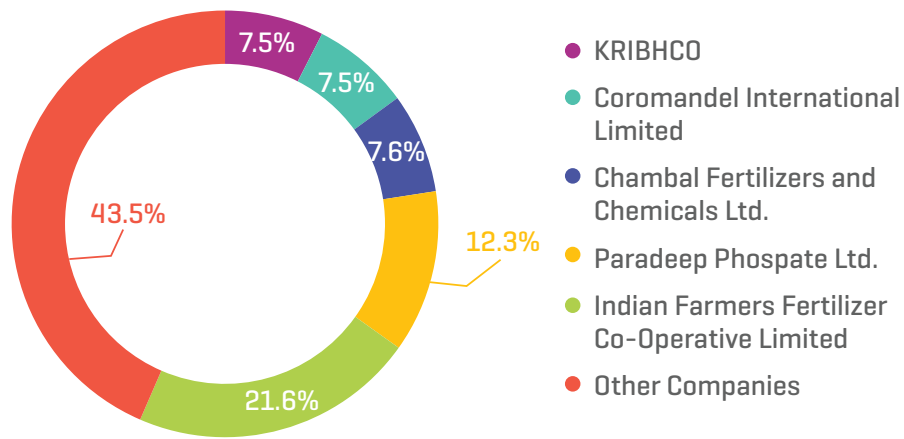


Figure 21: Production share of fertilizers company in India
 Source: FAI [2023]

Figure 21 illustrates that IFFCO, the largest cooperative leads the fertilizers sector and produced 9.5 MT of fertilizers in 2023. Three private companies, Paradeep Phosphate [12.3%], Chambal Fertilizers and Chemicals Limited [7.6%], and Coromandel International Limited [7.5%] are 2nd, 3rd and 4th largest producers, and produced 11.9 MT. KTRIBHCO is another cooperative that produced 3.3 MT of fertilizers which is 7.5% of total fertilizers production in 2023 [FAI, 2023].

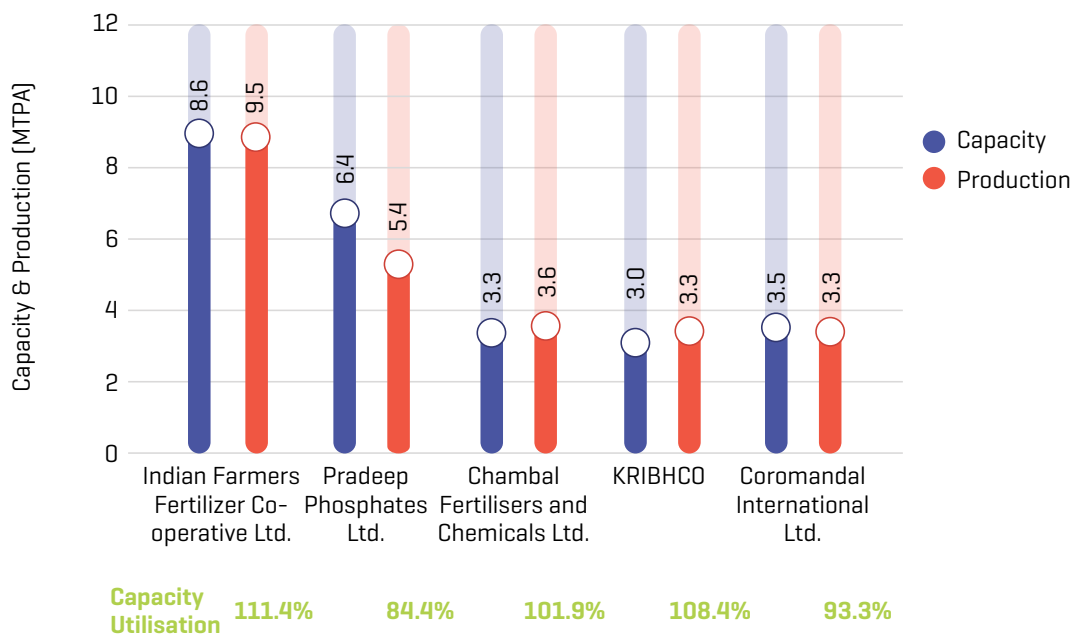


Figure 22: Production and capacity of major fertilizer companies
 Source: FAI [2023]

All the major producers of fertilizers in India are producing more than their defined capacity. Figure 22 outlines company-wise capacity utilization for various organizations.

Supply Chain

→ Raw material sourcing:

The supply chain in the fertilizer industry originates with raw material sourcing, where required raw materials such as phosphates, nitrates, and potash are transported to manufacturing plants after mining and procurement.

→ Logistics of raw material:

The logistics of raw materials to the manufacturing plants involve movement of liquid materials like natural gas and petroleum products via pipelines and other raw materials via trucks or rail depending upon the distance.

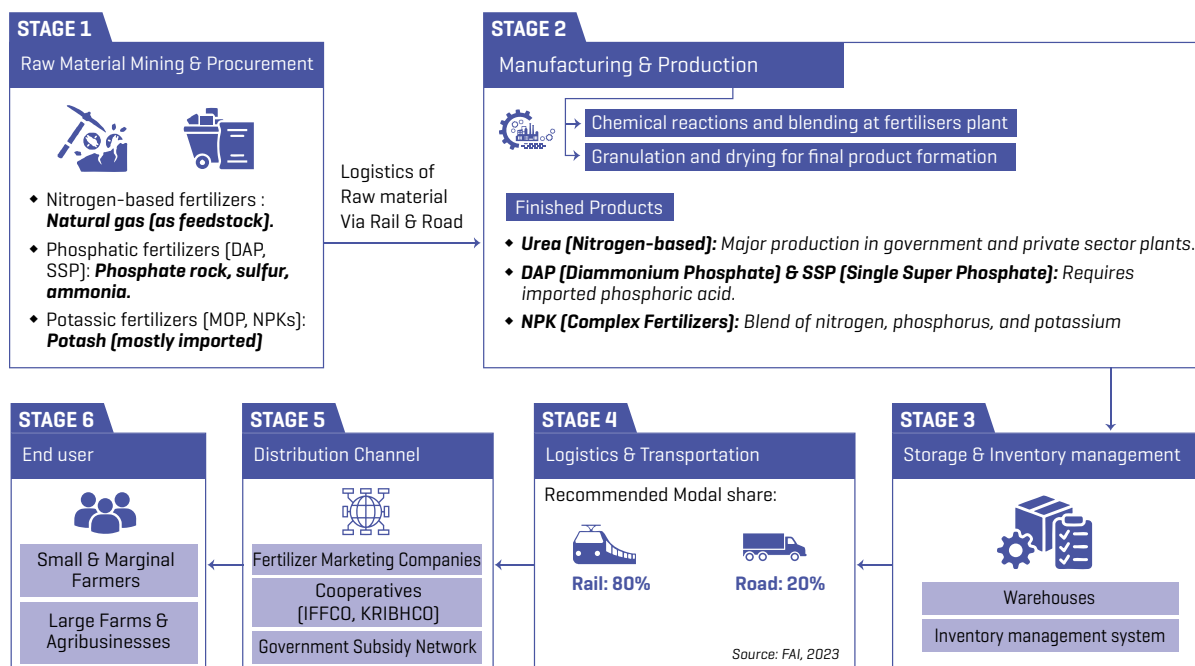


Figure 23: Supply chain of the fertilizer industry in India

Source: TERI

→ Manufacturing:

At the manufacturing stage, raw materials are processed into various types of fertilizers [including Urea, DAP, NPK, etc.]

→ Storage:

Once produced, they are stored in warehouses through storage and inventory management systems.

→ Transportation & distribution channel:

From manufacturing plants, fertilizers are transported to retail and end-use points through various distribution channels, which include state cooperative marketing federations, state agro-industries, corporations, commodity federations, and marketers/wholesalers. These distribution networks further depend on road freight to reach district and village-level cooperatives or private retail dealers, ensuring fertilizers are accessible at the local level. Most fertilizer supplies are transported by road within a 200–250 km radius from the plant, as road transport is preferred for distances up to this range [Randive et al., 2022].

As per Annual Statistical Statement (2023–24), Indian Railways transported 58.94 MT fertilizers as bulk commodity. The rail freight charges typically range between ₹1.1 and ₹1.5 per tonne per kilometre (as per rate class 130A), making it a more cost-effective option for bulk commodity movement over long distances. Road transport is crucial for the last-mile delivery of fertilizers. It facilitates distribution from rail or ports to local markets. Given the flexibility and reach of road networks, especially in rural and remote areas, road transport is integral to ensure that fertilizers are accessible to the end-user. The final stage is customer delivery, where fertilizers are transported to farmers and end-users via road networks.

Transport Modes and Modal Share

The fertilizer sector relies heavily on rail for the transportation of goods due to its affordability and connectivity. Historically, the modal share for fertilizers fluctuated between 73% and 83% till 2013. In 2013–2014, the Department of Fertilizers issued directives to suppliers to maintain minimum ratio of 80:20, i.e., 80% of the total quantity to be moved via rail and 20% by road (FAI, 2023).

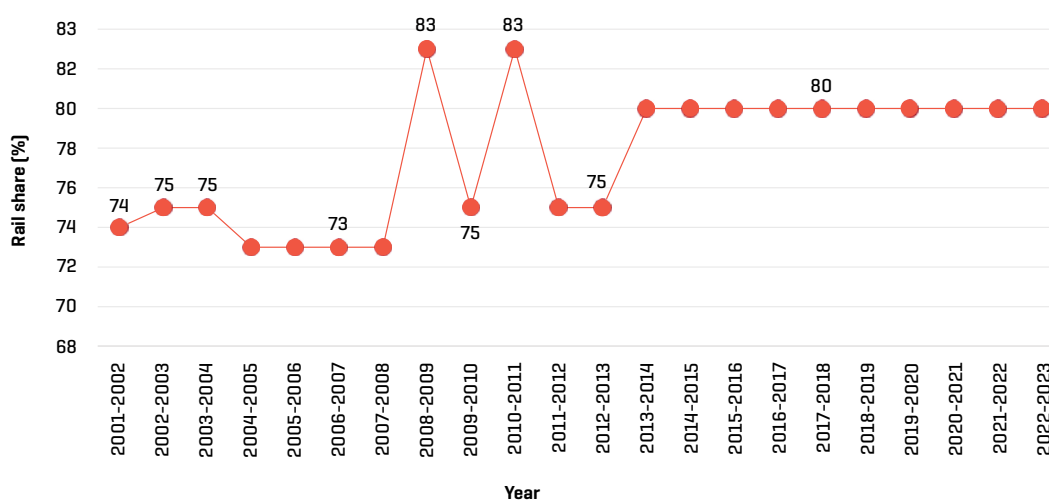


Figure 24: Rail share variation in fertilizer movement
 Source: FAI (2023)

Aligning with the directive, IFFCO dispatched 90% of goods via rail (IFFCO, 2024), and Madras Fertilizers achieved a rail-to-road ratio of 86:14 for urea movement. In 2023, the average lead for the final product was 827 km and rail moved about 54,753 tonnes of fertilizers.

5.1.4 Aluminium

Aluminium is the second most used metal in the world and is growing at the fastest rate, with applications in various sectors like power, transportation, building, construction, packaging and many more. India is the fourth largest producer of aluminium in the world producing 5.3% of global aluminium output. In 2023–2024, India produced 4.1 MT of aluminium, 2.1% more than the previous year with a production capacity of 4.14 MT (Ministry of Mines, 2024). Aluminium consumption in India is at 2.7 kg per capita much below the global average of 11 kg per capita (Ministry of Mines, 2024).

Aluminium is mostly produced in the raw form of ingots, billets, wire rods, foil, etc., from the production plant which are later converted into required products.



Figure 25: Types of aluminium produced in India
 Source: Ministry of Mines [2023]

Companies specialize in producing diverse types of products such as Hindustan Aluminium Corporation Limited (HINDALCO) produces alumina, ingots, billets, and wire rods along with value-added products like flat rolled products, extrusion and foils. National Aluminium Company Limited (NALCO) produces wire rods, billets, strips, and rolled products. Bharat Aluminium Company Limited (BALCO) focuses on the production of extruded and rolled products, Properzi rods, foil products, conductors, and wire rods.

Aluminium Production in India

Most of the aluminium produced in India comes from four states, including Odisha, Chhattisgarh, Uttar Pradesh, and Madhya Pradesh. Odisha is the largest producer owing to the availability of bauxite ore used as raw material for producing aluminium.



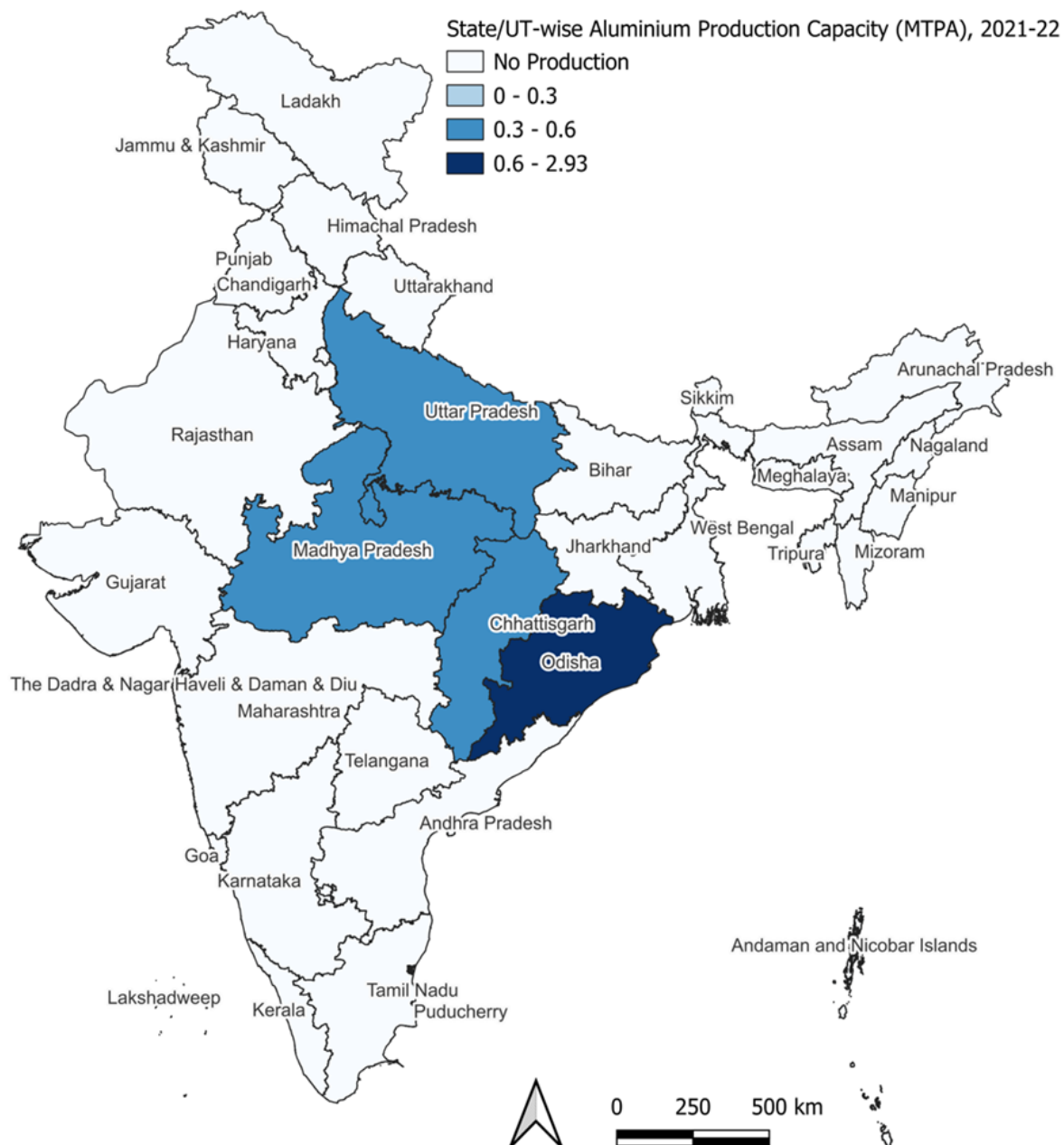


Figure 26: State/UT-wise aluminium production capacity
 Source: Ministry of Mines (2023)

Odisha has 68.3% of the national aluminium production capacity, followed by Chhattisgarh [13.85%], Uttar Pradesh [9.6%], and Madhya Pradesh [0.35%].

Major Producers in India

Indian aluminium sector is dominated by four companies in terms of market share, of which Vedanta, HINDALCO, BALCO are operated by private players and NALCO is the only government company. All three private companies produce 88.7% of the total countries' production.

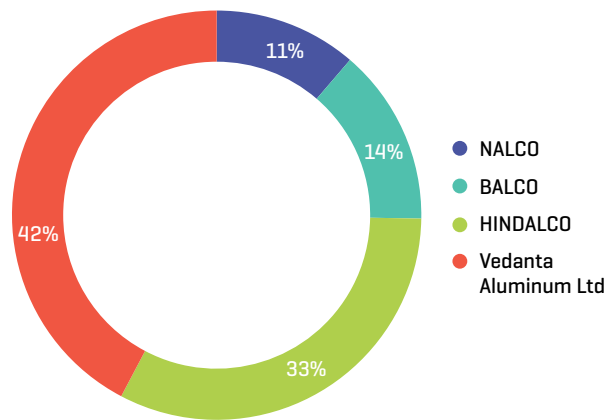


Figure 27: Production share of aluminium companies in India
 Source: Ministry of Mines [2023]

Vedanta leads the aluminium industry with a production share of 42% and Produced 1.7 MT of aluminium followed by HINDALCO contributing to 33% of production, BALCO [14%], and NALCO [11%] [MoM, 2023].

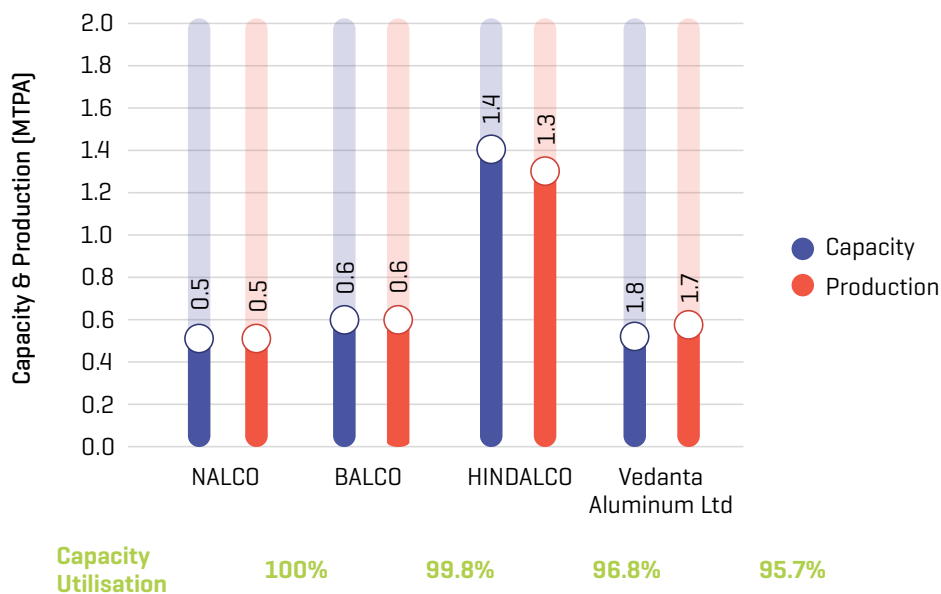


Figure 28: Production and capacity of major aluminium companies
 Source: Ministry of Mines [2023]

Companies in the aluminium industry are fairly utilizing their production capacity. Figure 28 shows that the capacity utilization of all the companies is above 95%.

Supply chain

→ **Raw material sourcing:**

The aluminium supply chain originates with raw material sourcing, where bauxite is mined and procured for processing.

- **Mining and procurement:** Mining and procurement activities involve the extraction of bauxite and its transportation to processing units.
- **Refining, processing & smelting:** The next stage, refining and processing, converts bauxite into alumina and further into aluminium through smelting.
- **Manufacturing and production:** At this stage, alumina is converted to finished product through a series of processes including smelting, rolling, casting, and extrusion.
- **Supply chain and inventory management:** The supply chain also incorporates storage and inventory management, which includes facilities like alumina silos and warehouses for aluminium ingots, ensuring smooth inventory handling and logistics.
- **Distribution channel:** Distribution channels play a vital role in coordinating logistics and transportation for both domestic and export markets. The freight operation primarily rely on road and rail transport for inbound and outbound movements, ensuring efficient delivery to industries such as automotive, construction, and packaging.

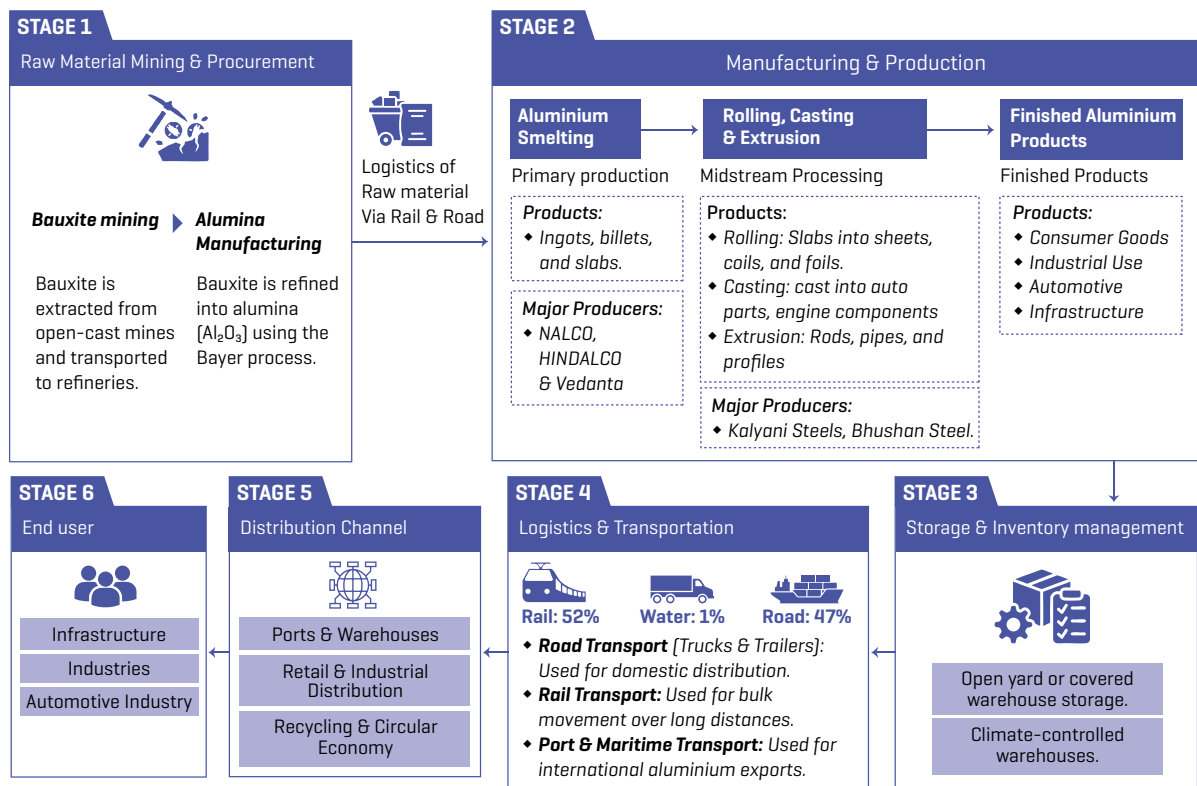


Figure 29: Supply chain of the aluminium industry
Source: TERI

5.2 Identification of Large Shippers

The priority sectors selected in the previous section significantly contribute to the economy and rely heavily on road transport for the distribution of their final products. Companies operating in these sectors oversee logistics and shipment of goods. As discussed, these companies/shippers use diesel-powered trucks to transport their final products, contributing significantly to GHG emissions. To include substantial fleet of trucks, top organizations in each priority sector were shortlisted.

This section highlights the methodology to identify the large shippers based on the data sourced from secondary sources.¹¹ The methodology for shortlisting top shippers varied across sectors owing to the availability of data. In Cement, Iron & Steel and Fertilizers shortlisting was necessary because of the presence of multiple companies. Conversely, in the Aluminium sector, top companies were directly selected based on production share, as limited players run the aluminium market in India. In detail, the methodology for companies' shortlisting and selection is illustrated in Figure 30.

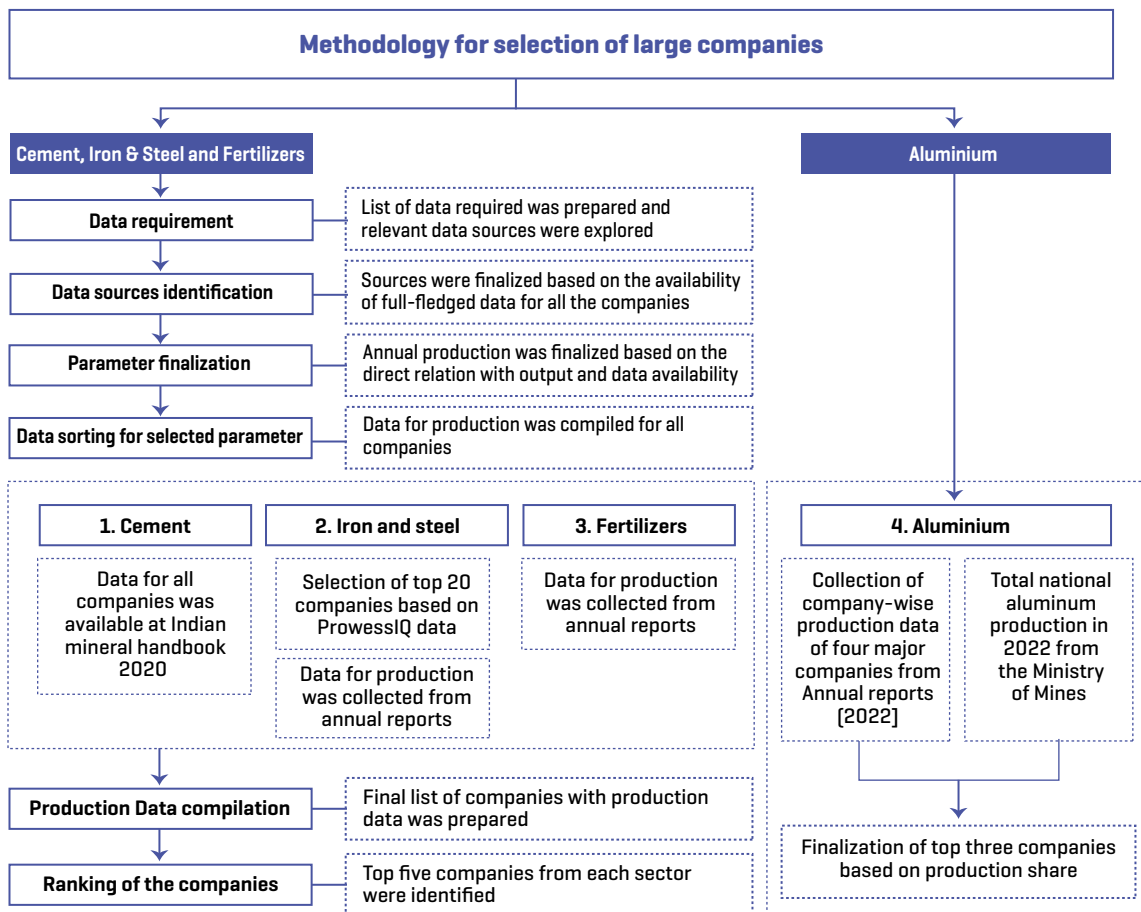


Figure 30: Methodology for shortlisting large shippers

Source: TERI

¹¹ Data from Annual reports, Indian Mineral Handbooks, ESG reports, Official websites, ProwessIQ, Joint Plant Committee, Indian Chronicle, and Fertilizer Association of India.

5.2.1 Identification of large shippers in cement, iron & steel and fertilizers

To shortlist major shippers, data related to production, capacity, annual turnover and volume of freight handled was sourced from Indian Mineral Yearbook (for cement) and Annual Reports. Further, expenditure on power and fuel was sourced from ProwessIQ (2022–23). Data related to market capitalization was also compiled from the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE).

To rank the large shippers, annual production was considered as it is directly proportional to the amount of output and was available for all the companies.

Shortlisting of Companies for Cement, Iron & Steel and Fertilizer Sectors

Production data for cement industries was ultimately sourced from the Indian mineral handbook for the year 2022. For Iron & Steel, the top five companies were selected by shortlisting based on sales data from ProwessIQ. Subsequently, the production data for all five companies was collected from their annual report for the year 2022–23. Production data for fertilizer industries was also collected directly from their annual reports for the year 2022–23, as the number of large companies were comparatively less.

Ranking of the companies

Companies were ranked based on annual production and a final list of the top five companies from each sector was prepared. To ensure accuracy, the final ranking was verified with ranking from secondary sources. Additionally, a second round of verification was done by shortlisting using other available parameters and no considerable variation was seen in the ranking. The final list of selected companies for each sector is provided in Table 8.

Table 8: List of top selected companies

Rank	Cement	Iron & Steel	Fertilizers
1	Ultratech Cement Limited	JSW	Indian Farmers Fertilizer Co-Operative Limited
2	Shree Cement	Tata Steel Limited	Paradeep Phosphate Ltd.
3	Ambuja Cement Limited	SAIL	Chambal Fertilisers and Chemicals Ltd.
4	ACC Limited	Jindal Steel & Power Limited	KRIBHCO
5	Dalmia Cement	Essar Steel Limited [ArcelorMittal Nippon Steel India (AMNS India)]	Coromandel International Limited
6	JK Cement	Rashtriya Ispat Nigam Limited	National Fertilisers Limited
7	Birla Cement Limited	Jai Balaji Industries Limited	Rashtriya Chemicals and Fertilizers Limited
8	Chettinad Cement	Jayaswal Neco Industries Limited	Madras Fertilisers Limited
9	Wonder Cement	Shyam Metals & Energy Limited	Gujarat State Fertilizers & Chemicals Limited
10	Ramco Cements	Vedanta Limited	Hindustan Urvarak & Rasayan Ltd.

Source: TERI

5.2.2 Identification of large shippers in aluminium sector

The aluminium sector in India is dominated by four major players including Vedanta, HINDALCO, BALCO, and NALCO. The production share of each company in national aluminium production was considered as the main parameter for selecting the companies for further study.



Table 9: Aluminium production landscape in India: key companies, capacities, and market share

Company	Type	Number of plants	Annual capacity [tonnes]	% of total production	Market share
Vedanta Aluminium Ltd	Private	(2) Jharsuguda-I (Odisha) Jharsuguda-II (Odisha)	17,22,000	42.3	88.7%
Hindalco Industries Ltd	Private	(4) Aditya (Odisha) Hirakud (Odisha) Mahan (MP) Renukoot(UP)	13,22,000	32.5	
Bharat Aluminium Co. Ltd	Private	(2) Korba (CG) - I Korba (CG)-II	5,69,000	14.0	
National Aluminium Co. Ltd	Public	(1)Angul (Odisha)	4,60,000	11.3	

Source: Ministry of Mines (2022)

Production data for the four companies and total national production was obtained from the annual reports (2022) and the Ministry of Mines. The top three companies Vedanta Aluminium Ltd, Hindalco Industries Ltd and Bharat Aluminium Company Ltd (BALCO) were selected for further analysis, as they collectively produced 88.7% of aluminium produced in the country.





6

GHG Emissions from Identified Shippers

The chapter highlights the trend of Scope 3 emissions associated with the shortlisted shippers, specifically focusing on category-4 (upstream transportation and distribution) and category-9 (downstream transportation and distribution).

The GHG Protocol Corporate Standard classifies a company's GHG emissions into three scopes as follows:

Scope 1 emissions refer to direct GHG emissions from sources that are owned or controlled by an organization, such as fuel combustion in company-owned boilers, furnaces, and vehicles, as well as emissions from industrial processes. However, direct CO₂ emissions from biomass combustion and non-Kyoto Protocol gases like CFCs and NO_x are excluded from Scope 1 and reported separately.

Scope 2 emissions account for indirect GHG emissions from purchased electricity, steam, heating, and cooling consumed by an organization. These emissions physically occur at the power plants generating energy but are attributed to the organization using electricity.

Scope 3 emissions encompass all other indirect emissions occurring in an organization's value chain, including both upstream and downstream activities. These can arise from the extraction and production of purchased materials, transportation of goods, employee commuting, and the use and disposal of solid products.

Since this study focusses on road freight transport, Scope 3 emissions are of utmost importance. This chapter aims to explore the relevance of Scope 3 emissions, with a particular emphasis on emissions originating from the transportation sector within energy-intensive industries. The discussion begins with analyzing the status of emissions monitoring and reporting by leading companies in the identified sectors, providing an overview across various emissions scopes.

6.1 Monitoring and Reporting GHG Emissions

To evaluate the status of monitoring and reporting of emissions, data for top shippers under the priority sectors were considered.

In the Cement sector, all five companies report and monitor all three emissions and approximately 75.8% of emissions fall under the Scope 1 category, followed by 19.7% falling under Scope 3, and only 4.6% under Scope 2. Figure 31 highlights that companies such as Dalmia Cement, ACC Limited, Ambuja Cement, and Ultratech Cement contribute significantly to Scope 3 emissions. A variation can be noted in the share of Scope 3 emissions, and this disparity can be attributed to the differences in the number of Scope 3 emissions categories considered. Ultratech and Shree Cement considered 7 categories out of 15 categories, while ACC Cement reported emissions across 11 categories of Scope 3 emissions. Dalmia, however, didn't disclose the categories considered.

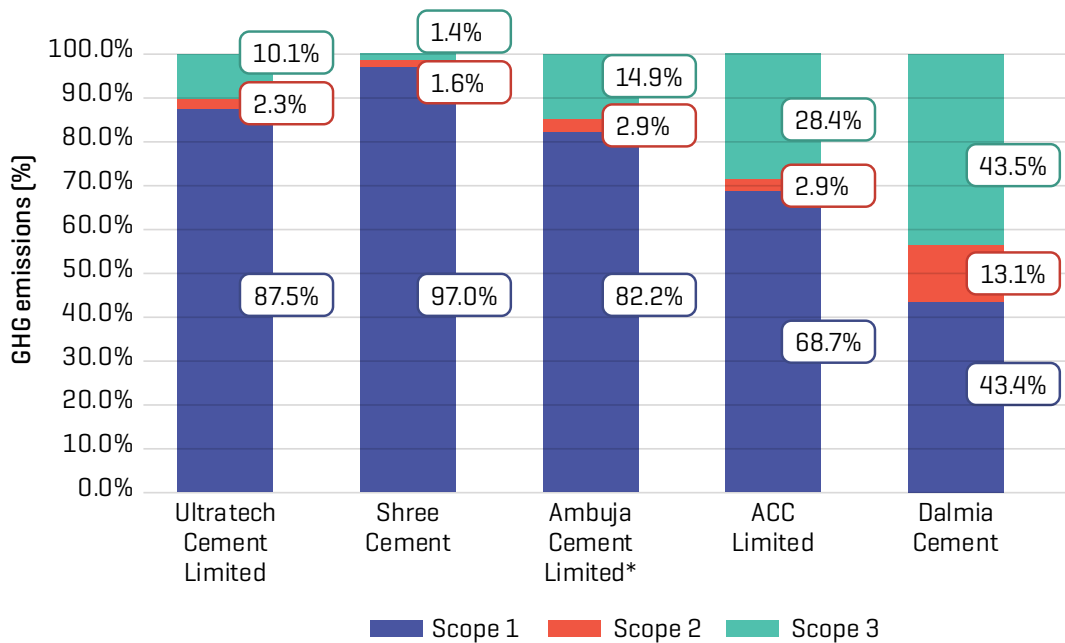


Figure 31: GHG emissions from cement sector
 Source: TERI

In the Iron & Steel sector JSW, TATA Steel, SAIL and AMNS report and monitor all three emissions. Most of the emissions from this sector fall under the Scope 1 category, accounting for approximately 89.8%, followed by Scope 3 emissions at 5.7%, and Scope 2 emissions at 5%. As shown in Figure 32, Scope 3 emissions are the second highest category in this sector and major players such as JSW and SAIL have a notable share of Scope 3 emissions.

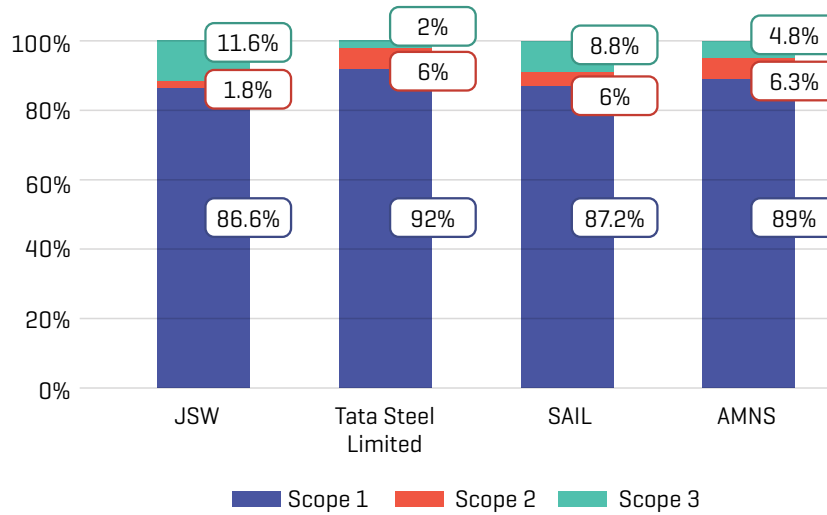


Figure 32: GHG emissions from the iron & steel sector

Source: TERI (2023-24)

Note: Data for all companies pertain to FY 2023-24

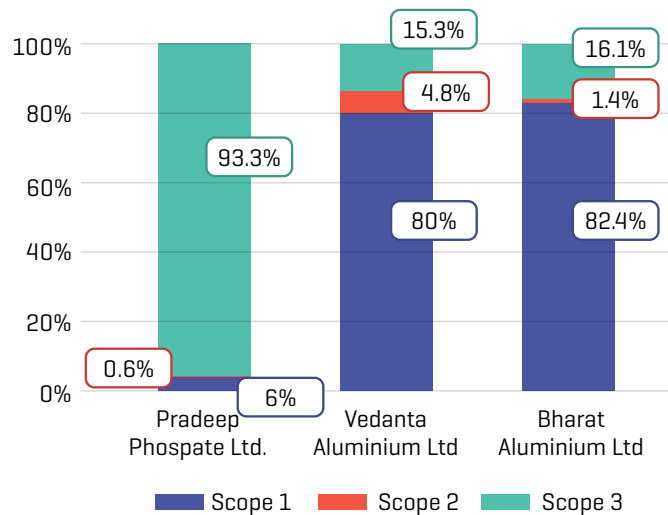


Figure 33: GHG emissions from fertilizers & aluminium sectors

Source: TERI

Note: Data for Pradeep Phosphate Ltd & Bharat Aluminium Ltd. pertains to FY 2023-24, and for Vedanta Aluminium Ltd it pertains to FY 2021-22

In the fertilizers sector, Pradeep Phosphate is the only company that reports and monitors Scope 3 emissions. Figure 33 explains that the Pradeep phosphate has the highest share of Scope 3 emissions of 93.3% of total emissions, followed by 6% under Scope 1 emissions and 0.6% under Scope 2.

In the case of the aluminium sector, most of the emissions fall under Scope 1, accounting for approximately 84.8%, followed by Scope 3 emissions at 16.4% and Scope 2 emissions at 3%. Figure 33 explains that both the aluminium companies, Vedanta and BALCO, report and monitor all the emissions and have a significant share of Scope 3 emissions.

In conclusion, many companies still do not report and monitor all three emissions, especially the Scope 3 emissions. Additionally, there is an inconsistency in considering categories out of the given 15 categories while calculating Scope 3 emissions.

Meanwhile, across sectors such as Cement, Iron & Steel, Fertilizers, and Aluminium, Scope 3 emissions constitute a significant portion of total emissions. This highlights the need to report, monitor, and plan to reduce Scope 3 emissions.

6.2 Significance of Scope 3 GHG Emissions

As highlighted in Figure 34, Scope 3 is further categorized into 15 distinct categories.

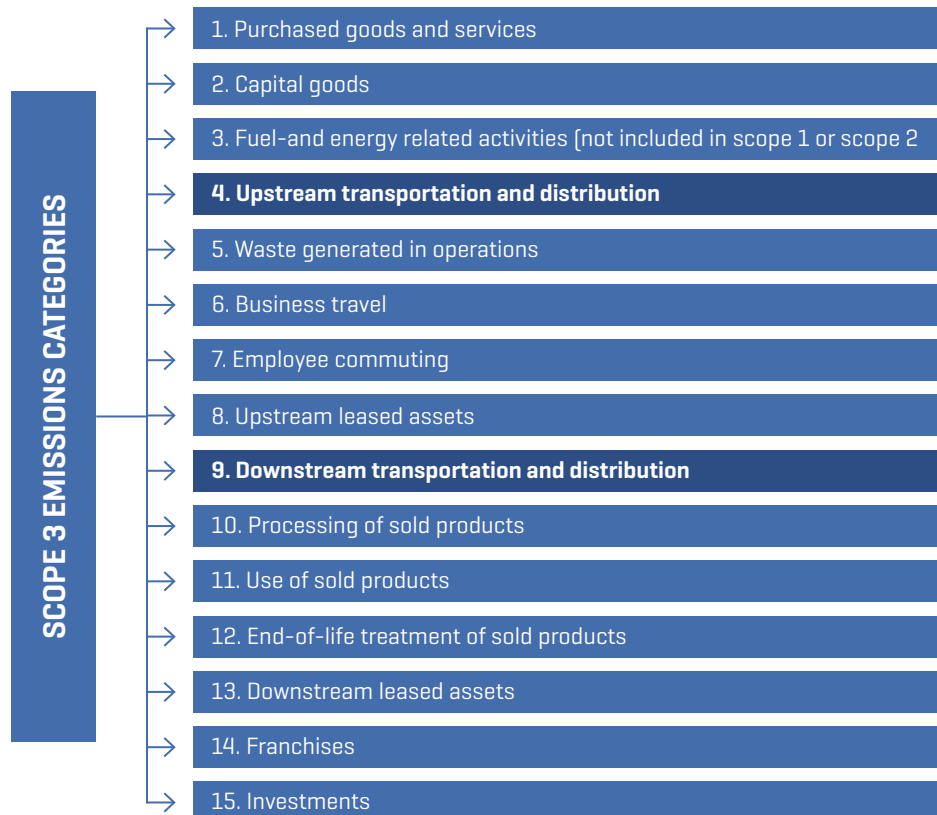


Figure 34: Sub-categories under Scope 3 emissions
Source: GHG protocol (2013)

6.2.1 Trends in Scope 3 emissions

To analyze the trend in Scope 3 emissions, a sector-wise assessment was conducted. Among the top 18 companies, 10 companies provided data for Scope 3 emissions. This data enabled a sector-wise analysis, providing insights on patterns and variation of Scope 3 emissions.



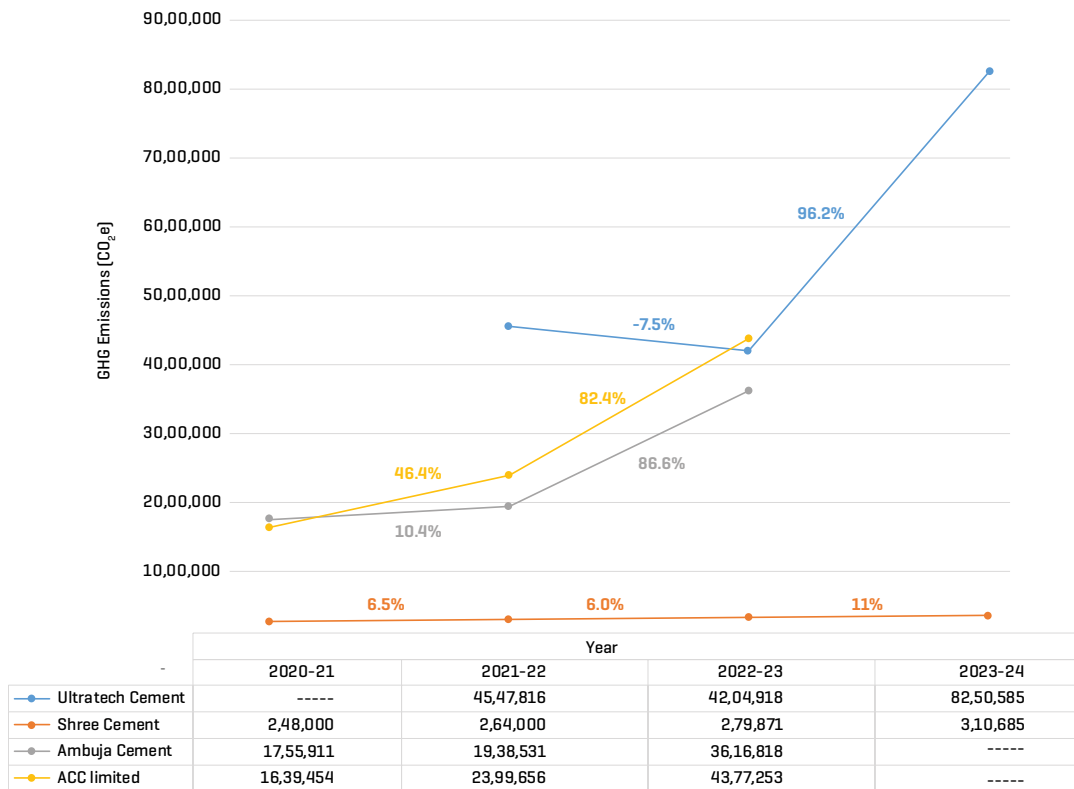


Figure 35: Variation of Scope 3 emissions in cement industry
 Source: TERI

Scope 3 emissions from the Cement sector are on the rise, as shown in Figure 35, which highlights the company-wise trend. Ultratech Cement shows the maximum increase, with Scope 3 emissions rising by 96.2% in 2023-24 from the previous year. ACC Limited and Ambuja Cement show an increase of 82.4% and 86.6 % for 2022-23. A constant increase in the Scope 3 emission can be seen for Shree Cement, increasing by 11% in 2023-24. The rise in the Scope 3 emissions could also be due to the consideration of more categories out of the 15 categories given. This rising trend of Scope 3 emissions highlights the significance of Scope 3 emissions in the cement sector.

The Iron & Steel sector also shows a significant increase in Scope 3 emissions, as explained in Figure 36. JSW reported a magnificent increase, with Scope 3 emissions soaring 4 times [444.1%] for the year 2023-24. In contrast SAIL reported a decline of 5.7% in Scope 3 emissions. For TATA Steel and AMNS, Scope 3 emissions showed increase of 6.3% and 1.6%, respectively.



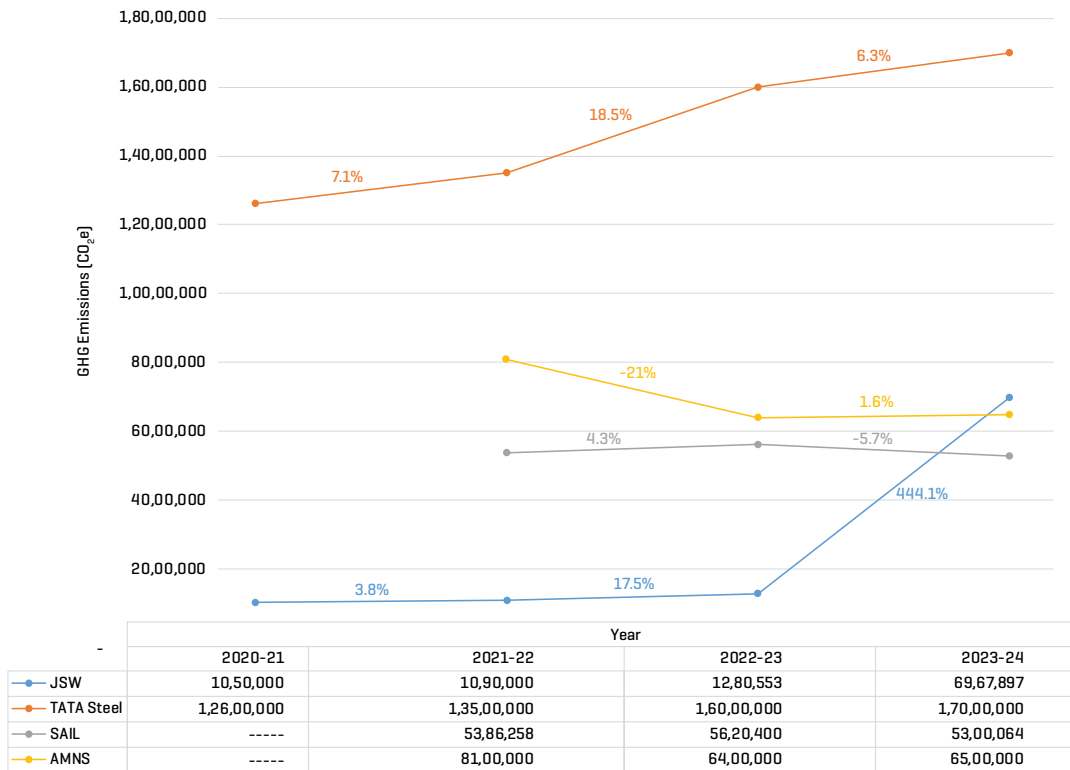


Figure 36: Variation of Scope 3 emissions in iron & steel sector
Source: TERI

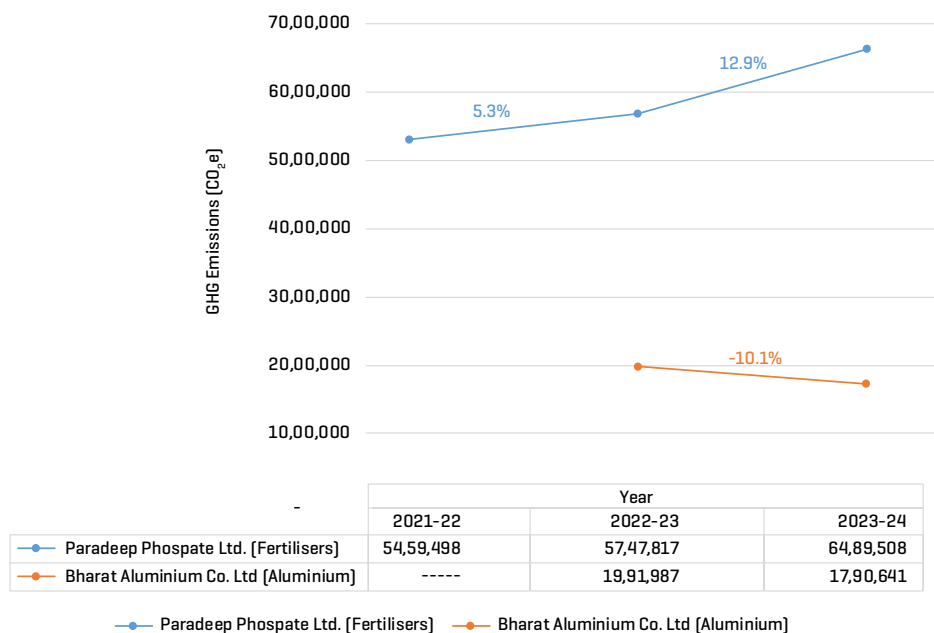


Figure 37: Variation of Scope 3 emissions in fertilizers & aluminium sector
Source: TERI

Sector-wise trend for both Fertilizers and Aluminium sector was not assessed due to unavailability of data. However, trend for one company from each sector was analyzed. Paradeep Phosphate from Fertilizers sector recorded an increase of 12.9% for Scope 3 emissions for 2023-24. In contrast, BALCO reported a decline of 10.1% in Scope 3 emissions for the same period.

Scope 3 emissions for all the companies mentioned are increasing, as indicated by the data extracted from their annual and integrated reports. This increase may be due to higher production or a shift in transportation modes towards roadways for both upstream and downstream activities. Another potential reason could be the consideration of more categories in subsequent years for calculating Scope 3 emissions. Please note that the analysis is based on the available data and may undergo change with more availability of information.

Companies like Ultratech Cement in the Cement sector and JSW in the Iron & Steel sector recorded a soaring rise in Scope 3 emissions. Hence, there is an urgent need to focus on Scope 3 emissions and develop strategies to control and reduce them.

6.3 Emissions from the Transportation Sector

This study focuses on HDVs; therefore, Category 4 & Category 9 are the most relevant categories. Category 4 [Upstream transportation and distribution] encompasses emissions generated from the HDV transporting raw material to the production unit and Category 9 [Downstream transportation and distribution] includes the emissions from the HDV used for transporting final products from the production unit.

Six companies provided category-wise data for Scope 3 emissions, including Ultratech Cement, Shree Cement, and Ambuja Cement from Cement sector, Tata Steel limited from Iron & Steel sector, Paradeep Phosphate Ltd from Fertilizers sector and Vedanta from Aluminium sector.

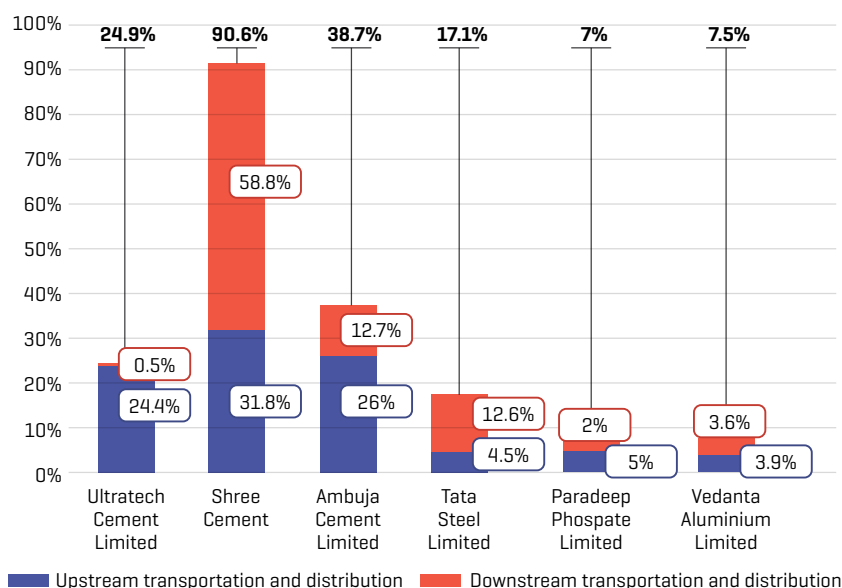


Figure 38: Emission related to transport in Scope 3 emissions

Source: TERI

Note: Data for all companies pertain to FY 2023-24, except for Ambuja Cement, Paradeep Phosphate Limited and Vedanta Aluminium limited, which is for FY 2022-23

Shree Cement recorded the highest share of 90.6% of Scope 3 emissions from transport, including both upstream and downstream, followed by Ambuja Cement at 38.7% and Ultratech Cement at 24.9%. The reason for such a high variation in the share of transport is due to the variation in the number of categories considered while calculating Scope 3 emissions by each company. In the Iron & Steel sector, Tata Steel recorded 17.1% of its Scope 3 emissions from transport. In the fertilizer sector, Paradeep phosphate and in the Aluminium sector, Vedanta reported 7% and 7.5% of Scope 3 emissions from the transport sector. The transport sector contributes significantly to Scope 3 emissions, as illustrated in Figure 38, and should be prioritized for emission reductions.



Indane इण्डेन

SHRIMPATI TRUCKS PONDICHERRY VARTHIKAM
SHRIMPATI TRUCKS PONDICHERRY VARTHIKAM

A.S.T TRANSPORTS

I.P. Ashok Leyland GAS

TN.52
L.1386



7

Conclusion

- ▶ **Launch of a Dedicated Clean Freight Program:** India should establish a Clean Freight Program modelled on international initiatives like SmartWay (USA), Lean & Green (Europe), and PLVB (Brazil). This approach would systematically drive freight decarbonization while creating economic incentives for cleaner logistics. Globally, clean freight programs such as SmartWay (USA and Canada), Lean & Green (Europe), and PLVB (Brazil) have successfully promoted low-emission and fuel-efficient logistics by fostering collaboration between shippers and carriers. For instance, SmartWay program in the USA is a voluntary EPA-led initiative that helps in reducing emissions from freight sector and improving supply-chain efficiency. These programs incentivize fleet-efficiency improvements through benchmarking, recognition, and shared best practices. India could adopt a similar approach by implementing a clean freight program integrated within CCTS, targeting Scope 3 emissions from road freight. By setting voluntary emissions reduction targets, large shippers can drive carriers to adopt fuel-efficient or zero emission technologies, leading to reduced emissions. **Integrating the emissions reduction with carbon credits trading can create an additional revenue stream for shippers and carriers,** while encouraging competition and fleet level performance among carriers.
- ▶ Currently, the Securities and Exchange Board of India (SEBI) has mandated top 1,000 listed organizations to report emissions through Business Responsibility and Sustainability Reporting (BRSR) framework. However, the analysis showed that very few organizations report category-wise Scope 3 emissions, highlighting the **need for mandatory Scope 3 emissions (category-wise) reporting to ensure comprehensive emissions data.**
- ▶ Based on the comparative assessment of various methodologies for quantifying and reporting GHG emissions in road freight transport, **ISO 14083:2023 stands out as the most comprehensive and globally applicable standard.**
- ▶ With the initiation of Indian Carbon Market under CCTS, there is a **huge opportunity for the road shippers and carriers to leverage the monetary benefit** (in terms of carbon credits) by adopting efficient technologies.
- ▶ Regulatory body may initiate the **inclusion of Scope 3 emissions reduction under the priority sectors identified in this study (Cement, Iron & Steel, Fertilizers, and Aluminium).** For this, regulatory body may focus on top five organizations under the sectors identified.
- ▶ While the focus would be on shippers for emission reduction targets, the actual reduction potential lies with their carriers. Shippers may be encouraged to collaborate with their carriers and prioritize those demonstrating strong fleet efficiency measure. **Establishing a carrier rating system** linked to clean freight program can incentivize carriers to adopt cleaner practices, as **higher-rated carriers would gain preferential business and recognition.** This approach would enable shippers to lower their Scope 3 emissions and foster a mutually beneficial ecosystem that rewards sustainability efforts.





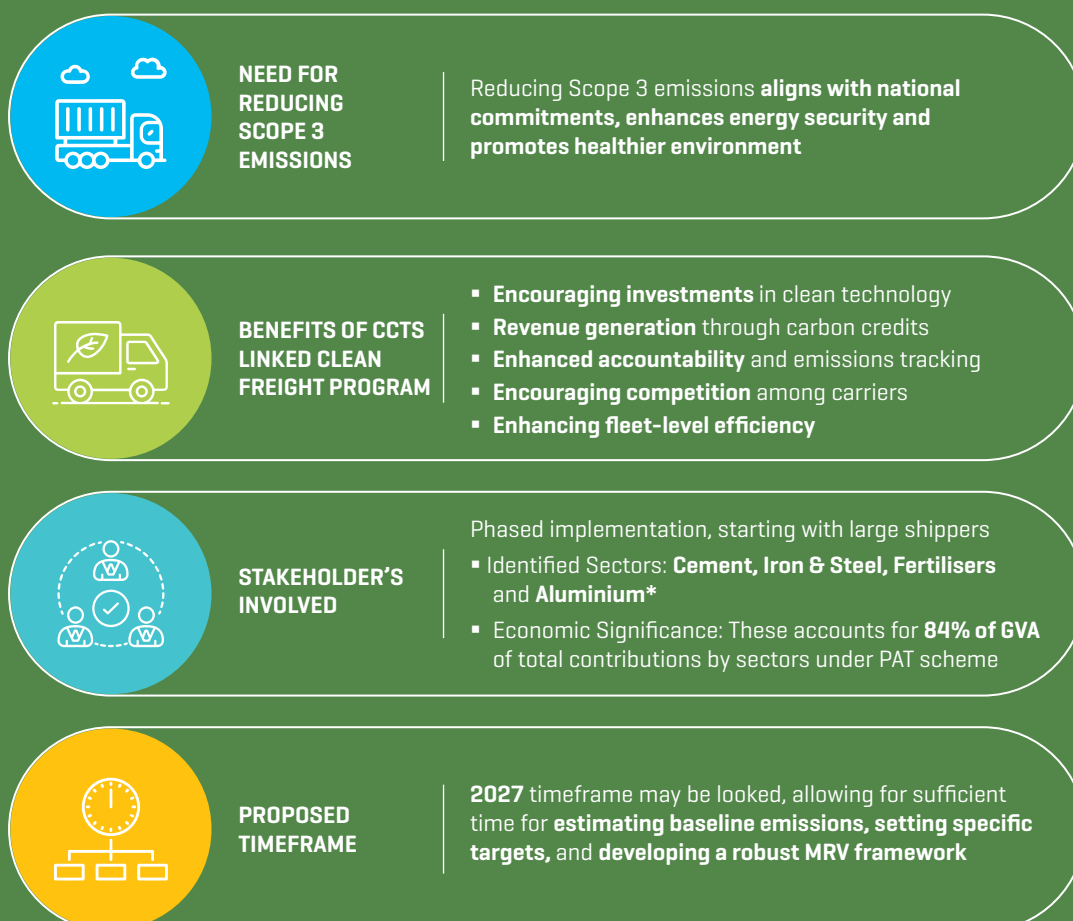
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Proposed Inclusion of Large Shippers under CCTS

While Scope 3 emissions fall outside the direct control of shippers, they still play a key role in driving reductions by engaging with their carriers. This depends on the strength of the business case and the level of coordination between the shipper and carriers. Further, since the focus is to drive sector-specific emissions reduction, the entities eligible under each sector, i.e., the shippers are the primary stakeholders.

Going forward, it is crucial to include Scope 3 mitigation measures by large shippers under CCTS. The scope of implementing a clean freight program in India, focusing initially on large shippers has been highlighted in Figure 39. Implementing a Clean Freight Program offers numerous advantages for both the environment and the economy, as follows:

- ▶ **Encouraging Investment in Clean Technologies:** It would encourage carriers to invest in fuel-efficient or zero emission technologies, eventually decarbonizing their road freight operations.
- ▶ **Revenue Generation through Carbon Credits:** By participating in carbon credit trading, shippers can create an additional revenue stream while contributing to overall emission reductions.
- ▶ **Enhanced Accountability and Transparency:** The program promotes greater accountability and transparency within trucking organizations, facilitating better tracking of emissions and operational efficiencies.
- ▶ **Encouraging Competition Among Carriers:** Once implemented, the program will trigger among carriers, driven by shippers' demand for more efficient and environmentally friendly transport solutions.
- ▶ **Enhancing Fleet-Level Efficiency Opportunities:** The Clean Freight Program also opens avenues for enhancing fleet-level efficiency, ultimately contributing to reduced operational costs and improved service delivery.



* Based on secondary research conducted by TERI

Figure 39: Proposed inclusion of large shippers under CCTS

Source: TERI

The program will adopt a phased implementation approach, focusing initially on large shippers.

- ▶ Identified sectors: The sectors identified for initial engagement include Cement, Iron & Steel, Fertilizers, and Aluminium. These sectors have been already under PAT scheme, making them suitable candidates for this program.
- ▶ Major shippers under identified sectors: Top three organizations under each sector could be targeted, due to the ease of data availability which will facilitate accurate emissions estimation from their transport operations.
- ▶ Economic significance: The Cement, Fertilizer, Aluminium and Iron & Steel sectors are critical contributors to the economy, collectively accounting for approximately 84% of the Gross Value Added (GVA) of the relevant industries, alongside a significant number of Designated Consumers (DCs).



Implementing a Clean Freight Program requires a **structured, phased approach**. **2027 timeframe** may be looked for incorporating these sectors into CCTS. This will allow **sufficient time for essential steps**, including **estimating baseline emissions, setting specific targets**, and **developing a robust Measurement, Reporting and Verification (MRV) framework**.

The inclusion of large shippers under CCTS will ensure long-term sustainability and industry-wide adoption. BEE, in collaboration with line ministries such as the Ministry of Road, Transport and Highways (MoRTH) and industry may establish a **dedicated framework for freight emissions accounting**, which will aid in estimating baseline emissions from road freight shippers. This could include **developing sector-specific guidelines for Scope 3 emissions reporting**, integrating **performance-based targets for shippers** and ensuring standardized data collection and verification.

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10

Annexures

10.1 Annexure-I

List of Organizations [under TERI CBS] considered for ESG Analysis

3M	Fourth Partner Energy Ltd
ACC Limited	GAIL (India) Limited
Adani Green Energy	GEF Capital Partners
AIC of India	GHCL Ltd
Airport Authority of India [AAI]	Greenko Group
Amplus Energy	Grundfos Pumps India Pvt. Ltd
Apraava Energy	Gujarat Fluorochemicals
Ashok Leyland	HCL Technologies
Atul Ltd	HDFC Bank
Avaada Group	HeidelbergCement India Limited
Axis Bank	Henkel Adhesives Technologies India Pvt. Ltd
BASF India Ltd	Hero Future Energies
Bayer Group of Companies in India	Hero MotoCorp Group
BGR Energy Systems Ltd	HINDALCO
Bharat Aluminium Co. Ltd	Hindustan Petroleum Corporation Ltd
Bharat Heavy Electricals Ltd	Hindustan Zinc Limited
Bharat Petroleum Corporation Ltd	Hiranandani Energy
BillerudKorsnäs Packaging India Pvt. Ltd.	Hitachi India Trading Pvt. Ltd
BMW Group	HSBC India
BP India Services Ltd.	IDBI Bank
Britannia Industries	India Power Corporation Ltd
BSES Rajdhani Power Ltd	Indian Farmers Fertiliser Cooperative Ltd
Capgemini	Indian Oil Corporation Ltd
Central Electricity Authority	Indus Towers Ltd
CESC Ltd	Infosys Technologies Ltd
Chambal Fertilisers and Chemicals Ltd	ITC Ltd - Paperboards & Specialty Papers Div
Coca Cola India	Jain Irrigation Systems Ltd
Cochin Shipyard	Jindal Stainless Ltd
Coromandel Fertilisers	Jindal Steel and Power Ltd
Dabur India	Johnson Matthey India Pvt. Ltd
Dalmia Cement [Bharat] Ltd	JSW Cement
Dalmia Cement Group	JSW Group
Danfoss Industries Pvt. Ltd	Jubilant Group
DCM Shriram Consolidated Ltd	Kotak Mahindra Bank
DIAL GMR Group	Lupin Limited
Dr Reddy's Laboratories Ltd	Magarpatta City
DS Group of Companies	Mahindra Group
E.I. DuPont India Private Ltd	Mahindra Susten
Eaton Technologies Pvt. Ltd	Mahindra Waste to Energy
Exide India	Marico Industries
Exim Bank	Maruti Suzuki India Limited

Mondelez International	SAP India
Mother Dairy	Schneider India
Mundra Solar Pvt. Ltd [Adani Solar]	Seshasayee Paper and Boards Ltd
National Fertilizers Limited	Shell India
Nestle India	Shree Cement
NMDC Ltd	Shree Digvijay Cement Co. Ltd
NTPC Ltd	Standard Chartered Bank
Numaligarh Refinery Ltd	State Bank of India
Nuvoco Vistas Corp Ltd.	Steel Authority of India Ltd.
Oil and Natural Gas Corporation Ltd	Tata Chemicals Limited
Oil India Ltd	Tata Cleantech Capital
Perfetti Van Melle India Pvt. Ltd.	Tata Motors Limited
Pernod Ricard	Tata Power
Pidilite Industries Ltd	Tata Projects Ltd
Power Grid Corporation of India Ltd	Tata Steel Limited
PTC Financial Services Ltd	Toyota Kirloskar Motor Pvt. Ltd
PTC India Ltd	TVS Motors Ltd
RBL Bank	Ultratech Cement
REC Ltd [Rural Electrification Corporation]	UPL Ltd
Reliance Industries Limited	Usha Martin Ltd
ReNew Power	Wipro Limited
SABIC	Yara Fertilisers India Pvt. Ltd

10.2 Annexure-II

Table 10: Sources of production data for each sector

Sectors	Source of production data
Cement	Indian Mineral Handbook 2022
Iron and Steel	Sales data from ProwessIQ Production data from Annual Reports [2021-22]
Fertilizers	Annual Reports [2022-23]

Source: TERI



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The Energy and Resources Institute (TERI)
Transport and Urban Governance Division, TERI
Core - 1B, 3rd Floor, Indian Habitat Centre,
Lodhi Road, New Delhi 110003, India
Tel: +91 11 2468 2100 or 2433 9605
Email: mailbox@teri.res.in | **Web:** www.teriin.org