India’s Freight Transition and Lessons from the Region

HDV Fuel Economy, Clean Freight Program and the Critical Role of Railways

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The Energy and Resources Institute
Creating Innovative Solutions for a Sustainable Future

HDV Fuel Economy Regulation (Supply-Side Intervention)

HDV Fuel Economy Norm Study

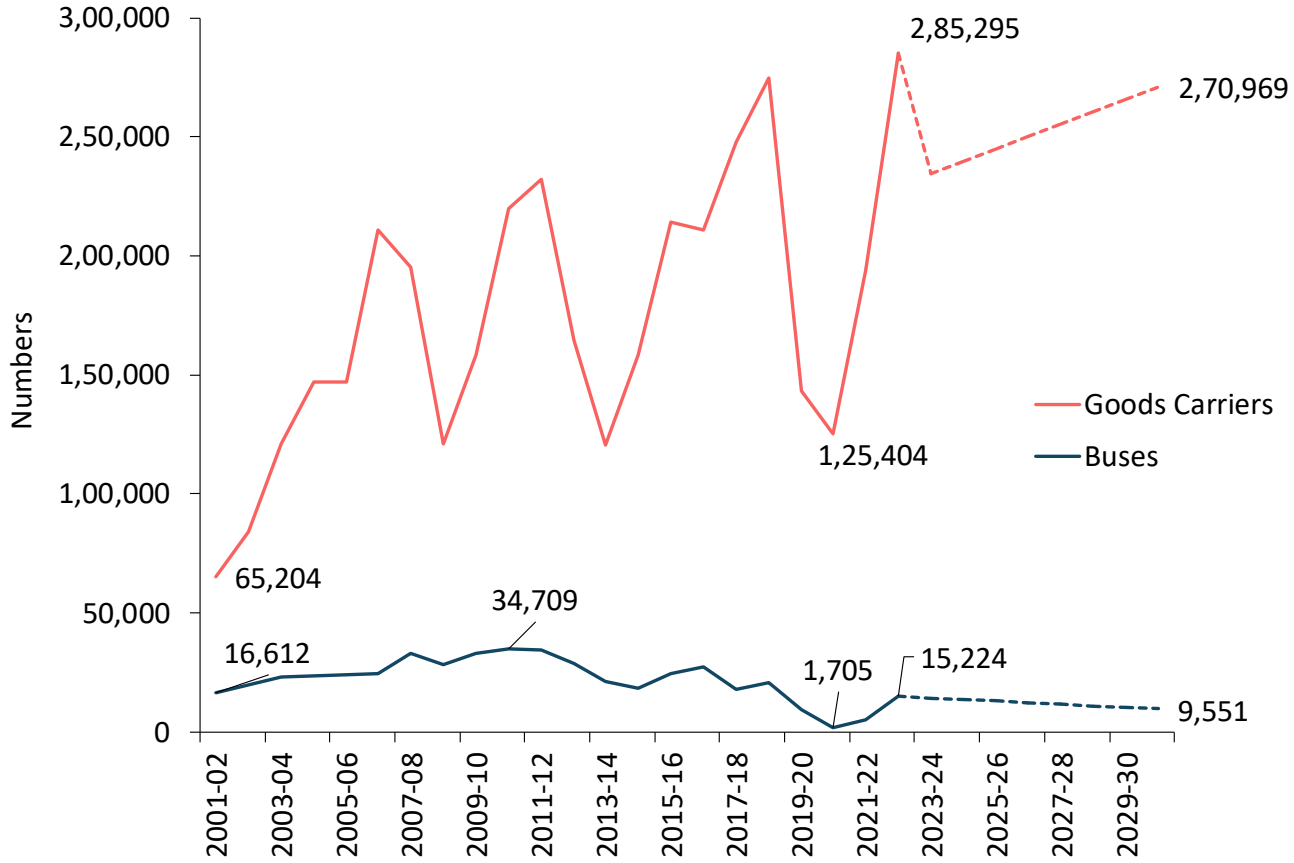
Aim: To develop a holistic roadmap for the implementation of revised and robust efficiency norms for the HDV Sector in India

Objectives

- To study the:
  - Trend of HDV market in India
  - Technology penetration
  - Emission and fuel consumption
  - Safety norms
- To formulate the fuel economy norms accordingly

Annual Domestic Sales: **2,53,094** by the year 2030-31

Stock of HDVs: **9 million** HDVs contributing to about **3.3 TTKMs**, by the year 2030-31



Source: SIAM, TERI Analysis

***Note:** Dotted line highlights projected values

Comparative Assessment: HDV Fuel Economy Norms

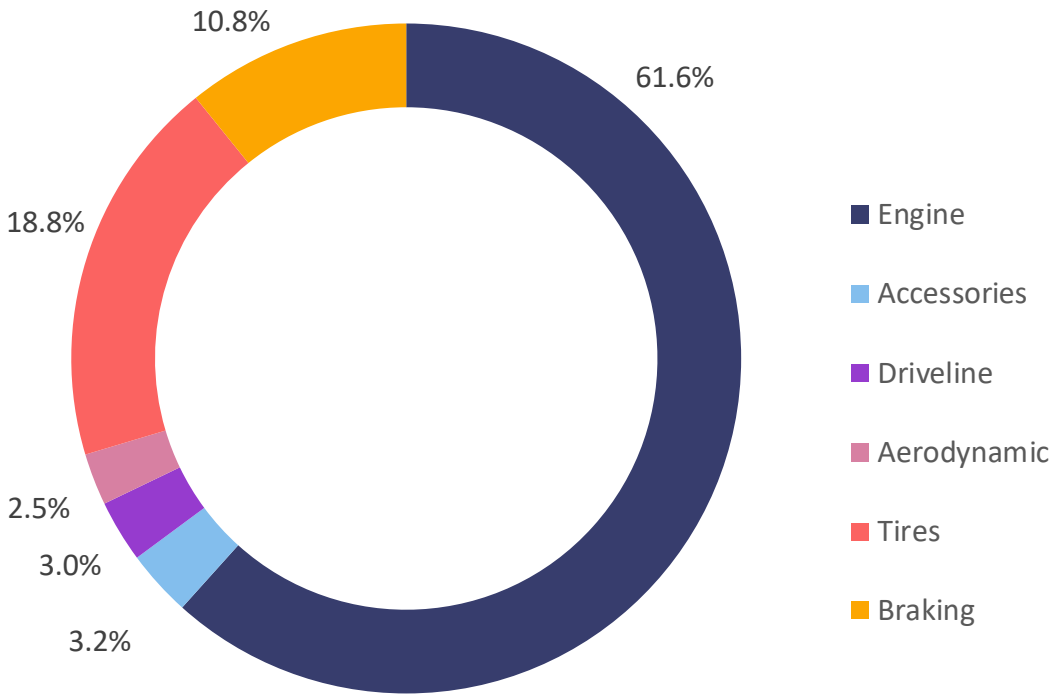
Country /Region	United States	China	Japan	European Union
Classification of HDVs	GVWR>= 8,500 lbs	GVW> 3.5 metric tonnes	GVW> 3.5 tonnes	GVW> 3.5 tonnes
Type of standard	HDV fuel efficiency standards	HDV fuel consumption standards	HDV fuel efficiency standards	HDV CO_2 emission standards
Regulating agencies	US Environmental Protection Agency (EPA); National Highway Traffic Safety Administration (NHTSA)	Ministry of Industry and Information Technology (MIIT); China Automotive Technology & Research Centre (CATARC)	Ministry of Economy, Trade and Industry (METI); Ministry of Land, Infrastructure, Transport & Tourism (MLIT)	European Union (European Commission, Parliament, Council, and Member States)
Applicability of HDV norms	All on road vehicles with GVWR>= 8,500 lbs	HDV diesel and gasoline vehicles with GVW> 3.5 metric tonnes	Diesel trucks and diesel highway buses with (GVW) >= 3.5t; Diesel tractor trucks, and transit buses with GVW >= 6t	All on road vehicles with GVW> 3.5tonnes
Proposed	2014	2012	2015	2018
Phased implementation? (Yes/No)	Yes	Yes	Yes	Yes
Phase 1 timeline	2014–2018	2012–2013	2015–2019	2019–2024
Phase 2 timeline	2018–2027	2014–2019	2020–2025	2025–2029
Phase 3 timeline	NA	2021 onwards	NA	2030 onwards
Units	grams CO_2/ payload ton-mile, gallons/1,000 payload ton-miles	litres/100 kilometres	kilometres/litre	grams CO_2/ton-km
Simulation models used (if any)	Greenhouse Gas Emissions Model (GEM)			VECTO

Energy Efficient Technologies for HDVs

- **Power Train Technologies**
  - **Engine** (Advanced engine controls, Engine friction reduction, etc.)
  - **Transmission and driveline** (More number of gears, improved gear efficiency, etc.)
  - **Alternate powertrains** (Hybrid, Electric, etc.)

- **Road Load Technologies**
  - Tires
  - Aerodynamics
  - Auxiliary power consumption reduction
  - Vehicle weight reduction

Energy-losses breakdown for a typical tractor-trailer in India

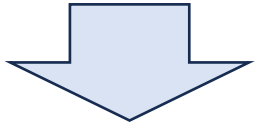


Source: ICCT

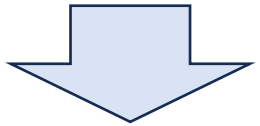
Learnings and Recommendations

Energy security is already a significant issue and is expected to become even more critical in the future

Regulation's objective should be to encourage manufacturers to optimize engines and vehicles for efficiency across various real-world conditions



A country can leapfrog to state-of-the-art technologies for fuel consumption reduction, to make the HDV market competitive –fuel import reduction and emissions reduction



Level of stringency is a function of multiple factors: country's priorities and commitments, technical capabilities and readiness of the manufacturing, testing know-how and facilities, etc.

Clean Freight Program – HDVs (Demand-Side Intervention)

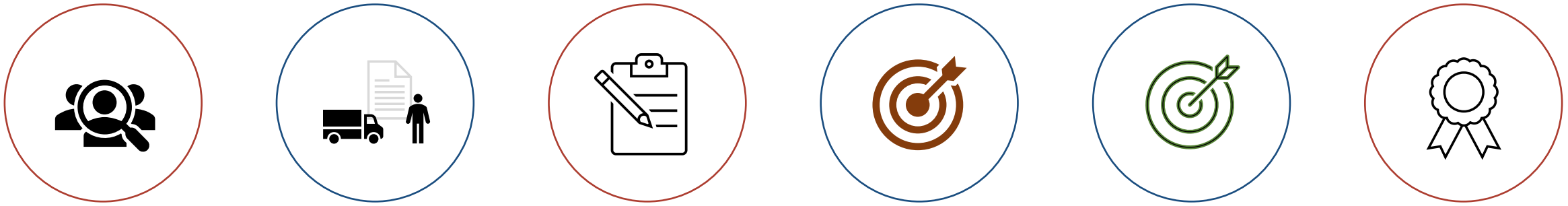
Key Drivers of a Clean Freight Program

Essential to **reduce carbon emissions** by **enhancing the energy efficiency** of road freight transport in India using baseline emissions mapping of industries as a key pillar

Moving Towards Clean Freight in India

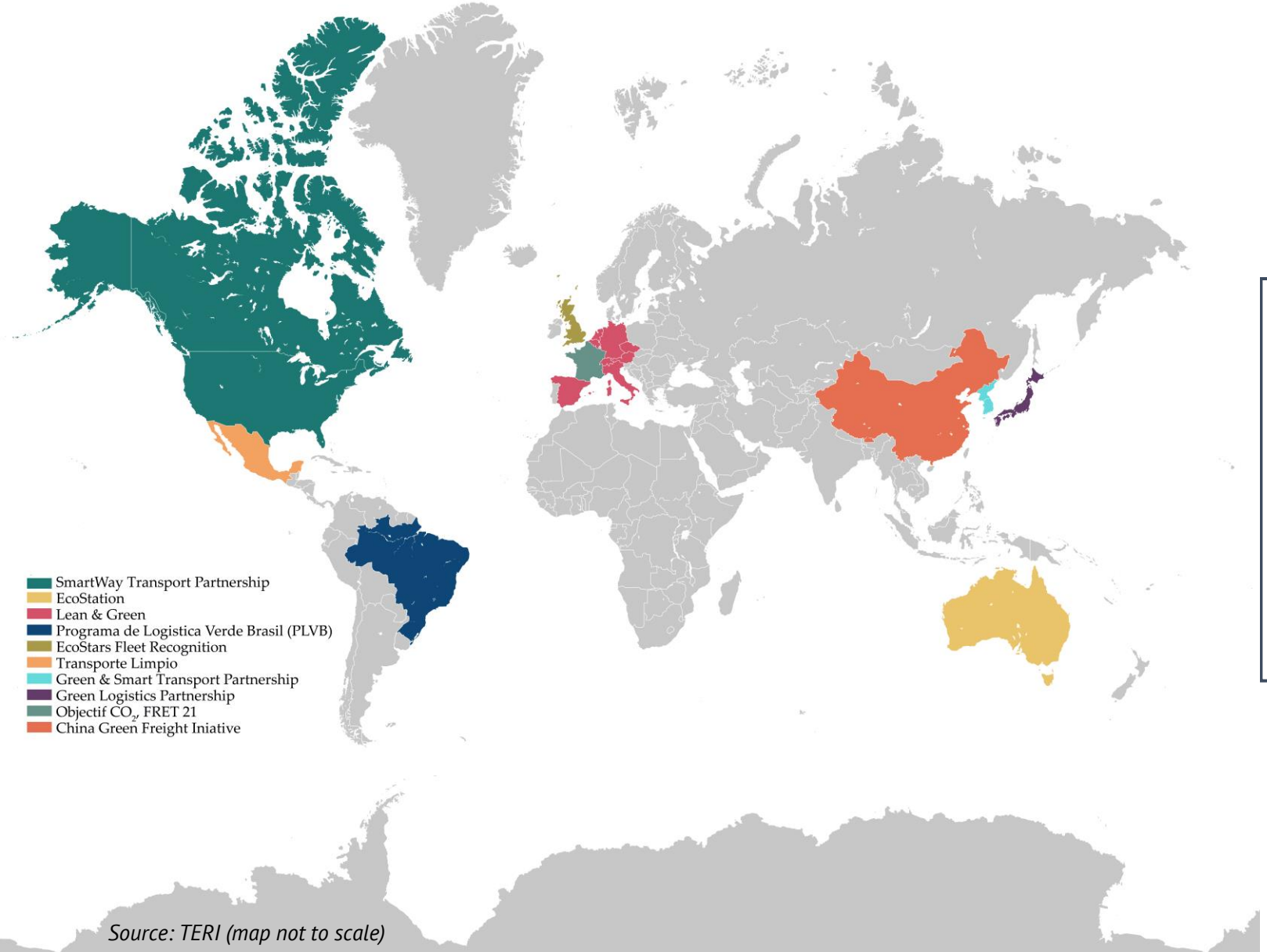
- ***Stringent fuel efficiency regulations for HDVs***
- ***Incentivizing Fuel Efficiency Improvement***
- ***Scrapping end-of-life MHDVs***
- ***Focusing on Driver Training Programs***
- ***Technology Advancement: Zero Emission Trucks (ZETs)***

Steps Involved



1. *Identification of Shipper/ Carriers*
2. *Emission tracking and monitoring system*
3. *Calculation of baseline emission*
4. *Setting of shipper-wise emission targets*
5. *Lowering emission targets and meeting newer ones periodically*
6. *Fiscal/non-fiscal benefits to Shippers/ Carriers for adoption of cleaner freight*

International Clean Freight Programs



Source: TERI (map not to scale)

International Clean Freight Programs

- **Partnership Programs** — Freight carriers and implementing agencies sign an agreement to achieve specific targets for reducing overall emissions
- **Industry led Voluntary Programs** — Freight carriers submit their sustainability targets and design action plan to achieve those targets. Accreditation is done by the program when the action plan is completed
- **Government Led Voluntary Programs** — Government sets mandatory target for freight carriers

Comparative Assessment of Clean Freight Programs (1/2)

Parameters	Clean Freight Programs		
	SmartWay (USA, Canada)	**EcoStars Fleet Recognition (UK)**	**China Green Freight Initiatives (China)**
Inception Year	2004	2009	2012
Voluntary/ Mandatory	Voluntary	Voluntary	Voluntary
Government-led/Industry-led	Government-led (Partnership)	Government-led	Government-led
Agencies Involved	US EPA; NR Canada	Transport Research Laboratory (TRL)	Central Road Transport Association (CRTA); Ministry of Transport; Research institute of Highways (RIOH) ; Clean Air Asia (CAA)
Target sectors	All freight transport	Road freight	Road Freight
Target stakeholders	Shippers, Freight Carriers, Logistic companies	Commercial fleet operators	Freight Carriers, Logistic companies
More than 100 members (Yes: >100 members, No: <100 members)	Yes	Yes	No
Phased Implementation (Yes/No)	Yes	Yes	Yes
Measurement/Reporting & Verification	Companies report their data to EPA through truck tool, EPA reviews it	TRL collects qualitative and quantitative data from members	Companies are encouraged to meet the requirements for green trucking
Ratings of member companies	Star Ratings	Star Ratings	Green leaf ratings
Methodology Used	Fleet logistics Energy and Environment Tracking (FLEET) model	Programs emission toolkit	China Freight Vehicle Standard
Membership	Free	Free	Free
Benefits provided to the members	• Assessment tools • Performance reports • Data based results to be shared with investors, clients	• Sharing of knowledge for fuel management, driver skills, vehicle maintenance, performance monitoring • Custom roadmap to achieve targets	• Sharing of best practices • Annual CGFI seminars
Direct Financial Incentives	No	No	No
Program Impacts (reduction in CO_2/ Cost Savings)	• >133 million metric tons of CO_2 • Savings of $41.8 billion in fuel costs	• Not Available	• Not Available

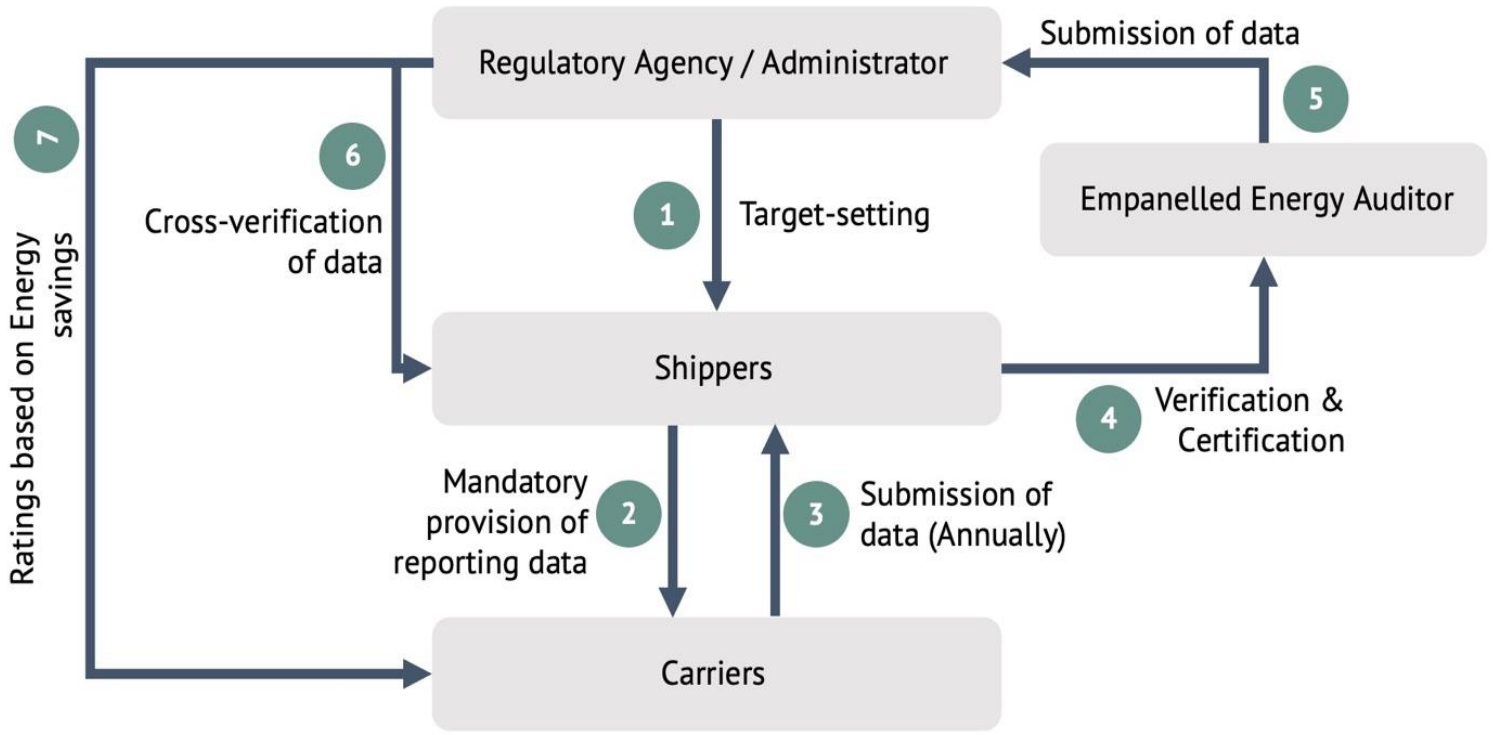
Comparative Assessment of Clean Freight Programs (2/2)

Parameters	Clean Freight Programs		
	Objectif CO_2 (France)	**Lean and Green (Europe)**	**PLVB (Brazil)**
Inception Year	2008	2007	2016
Voluntary/ Mandatory	Voluntary	Voluntary	Voluntary
Government-led/Industry-led	Government-led	Industry-led	Industry-led
Agencies Involved	Ministry of Ecology, ADME	Connekt GS1, Flanders Institute for logistics, Cluster for Logistics Luxemburg, AEGOC, Freight Leaders Council Italy	Logistics service providers and carriers
Target sectors	Road Freight	All freight transport	All freight transport
Target stakeholders	Freight carriers	Shippers, Carriers, Logistics Service Providers, Ports	Shippers, Carriers, Logistics service providers
More than 100 members (Yes: >100 members, No: <100 members)	Yes	Yes	No
Phased Implementation (Yes/No)	Yes	Yes	Yes
Measurement/Reporting & Verification	Voluntary charter to reduce CO_2 emissions	Action Plan to reach member's reduction targets	members measure, report, and verify their data
Ratings of member companies	Star Ratings	Star Ratings	Star Ratings
Methodology Used	Web based tool (in-line with French Grenelle law)	GLEC Framework, EN 16258	Greenhouse Gas Protocol, ISO 14064-1, EN 16258
Membership Fees	Annual membership fees	Annual membership fees	Annual membership fees
Benefits provided to the members	• Networking events, workshops • Sharing of best practices • Custom-made solutions for increasing the efficiency	• Networking, branding, development of marketing materials, press releases, public relations management, "speed docking" competitions to reduce cycle times of deliveries	• Partnership events • Sharing of best practices related to vehicle solutions and fleet operations
Direct Financial Incentives	No	No	No
Program Impacts (reduction in CO_2/ Cost Savings)	• > 3 million tons of CO_2e avoided	• >500 thousand tons of CO_2 avoided	• Not Available

Key Learnings from Clean Freight Programs

- Worldwide, clean freight programs are voluntary in nature; therefore, the **roles of freight carriers and shippers** are crucial in the implementation of such programs
- For Indian context, a **centralized program administered** by a **central agency** will be more beneficial
- Different clean freight programs use different methodologies to calculate energy consumption and GHG emissions related to freight and passenger transport services.
- Generally, emission intensity is measured in CO_2/t-km or CO_2e/t-km
- For a similar program in India, a **phased implementation** starting with **large fleet operators** can be designed. These operators generally have greater access to capital and can be more responsive to any voluntary approach

Clean Freight in India: Implementation Strategy



- **Target setting on shippers** (as they can instruct their associated carriers to comply with pre-defined targets)
- **Data reporting by carriers** to their shippers (data related to fuel consumption, CO_2 /CO_2e emissions annually)
- Shippers can share the data received from their respective carriers to an empaneled energy auditor for verification and certification
- **Regulatory agency can cross-verify** this data with shippers, in case of any discrepancy
- Based on cross-verification, regulatory agency/BEE can certify whether shippers have achieved respective target or not
- **Inclusion of freight transport** in the **Carbon Credit Trading Scheme (CCTS),** allowing trading of ESCerts
- **Phased implementation, starting with large shippers**

Clean Freight in India: Responsibility Matrix

Stakeholders	Roles	Responsibilities
Bureau of Energy Efficiency (BEE)	• Administrative/Regulatory	BEE could act as the regulator for a clean freight program (in-line with CCTS)
	• Target setting for shippers	In consultation with shippers, BEE would set specific targets for each shippers
	• Cross-Verification	BEE would cross-verify the data reported by shippers (in case of any discrepancy)
	• Issuing star ratings for carriers	BEE would issue star ratings to the carriers associated with shippers, after ensuring data authenticity (based on the certificate issued by the auditor)
Empaneled Energy Auditor of BEE	• Verification	Energy auditor would verify the data reported by shippers
	• Certification	Energy auditor would issue certificate of authenticity of data reported by shippers
Shippers	• Target Setting for shippers	Shippers would collaborate with BEE for setting specific targets
	• Data monitoring and verification	Shippers would monitor and verify the data reported by their carrier
	• Data reporting to the energy auditors	Shippers would submit the data to the energy auditor
	• Cross-verification	Shippers would aid BEE in cross-verification of documents (in case of any discrepancy)
Carriers	• Data reporting to the shippers	Carriers associated with their respective shippers would report the data related to their overall operations (e.g. fuel consumption, GHG emissions, etc.) to the shippers
	• Star ratings	Carriers would receive the final star ratings issued by BEE

Modal Shift: Role of Railways in Decarbonizing Transport

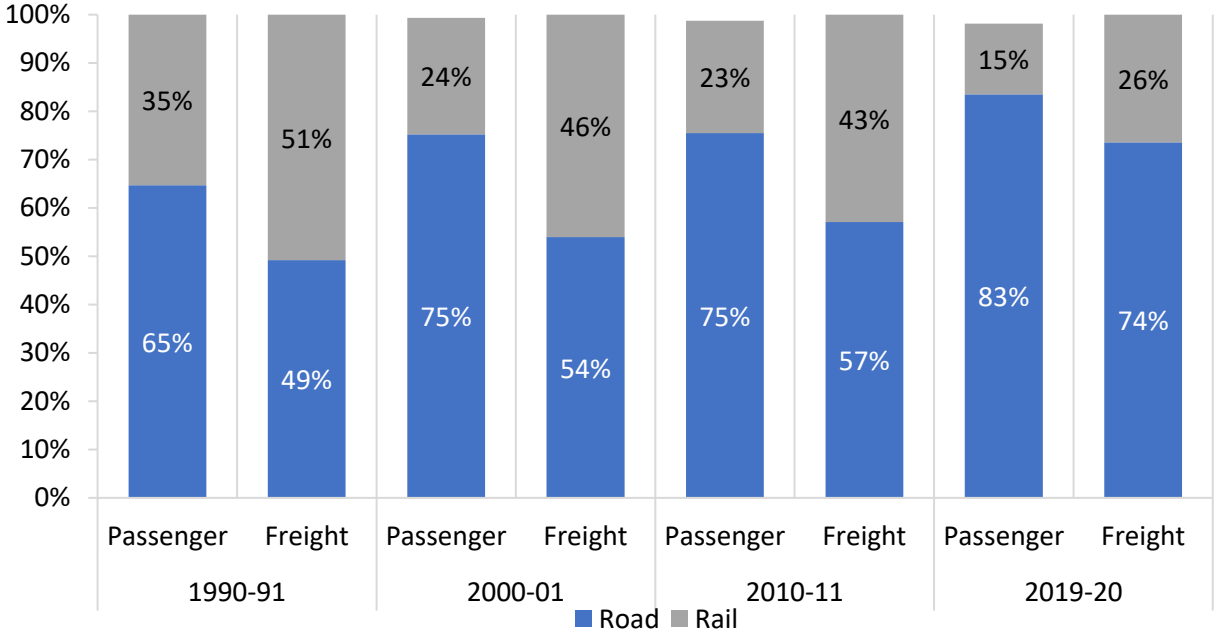
Railways: Accelerating or Chugging?

Modal shift: Moving people and freight on to railways serves as the key policy lever

A passenger train in India carries about **800 to 1,200 passengers** at a time; a **goods train**, about **4,000/4,500 tonnes of cargo**

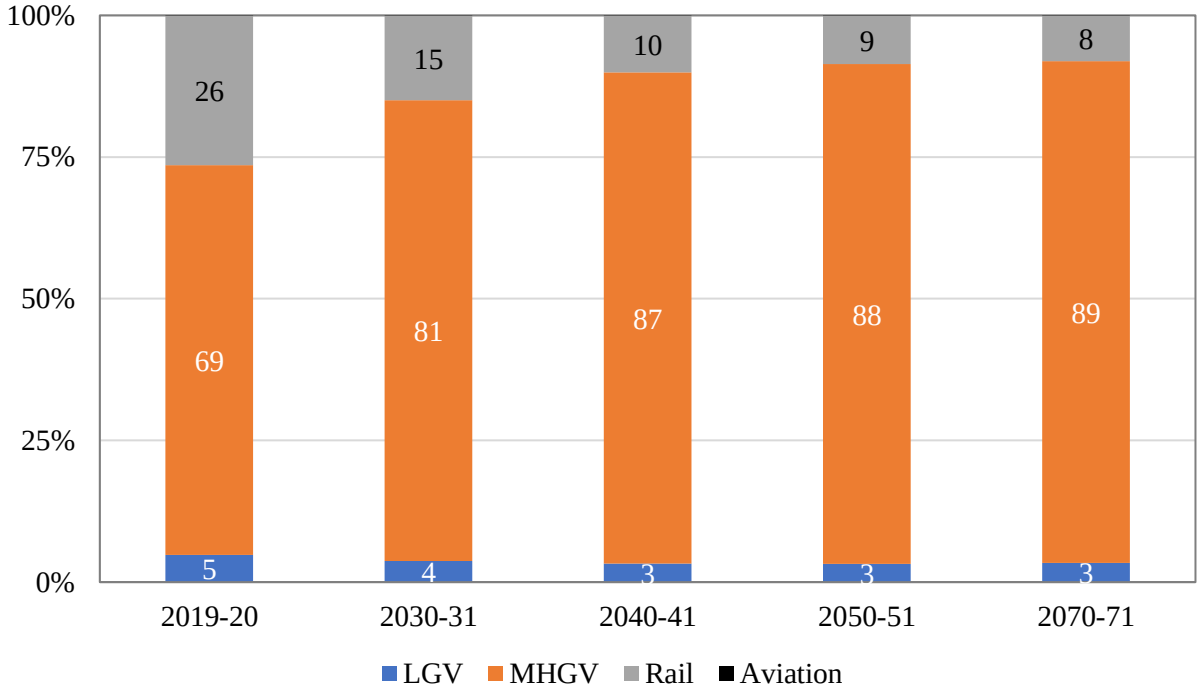
Railways is 4.5 times less emission intensive than road transport for per tonne km of freight carried

Share of Road and Rail in Passenger and Freight Transport Demand



Source: MoRTH & Indian Railways

Projected Modal-split in Freight Transport



Source: TERI Transport Model

Importance of Railways in Transport Decarbonization

Indian Railways recorded freight loading of **1500 mt** (2022-23)

Between 2019-20 and 2022-23 IR reported increase in **loading** of **302 mt & movement** by **234 BTKM**

Assuming the lead distance of **570 km**, same as railway's average lead for freight

and

~7.9 mt of CO_2 of avoided emissions

Translates to about **19 million trips** by trucks on Indian roads

Average payload of **16 tonnes per trip** by a truck in India

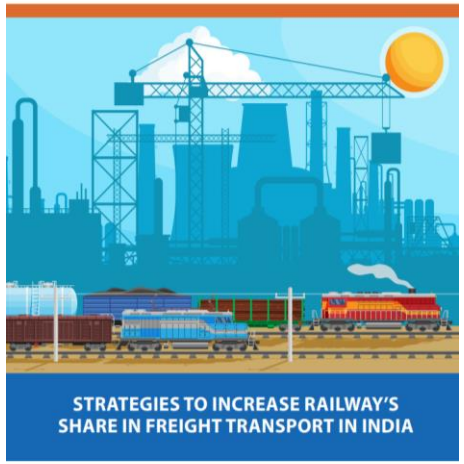
Source: TERI Analysis

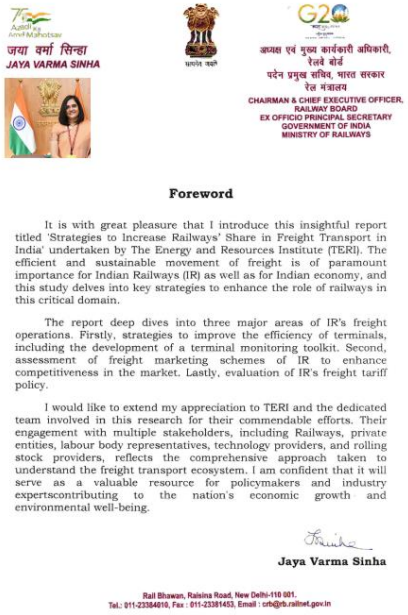
Strategies to Increase Railway's Share in Freight Transportation

- **Objective 1** - Focuses on analyzing **operational constraints at station and terminal** level and **develop tools for quick identification and response to bottlenecks** affecting freight movement

- **Objective 2** - Focuses on identifying commodities presently moving by road which can be shifted to railways and suggesting improvements to existing **marketing policies**

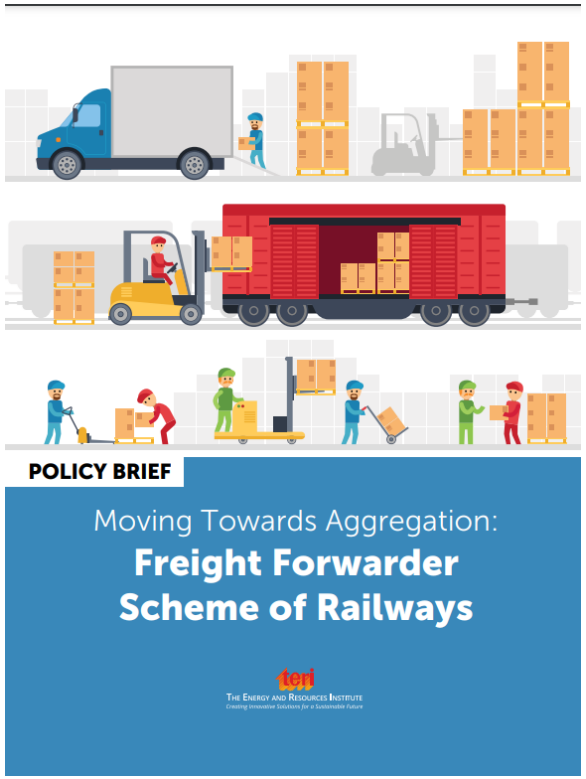
- **Objective 3** - Aims to relook at existing **tariff policies** and suggests areas where improvements can be made to make rail tariffs more competitive compared to other modes



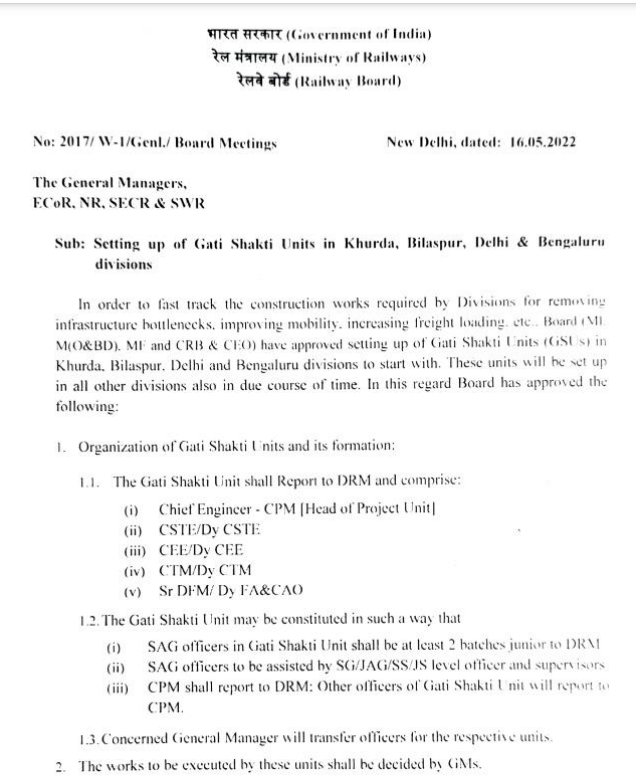


Reports available: https://www.teriin.org/project/strategies-increase-railways-share-freight-transportation

Policy Wins



Recommendations from the Policy Brief on Freight Forwarder Scheme provided key policy inputs for the **Mission 3000MT Policy Document** of the Indian Railways



भारत सरकार (Government of India)
रेल मंत्रालय (Ministry of Railways)
रेलवे बोर्ड (Railway Board)

No: 2017/ W-1/Genl./ Board Meetings — New Delhi, dated: 16.05.2022

The General Managers,
ECoR, NR, SECR & SWR

Sub: Setting up of Gati Shakti Units in Khurda, Bilaspur, Delhi & Bengaluru divisions

In order to fast track the construction works required by Divisions for removing infrastructure bottlenecks, improving mobility, increasing freight loading, etc., Board (MI, M(O&BD), MF and CRB & CEO) have approved setting up of Gati Shakti Units (GSUs) in Khurda, Bilaspur, Delhi and Bengaluru divisions to start with. These units will be set up in all other divisions also in due course of time. In this regard Board has approved the following:

1. Organization of Gati Shakti Units and its formation:

1.1. The Gati Shakti Unit shall Report to DRM and comprise:

(i) Chief Engineer - CPM [Head of Project Unit]
(ii) CSTE/Dy CSTE
(iii) CEE/Dy CEE
(iv) CTM/Dy CTM
(v) Sr DFM/ Dy FA&CAO

1.2. The Gati Shakti Unit may be constituted in such a way that

(i) SAG officers in Gati Shakti Unit shall be at least 2 batches junior to DRM
(ii) SAG officers to be assisted by SG/JAG/SS/JS level officer and supervisors
(iii) CPM shall report to DRM; Other officers of Gati Shakti Unit will report to CPM.

1.3. Concerned General Manager will transfer officers for the respective units.

2. The works to be executed by these units shall be decided by GMs.

Recommendations from the Policy Brief on Rail Freight Terminals provided key policy inputs for the **GATI Shakti Cargo Terminal Policy** of the Indian Railways

Policy Wins

‘Rail Green Points’ Initiative of Indian Railways

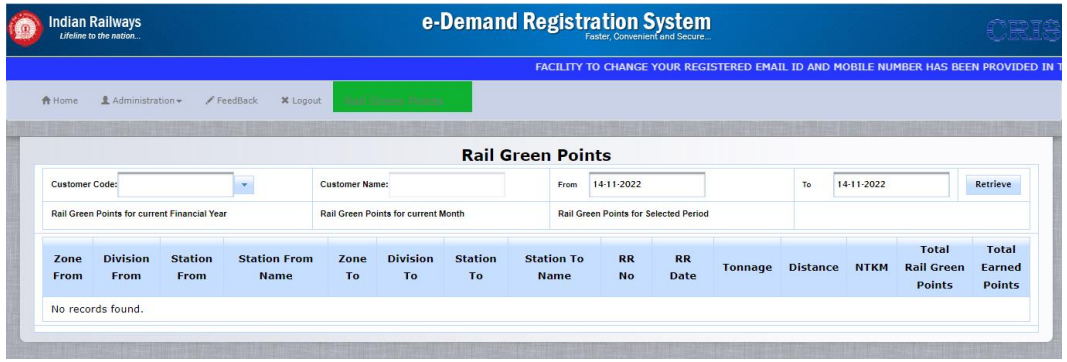
Estimation of Rail Green Point

The Energy and Resource Institute (TERI) has developed as calculator for estimation of Green House Gas (GHG) emission in tonnes of CO_2 for road and rail based on tonne-km. The GHG calculator of TERI is available at http://freightghgcalculator.com/. The same methodology will be used to estimate carbon emission saving on account of transportation by rail (instead of road) and the same will be termed as Rail Green Point(RGP).

As per latest details collected by CRIS/FOIS from TERI, the following emission factor may be considered: *(as modified from time to time)*

Mode	Emission Factor ($KgCO_2$ per ton-km)
Rail	0.009
Road	0.040

This incorporation by CRIS must be done under advice to TERI considering their emission factor is being used for the calculation of Rail Green Point.



Toolkit for Freight Terminals

- **2,001 Goods Sheds, 1,086 Sidings, and 72 Private Sidings** are operational on IR Network
- Only **43% of Goods Sheds** handle more than **100 rakes/year**
- **Terminal Capacity is Highly Underutilized**

		Operational Parameters		Commercial Parameters				Ecosystem Parameters		
Terminal Name	Scale of Freight Terminal	Rake Placement	Placement to Dispatch	Loading/Unloading Infrastructure	Loading/Unloading Process	Storage and Evacuation	Valueadded Services	Understanding and Coordination with	Freight Ecosystem in the City	Overall Performance
Number of Parameters Considered	*7*	*6*	*5*	*7*	*3*	*4*	*2*	*2*	*5*	*41*
Cossimbazar	50%	67%	60%	41%	37%	65%	50%	40%	32%	50%
Dankuni	74%	65%	58%	64%	50%	63%	45%	45%	44%	57%
Shakurbasti	32%	80%	60%	74%	27%	78%	90%	45%	66%	67%
Mulund	30%	53%	68%	29%	30%	38%	70%	70%	30%	45%
Taloja	30%	62%	64%	93%	30%	63%	95%	75%	66%	69%
Kalamboli GS	52%	73%	54%	40%	43%	63%	40%	55%	56%	54%
MILK PFT	54%	38%	66%	60%	37%	23%	80%	60%	50%	50%
Hajaribag	44%	65%	66%	64%	23%	63%	20%	35%	28%	51%
NTPC Siding Banada	52%	63%	80%	89%	100%	85%	100%	100%	100%	94%
Dhori NSD Colly Siding	42%	38%	80%	80%	87%	40%	100%	100%	80%	70%
Cheoki	50%	65%	68%	54%	33%	63%	50%	45%	40%	54%
Sarai	72%	57%	68%	56%	50%	63%	70%	35%	48%	56%
Harauli Fatehpura	26%	63%	78%	86%	43%	40%	60%	50%	56%	64%
Karpoorigram	54%	33%	58%	39%	37%	38%	10%	70%	42%	41%
Narayanpura Anant	62%	57%	66%	61%	33%	63%	70%	35%	48%	56%
Muktapur	48%	32%	60%	37%	40%	33%	10%	45%	36%	38%

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