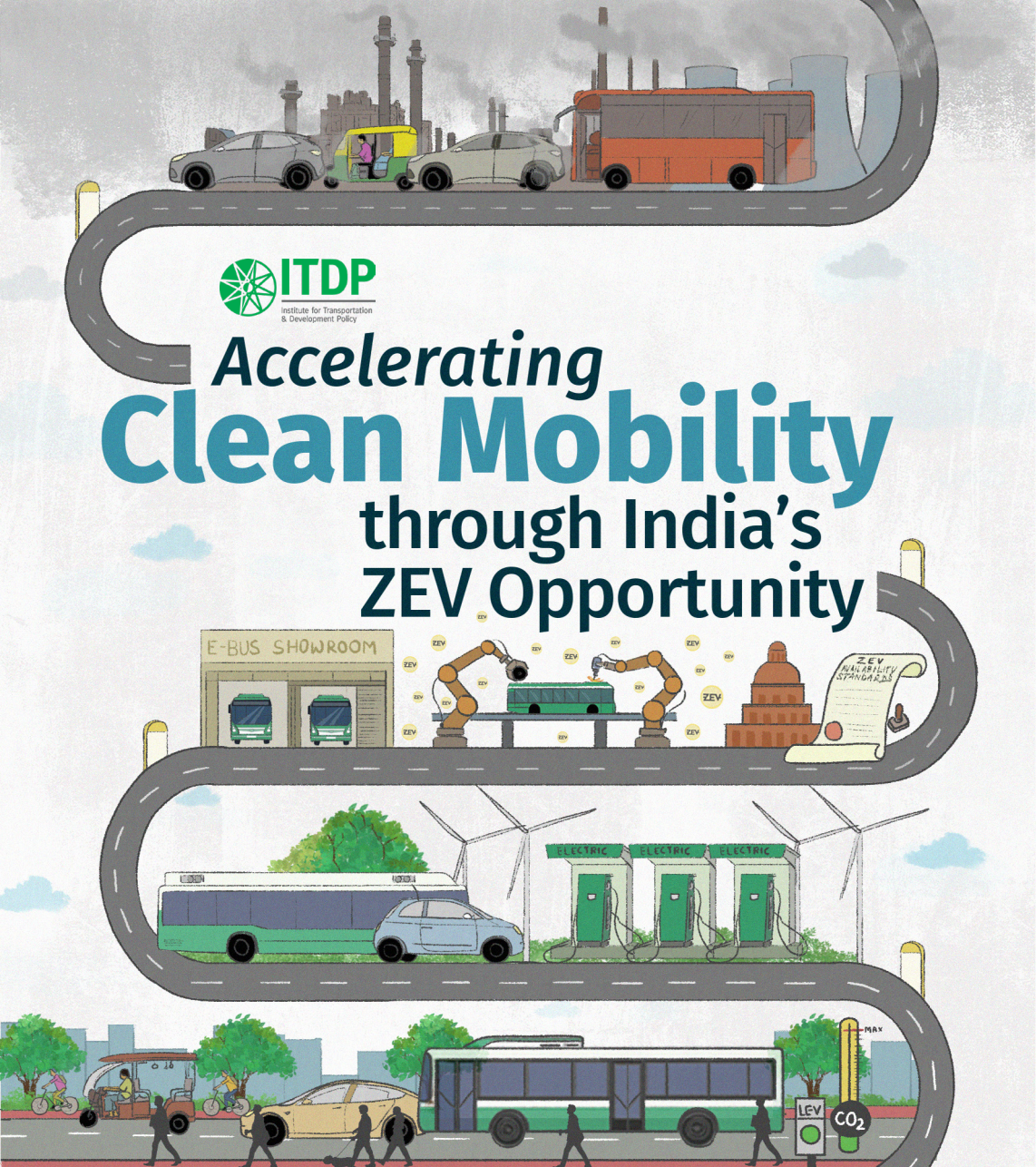
ITDP
Institute for Transportation & Development Policy
Accelerating
Clean Mobility
through India's
ZEV Opportunity
E-BUS SHOWROOM
ZEV
ZEV AVAILABILITY STANDARDS
ELECTRIC
ELECTRIC
ELECTRIC
MAX
LEV
CO_2

Accelerating Clean Mobility

through India's ZEV Opportunity

Acknowledgement

We thank Mr. Prasanna Patwardhan (President, Bus and Car Operators Confederation of India), Dr. T. Surya Kiran (Former Executive Director, Association of State Road Transport Undertakings), and Dr. Deepa Mudhol Munde (IAS) (Former Chairman and Managing Director, Pune Mahanagar Parivahan Mahamandal Limited) for their valuable insights on advancing zero-emission mobility through availability standards in both public and private bus sectors.

We hope this serves as a practical guide for State Transport Undertakings (STUs), the private bus sector, and policy makers at both national and state levels to frame supplyside regulations and availability standards that accelerate the transition to zero-emission mobility.

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Accelerating Clean Mobility through India's ZEV Opportunity

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1 The Commuter's Reality:

Challenges in Transit

India's bus ecosystem serves over

32Cr

people every day, through both public and private buses, making it the most-used mode of transport in the country.

This figure is six times higher than the combined daily ridership of trains, metros, and flights. From dense city centres to rural areas, buses, especially those operated by State Transport Undertakings (STUs), remain the most accessible and essential option for lakhs.[1]

[1] *Source: ASRTU, BOCI (2023)*

Yet, this vital system is under strain. Ageing fleets, long wait times, and worsening air pollution have highlighted the need for cleaner, more reliable alternatives.

Electric buses (e-buses) bring a crucial opportunity.

Electric buses help reduce air pollution, cut emissions, and improve the quality of public transport. Over the past decade, several national schemes have aimed to support this shift.

The National Electric Mobility Mission laid the foundation, followed by FAME-I, which supported

400 **e-buses in 10 cities.**

FAME-II scaled this up to over

5,100 **e-buses across 73 cities.**

More recently, the PM E-Bus Sewa and PM E-Drive have committed 24,000 additional e-buses to expand the electric fleet.

In fact, under the National Electric Bus Programme, the target is to have

50,000

e-buses by 2027.

While these steps mark important progress, the situation on the ground is yet to change dramatically. Many cities continue to face delays in bus deliveries and overcrowded services.

At one such city bus stop, 24-year-old Revathy waits. After a long delay, a bus finally approaches—an electric one, gleaming in white and green. But it's already overcrowded. There's no room to board. She steps back to wait for the next one. With a sigh, she opens her newspaper to pass the time. One headline reads: "City to get 150 e-buses under PM e-Bus Sewa!" Just below it, another: "Delay in e-bus delivery frustrates city commuters." The opportunity is clear, but so is the gap between plans and everyday reality.

Is it time for India to accelerate towards change?

*Based on news reports published between 2024-25

These are not isolated incidents. Reports of delayed e-bus deliveries, procurement hurdles, and contractual disputes have become increasingly common. STUs, responsible for providing public transport, are caught in a bind, struggling to modernise their fleets and provide reliable service.

The consequences are far-reaching:

Increased air pollution is contributing to severe health problems.

Aggravated traffic congestion, as people opt for private vehicles out of necessity.

A major setback to India's climate goals, as the transport sector remains a significant source of emissions.

This is the urgent reality that demands immediate and decisive action.

2 Systemic Roadblocks:

Understanding E-Bus Adoption Barriers

India's path to electric mobility, while ambitious, faces significant systemic challenges that threaten to derail progress. These systemic obstacles require immediate attention to correct the course.

2.1 The Production Gap:

A Race Against Time

Current Reality:

As of 2024-2025,

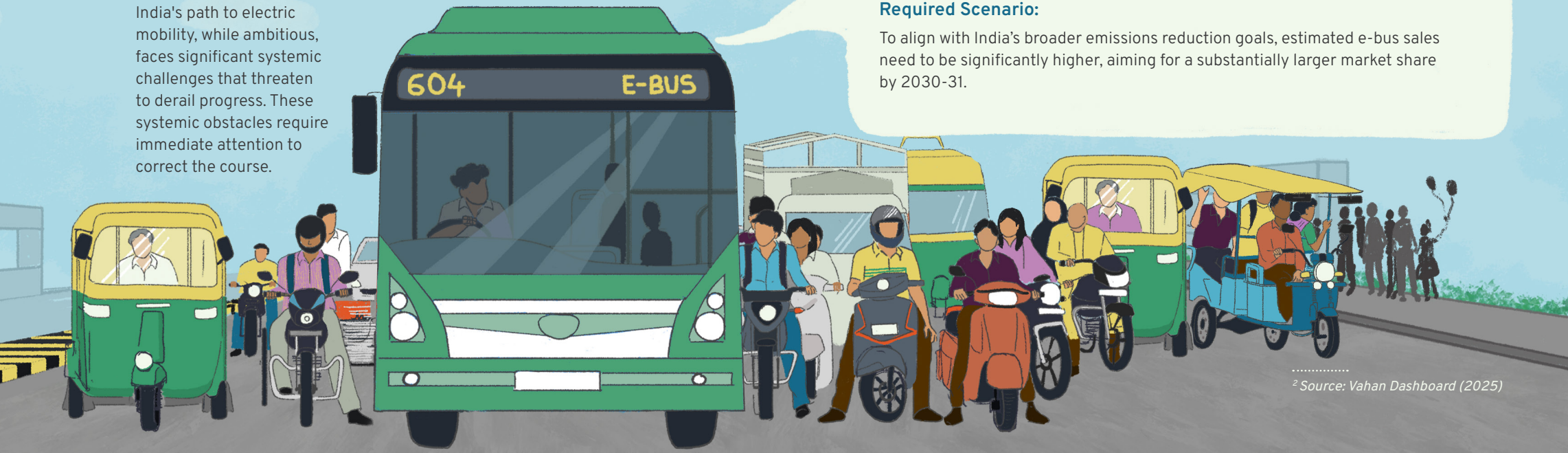
3.4% of all bus sales were e-buses.[2]

Business As Usual Scenario:

By 2030-31, e-bus sales are projected to reach 17,814 units, representing **11.4%** of the market.

Required Scenario:

To align with India's broader emissions reduction goals, estimated e-bus sales need to be significantly higher, aiming for a substantially larger market share by 2030-31.

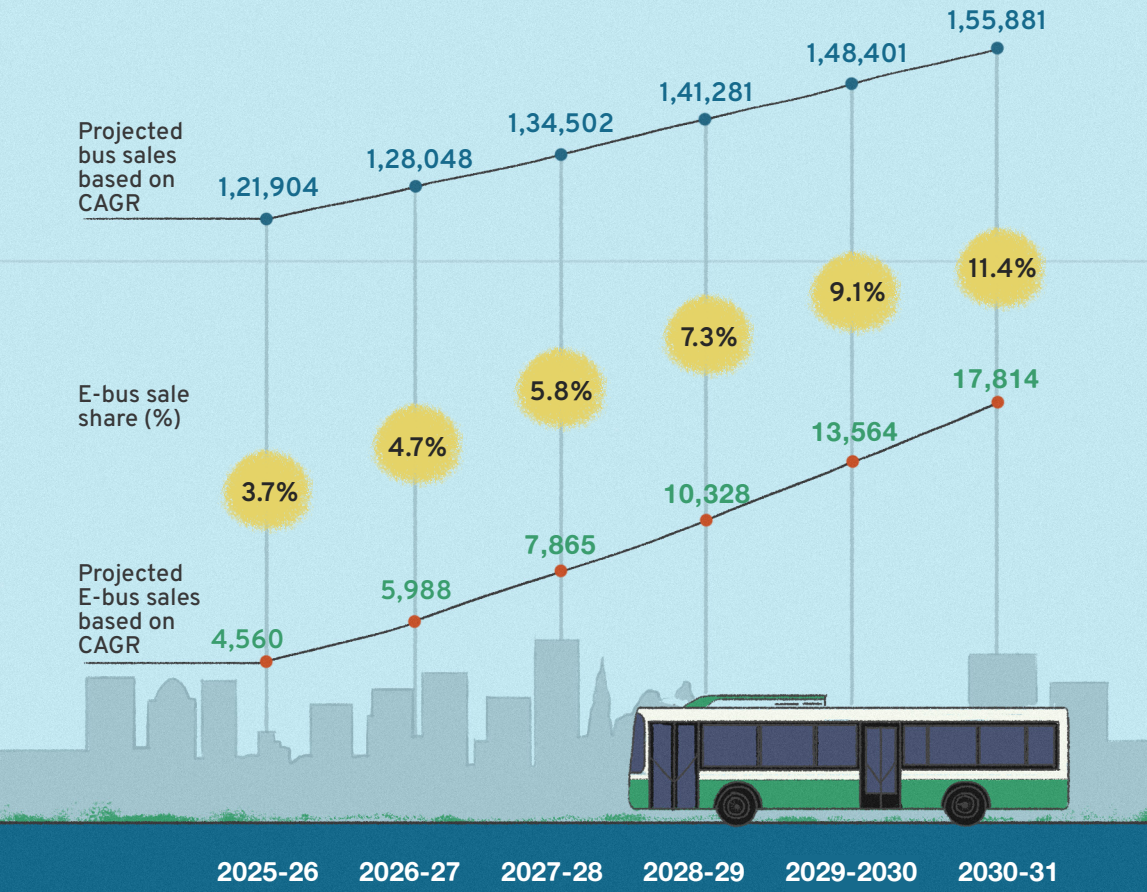


[2] *Source: Vahan Dashboard (2025)*

Current Trajectory vs. Required Growth

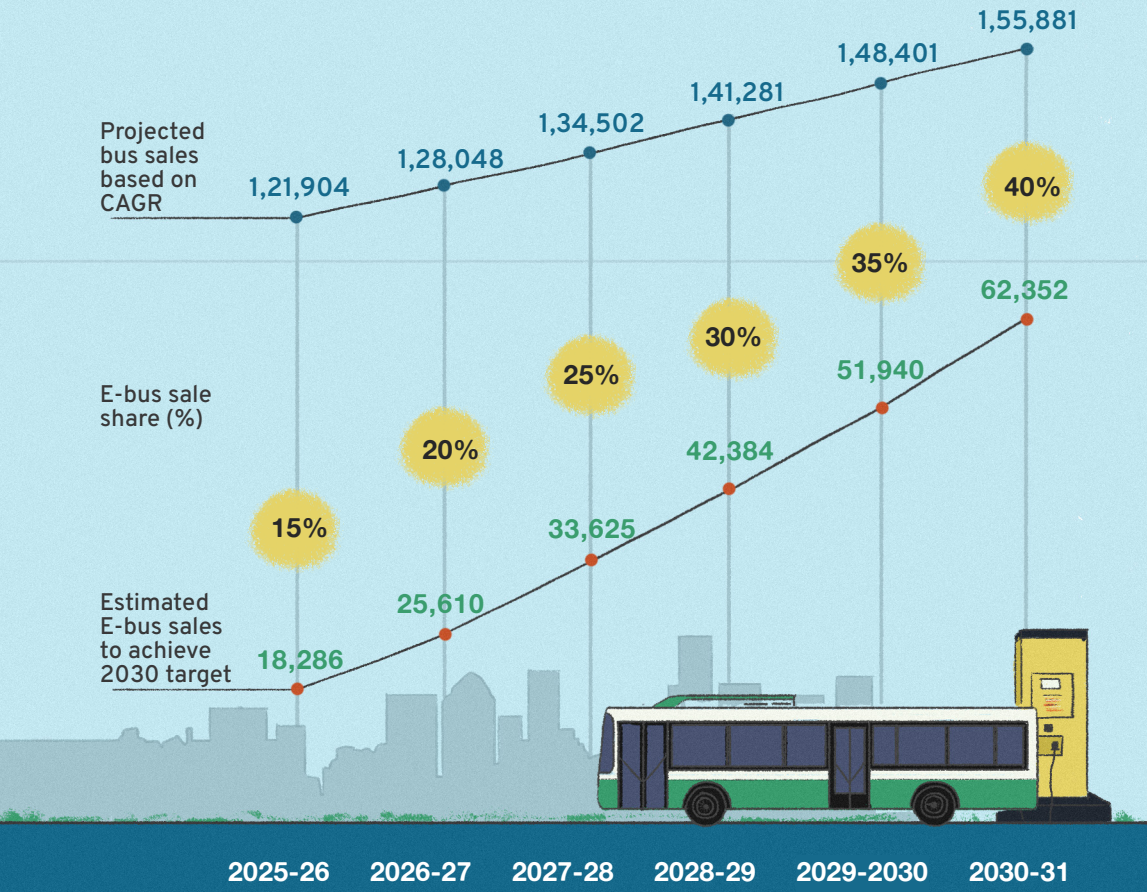
E-Bus Sale Business As Usual Scenario[3]
(only dependency on demand side incentives)

CAGR = Compounded Annual Growth Rate



[3] *Source: Analysis by ITDP India*

Estimated E-bus sales to achieve EV30@30 target[4]

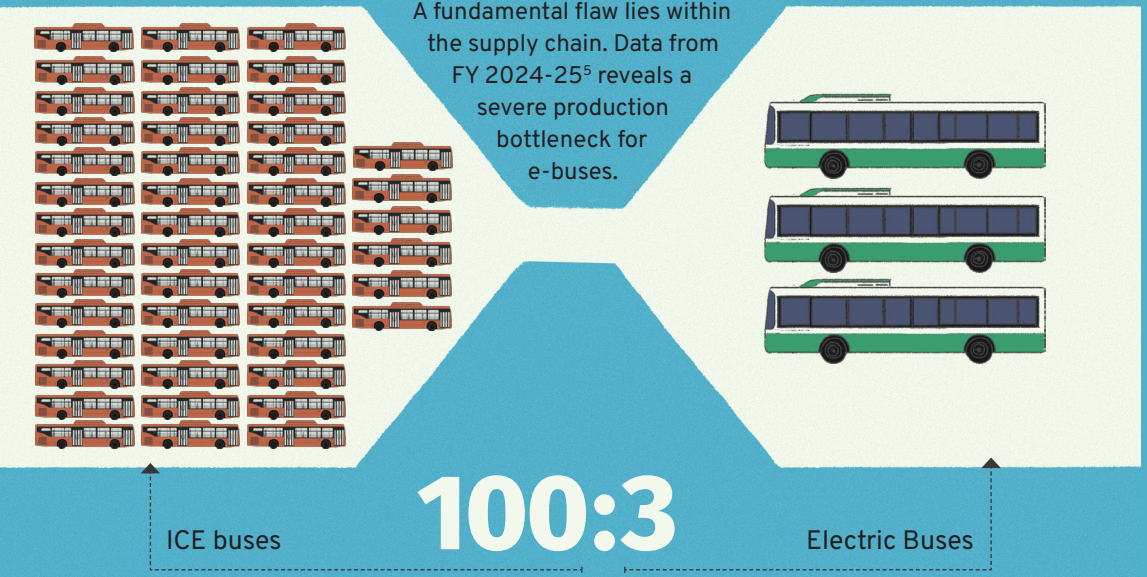


[4] *Source: Analysis by ITDP India*

2.2 Supply-Side Challenges

The Bottleneck

A fundamental flaw lies within the supply chain. Data from FY 2024-25[5] reveals a severe production bottleneck for e-buses.



For every 100 Internal Combustion Engine (ICE) buses, only three e-buses are manufactured on average. This stark disparity exposes the inability of e-bus OEMs to meet current demand, let alone manage the projected surge.

[5] *Source: Vahan Dashboard (2025)*

Average Original Equipment Manufacturer (OEM) registrations are calculated based on the top 95th percentile excluding outliers with lower registration volumes.[6]

	E-Bus OEMs	ICE Bus OEM's
Total OEMs	13	16
Total sales	3,472	1,12,053
Avg. sale/ OEM	209	7,817
Highest sale by any OEM	743	20,131
Lowest sale by any OEM	6	600

E-bus sales vs ICE bus sales for FY 2024-25 as per Vahan Dashboard

This supply-side weakness directly results from a lack of clear, consistent policy direction, creating market uncertainty, and delaying OEM investment in scaling up production.

[6] *Source: Vahan Dashboard (2025)*

2.3 Policy Myopia:

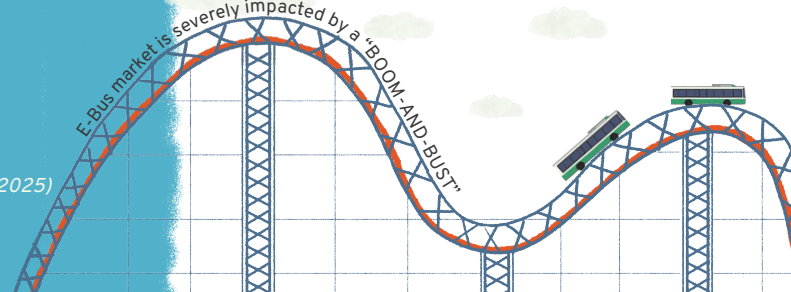
The Shortcomings of the Current Approach

Current e-bus adoption strategies in India over-rely on demand-side incentives, neglecting critical supply-side mechanisms. This approach has room for improvement.

Challenges for the Market

Market Instability:

The e-bus market is severely impacted by a "boom-and-bust" procurement cycle, stemming from inconsistent government funding and an over-reliance on sporadic tenders and subsidies. This volatility, intensified by electrification targets that remain voluntary rather than binding, consistently discourages OEMs from making essential long-term investments in production capacity and technology development.



Challenges for the Private Sector

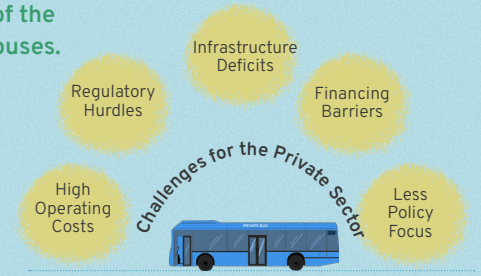
Private Sector Neglect

Current policies mostly focus on STUs, excluding the private sector, which owns

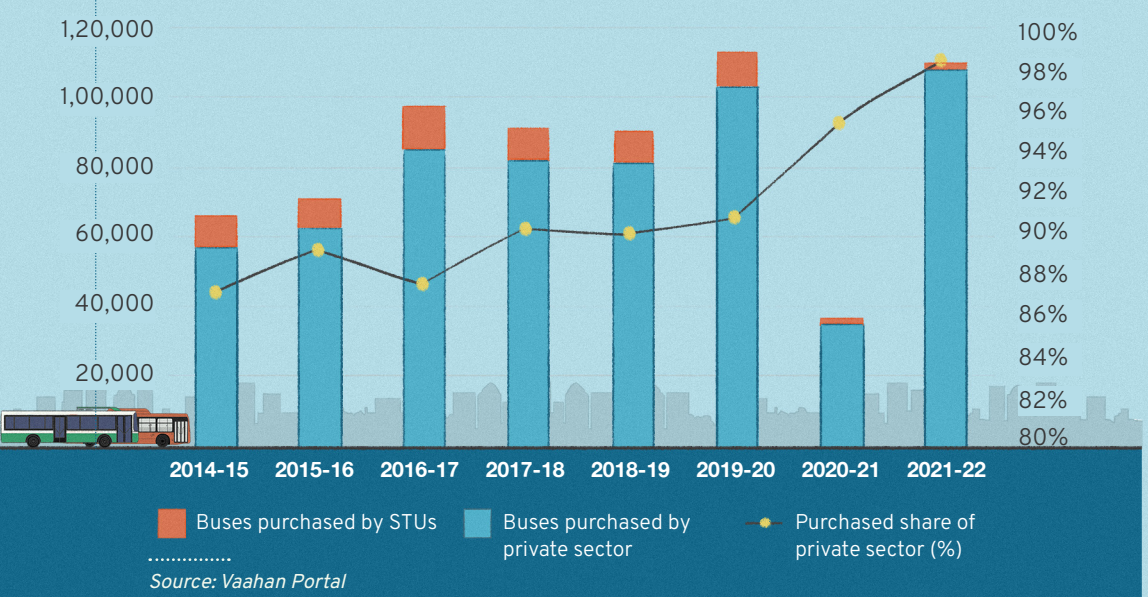
93% of India's bus fleet.

STUs own merely **7%** of the buses.

This exclusion deprives private operators of crucial incentives and support, severely slowing the overall electrification progress. This leads to the private sector facing high upfront costs, limited financing options, and range anxiety due to inadequate charging infrastructure.



As a result, currently only 1.3% of private buses are electrified.



Source: Vaahan Portal

Challenges for the OEMs

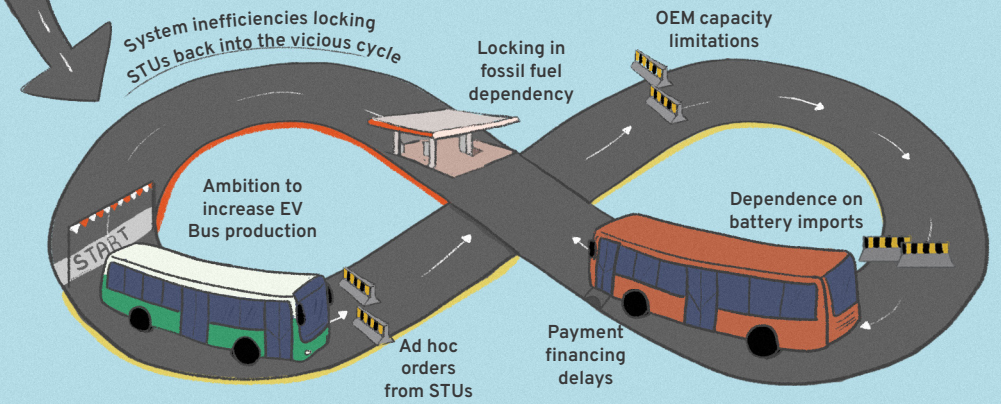
The Gross Cost Contract (GCC) Challenge

The GCC model, intended to lower upfront costs, shifts operational burdens onto OEMs. This diverts their resources from core manufacturing, making it difficult to scale production quickly, leading to delivery delays.

Challenges for the STUs

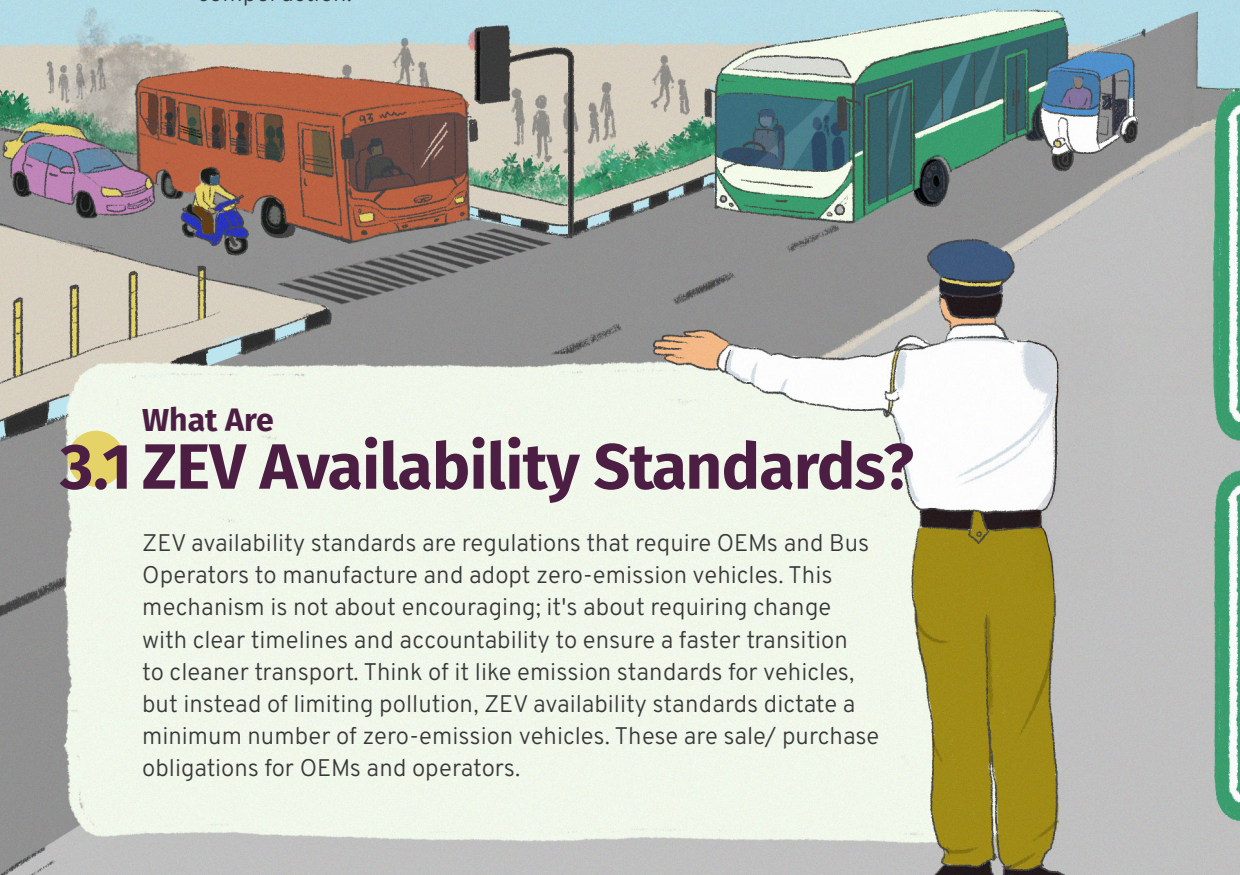
Delivery Delay

A confluence of factors — uncertain procurement, OEM operational burdens, and reliance on imported components — causes significant e-bus delivery delays. These delays derail fleet expansion and undermine electrification targets for STUs. The culmination of these issues leads to STUs losing faith in e-buses, forcing them to revert to ICE bus procurement to meet immediate needs. This creates a vicious cycle, locking in fossil fuel dependency.



3 ZEV Availability Standards:

To accelerate India's e-bus revolution, a fundamental regulatory intervention is the Zero Emission Vehicle (ZEV) availability standards. Unlike voluntary incentives, ZEV availability standards are legally binding requirements that compel action.



What Are 3.1 ZEV Availability Standards?

ZEV availability standards are regulations that require OEMs and Bus Operators to manufacture and adopt zero-emission vehicles. This mechanism is not about encouraging; it's about requiring change with clear timelines and accountability to ensure a faster transition to cleaner transport. Think of it like emission standards for vehicles, but instead of limiting pollution, ZEV availability standards dictate a minimum number of zero-emission vehicles. These are sale/ purchase obligations for OEMs and operators.

Types of Policies to 3.2 Accelerate ZEV Adoption

To effectively drive e-bus adoption, a combination of policies is needed. These can be broadly categorised into ZEV availability standards and complementary measures.

ZEV Availability Standards

ZEV availability standards are legally binding requirements that compel specific actions to accelerate the adoption of zero-emission vehicles. These are primarily supply-side policies.

Standards for OEMs:

These availability standards compel OEMs to produce an increasing percentage of ZEVs annually, like electric or hydrogen-powered vehicles.

Why they are crucial:

Without them, OEMs prioritise the production of more profitable ICE vehicles, delaying the shift to EVs.

California's ZEV Programme serves as a prime example, requiring OEMs to produce and sell a minimum percentage of EVs, with penalties for non-compliance.

Standards for Commercial Permits:

These availability standards require commercial fleet operators (buses, trucks, taxis, etc.) to procure a certain percentage of ZEVs to obtain or renew their operating permits.

Why they are crucial:

In India, where private operators own a vast majority of buses, this standard ensures their participation in electrification.

Shenzhen, China, successfully implemented this by mandating ZEVs for ride-hailing services.

Complementary Measures

to Accelerate ZEV Uptake

These policies support and enhance the effectiveness of ZEV availability standards but do not, by themselves, direct the production or procurement of ZEVs.

1. ICE Vehicle Registration Restrictions:

ICE-restricted vehicle registration policies phase out fossil-fuel-powered vehicles by gradually limiting new registrations to only ZEVs.

Why they are crucial:

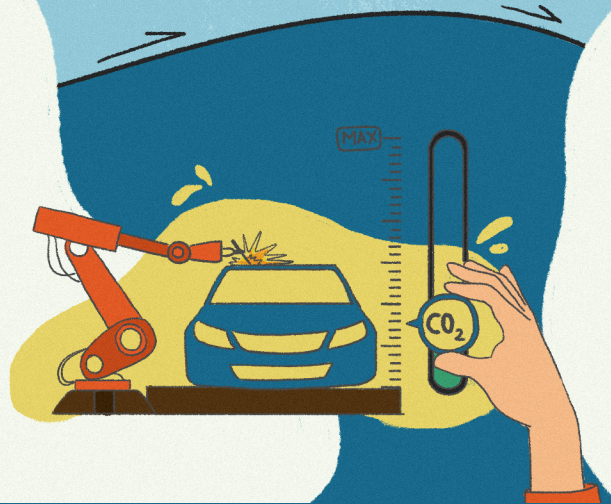
These policies complement ZEV availability standards by creating a market advantage for ZEVs and discouraging the purchase of polluting vehicles.

2. Fuel Efficiency Policies:

Policies that set progressively stricter fuel efficiency standards for vehicles. India's CAFE (Corporate Average Fuel Efficiency) norms set fuel consumption limits for automakers, requiring an average of 113 g/km CO_2 emissions from April 2022. While fuel-neutral, they currently allow compliance through more efficient ICE vehicles.

Why they are crucial:

Linking ZEV availability standards with CAFE norms—like in California and China—would push manufacturers to meet fuel targets by producing more electric vehicles, ensuring a faster and more complete shift away from fossil fuels. These policies indirectly incentivise ZEVs, as they help OEMs meet the standards.



While cities like Beijing and Shanghai have used ICE-restricted registration quotas, India also has relevant examples.

Delhi's Approach

The Delhi EV Policy 2.0 phases out certain ICE vehicle types.

From August 15, 2025, CNG auto-rickshaw registrations/renewals stop; older ones are scrapped/retrofitted.

The policy also directs electrification of taxis, LCVs, and public buses (95% electric commercial fleet by 2027).

Supported by incentives, scrappage benefits, and charging infrastructure.

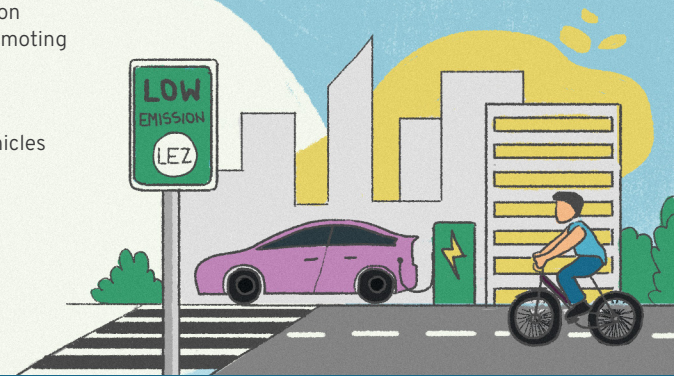
Implementing progressive ICE-restricted registration for buses can similarly ensure a phased transition to zero-emission fleets.

3. Low Emission Zones (LEZs):

LEZs restrict the entry of high-emission vehicles into specific urban areas, promoting the use of ZEVs within those zones.

Why they are crucial:

LEZs create a demand for cleaner vehicles in urban areas, supporting the wider adoption of ZEVs.



4 The Need for Availability Standards

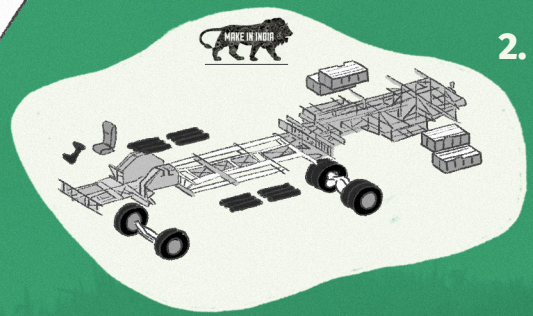
India stands at a crossroads. Its current approach to EV adoption, heavily reliant on incentives, is proving insufficient. ZEV availability standards are not merely an option, mechanism, or tool; they are an indispensable catalyst for change.

4.1 The Urgency of Now

India's ambitious climate goals and the pressing realities of air pollution demand a radical shift. The increasing global market competition, the necessity to remain technologically competitive, and the substantial benefits of scaling e-bus manufacturing and adoption require ZEV availability standards to give a guaranteed push. Voluntary adoption will not deliver the scale and speed required.

1. Igniting Production and Innovation

ZEV availability standards act as a powerful catalyst for change, directing OEMs to ramp up production of e-buses. This increased production directly addresses the current supply shortages and long delivery times, ensuring that cities can modernise their fleets without delay. They also provide the market certainty for investment in parallel industries, giving confidence to battery and infrastructure companies. These tools are also critical for utilities to plan and develop necessary grid infrastructure.



2. Building a Local Powerhouse

ZEV availability standards are not just about importing e-buses; they are a golden opportunity to "localise" manufacturing. With over 342[7] registered bus body builders in India, this well-established ecosystem can be leveraged for e-bus production as well.

[7] *Source: ARAI 2023*

3. Tailoring for Commercial Strength

ZEV availability standards are effective for commercial vehicles, as these fleets are already subject to strict government regulations, making enforcement of electrification targets more feasible. Moreover, since commercial vehicles contribute disproportionately to overall emissions, requiring their transition to zero-emission technologies yields a significant reduction in per capita transport emissions. This makes them an ideal sector for implementing ZEV availability standards. Expanding supply-side incentives to commercial fleets will help achieve long-term scalability and reduce India's dependence on fossil fuels.

Availability standards can ensure that both public and private bus operators transition to e-buses, maximising the benefits.

4. Economies of Scale

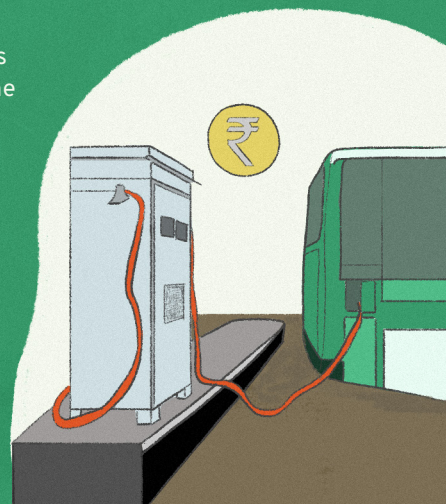
ZEV availability standards can drive down e-bus costs and enhance financial viability, reducing the need for continuous government subsidies. Availability standards minimise the need for large-scale government spending, shifting the financial responsibility to the industry. This is not about avoiding investment; it's about smart investment that leverages market forces.

Increased sales volumes, due to availability standards, often lead to lower prices, achieving economies of scale similar to bulk buying. For example, automakers are reducing EV prices by 20-35% in the UK to meet ZEV sales targets, making e-buses a more financially viable option for fleet operators and accelerating their adoption.

5. The Total Cost of Ownership (TCO) Advantage

The ultimate goal is to make e-buses as affordable as traditional diesel buses. ZEV availability standards can help reach TCO parity sooner. Think of TCO as the overall cost of owning and operating a vehicle over its lifetime. Even if the initial price is higher, e-buses can be cheaper in the long run due to lower fuel and maintenance costs.

By driving down battery costs, promoting charging infrastructure development, and encouraging innovative financing models, availability standards can accelerate the point where e-buses become the obvious economic choice.



4.2 Global Evidence

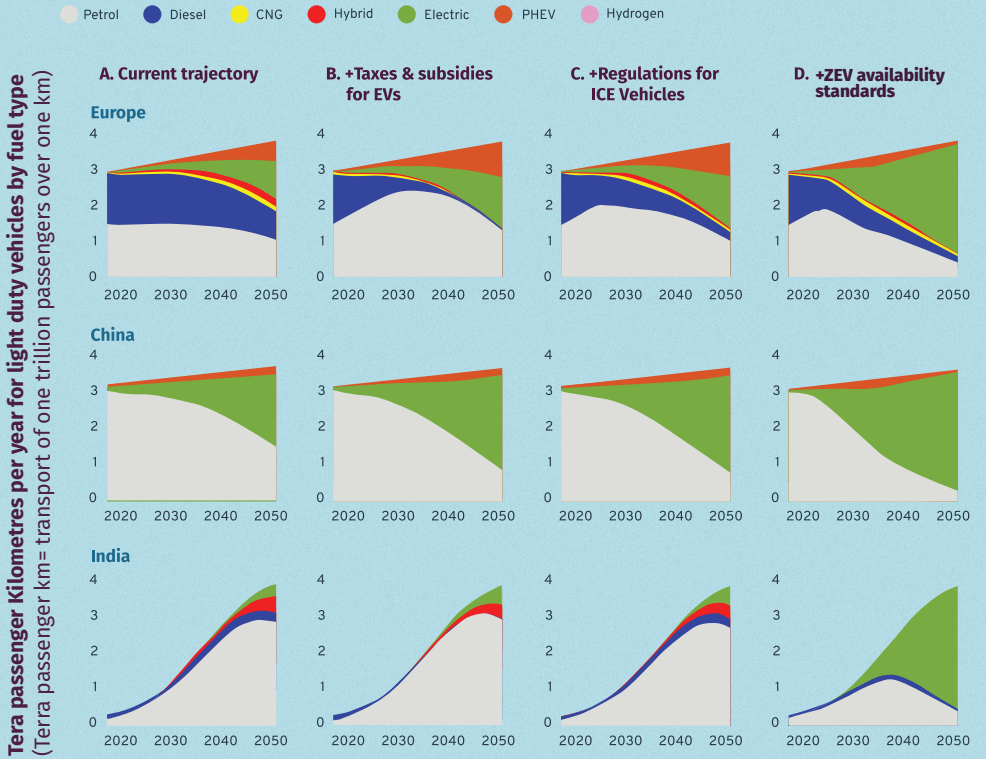
Availability Standards Deliver

Across major markets, ZEV availability standards are the most effective policy tool for driving EV adoption.

Availability standards ensure a decisive shift to zero-emission technology, removing uncertainty and guaranteeing progress. In contrast, subsidies and taxes, when used without the support of regulations or availability standards, prove relatively ineffective due to limited consumer awareness and access.

Furthermore, regulations are generally more cost-effective than relying solely on financial incentives to achieve a transition to electric vehicles.

Impact of different policy pathways on passenger vehicle transitions across regions through 2050



Pathway A, India's share of tera passengers transported per km per year will remain high for petrol vehicles even till 2050.

Pathways B and C, despite financial incentives and regulations, in the long run, the shift to EV is minimal.

Pathway D, with ZEV availability standards India ensures consistent manufacturing and adoption of EVs

Source: Economics of Energy Innovation and System Transition (EEIST), 2023, Policies To Pass The Tipping Point In The Transition To Zero-emission Vehicles (Graph simplified to highlight Indian scenario)

5 Global Strategies:

Learning from Leading Examples

The global shift towards EVs offers invaluable lessons for India. This section describes successful implementation of ZEV availability standards in leading regions, providing actionable insights for India's policy framework.

5.1 China:

The Power of Production

China's New Energy Vehicle (NEV) mandate has propelled it to the forefront of EV adoption.

Key Policy:
The NEV mandate requires automakers to produce and sell a minimum percentage of NEVs (battery electric, plug-in hybrid, and fuel cell).

Impact:
This has forced manufacturers to invest heavily in EV technology, scale up production, and innovate rapidly. It's like setting a strict quota for a factory's output. If they don't meet it, they face penalties, driving them to find ways to produce more.

Insight for India:
India can emulate China's approach by setting ZEV availability standards for OEMs, ensuring a steady supply of e-buses.

5.2 European Union

The Market-Driven Push

Key Policy:
The EU sets progressively tightening CO_2 emission standards for vehicles, effectively pushing automakers to produce EVs to comply.

Impact:
This creates a market-driven transition, as manufacturers are incentivised to produce cleaner vehicles to avoid penalties. It's like setting stricter and stricter fuel efficiency requirements for cars. Companies are forced to innovate and produce cleaner vehicles to meet those standards.

Insight for India:
India can adopt a similar approach by linking ZEV availability standards with fuel efficiency standards, gradually phasing out ICE vehicles.

5.3 California:

Sub National Leadership

Key Policy:
California requires automakers to earn a certain number of ZEV credits based on the types and sales of zero-emission vehicles.

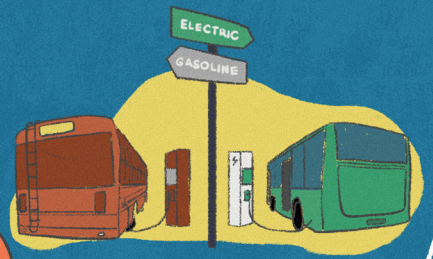
Impact:
This has spurred significant ZEV development and adoption, with California leading the US in EV sales. It's like a points system where automakers earn "green credits" for selling EVs. They can trade these credits, creating a market-based incentive for ZEV production.

Insight for India:
Indian states can implement their own ZEV availability standards for buses and commercial vehicles, tailored to local needs and pollution levels.

6 Implementation Roadmap for ZEV:

A Framework for India

There are essentially three steps to develop a ZEV framework in India:



Step 1

Setting the Timeline: A Phased Approach to Electrification

Step 2

Setting Production availability standards for the ICE Industry

Step 3

Setting a Timeline for Phasing Out ICE Buses

Step 1

Setting the Timeline

A Phased Approach To Electrification

A well-structured timeline is the backbone of a successful transition to electric mobility. It provides a roadmap for all stakeholders, from OEMs to operators, ensuring a coordinated and efficient shift. This section outlines a practical yet ambitious phased approach for India.

National ZEV Vision

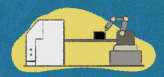
India needs a clear, long-term vision for complete vehicle electrification, with target years set for key milestones. This provides certainty to the automotive industry and helps them align their production plans.

Prioritising Vehicle Segments

The transition should prioritise vehicle categories based on their contribution to pollution and feasibility for electrification. For example, city buses, which operate on fixed routes and contribute significantly to urban pollution, can be prioritised for early electrification.

Phased Implementation

A gradual rollout of ZEV availability standards is essential to allow for industry adjustment and infrastructure development. This could involve:



Setting initial ZEV sales targets for manufacturers.

Phasing in ZEV procurement requirements for government fleets.

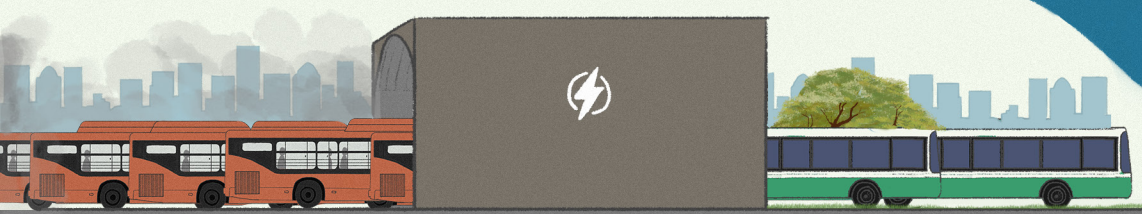
Establishing timelines for restricting the registration of new ICE vehicles in certain categories.

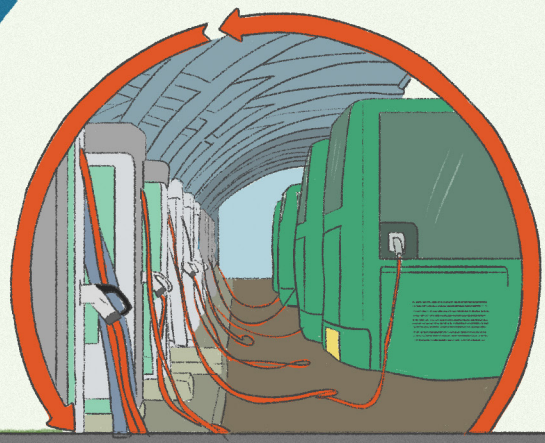
Infrastructure Alignment

The timeline must be closely coordinated with the development of the charging infrastructure. This ensures that there is sufficient charging capacity to support the growing number of EVs on the road.

Continuous Monitoring

The timeline should be regularly reviewed and adjusted based on technological advancements, market trends, and the availability of resources.





Step 2

Setting Production Availability Standards For The ICE Industry

OEM Production Targets

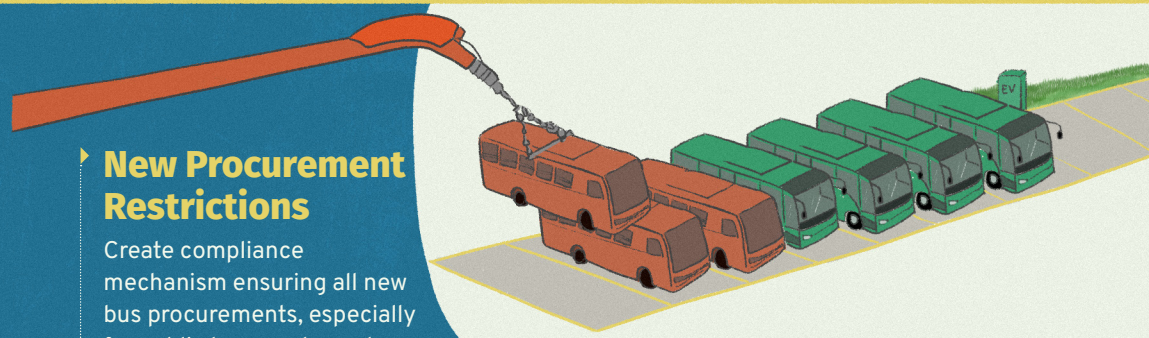
Standards should require OEMs to produce a minimum percentage of ZEVs annually. These targets should increase progressively over time, driving a gradual shift away from ICE vehicle production.

Aligned with Demand

Production availability standards should be aligned with the projected demand for EVs, ensuring that there are enough vehicles to meet the needs of the market.

Step 3

Setting a Timeline For Phasing Out ICE Buses



New Procurement Restrictions

Create compliance mechanism ensuring all new bus procurements, especially for public transport, must be for ZEVs from a specific year onwards.

Fleet Replacement Targets

Establish timelines for replacing existing ICE bus fleets with ZEVs. This could involve setting targets for different types of bus operators (e.g., city buses, intercity buses, school buses).

Scrappage Policies

Implement policies to encourage the scrapping of older, more polluting ICE buses. This can help to accelerate the adoption of cleaner vehicles and improve air quality.

Supporting Measures

Phasing out ICE buses should be accompanied by supporting measures, such as:

- Incentives for operators to purchase ZEV buses.
- Investments in charging infrastructure at bus depots and along routes.
- Training programmes for drivers and maintenance personnel.

A Timeline that India Can Take Inspiration From

India's timeline should be tailored to its unique context, considering its diverse vehicle market and infrastructure challenges.

Short-Term:

2027–2035

Initial Focus

- Prioritise STU buses for complete electrification, given their high usage and pollution contribution. Direct 100% e-bus procurement for city buses from 2027 onwards.
- Incentivise and set targets for the electrification of school buses and corporate fleets.

Mid-Term:

2036–2040

Expanding Scope

- Extend ZEV availability standards to private, public intercity buses and rural buses.
- Begin phasing out ICE buses in a structured manner, linking e-bus procurement with the retirement of older ICE buses.

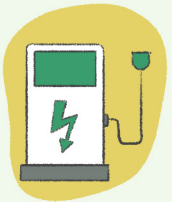
Long-Term:

Beyond 2040

Achieving Full Electrification

- Set a target year for 100% ZEV sales across all categories of buses.
- Implement policies to support the widespread adoption of EVs, including charging infrastructure development and battery recycling programmes.

Key Considerations for Implementation

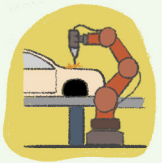


Technology Readiness

Align the timeline with the expected advancements in battery technology, charging infrastructure, and EV performance.

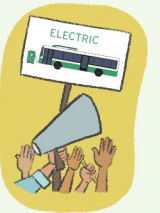
Economic Impact

Carefully assess the economic implications of the timeline, providing support for affected industries and workers.



Industrial Capacity

Ensure that the domestic auto industry can meet the growing demand for ZEVs.



Public Acceptance

Conduct public awareness campaigns to promote EV adoption and address concerns about range anxiety and charging availability.

6.4 Implementing ZEB Availability Standards

Defining Demand

While ZEV availability standards are critical to address supply-side issues in e-bus production, it is equally important that assured demand is present in the market. It is here that the need for Zero Emission Bus (ZEB) availability standards comes into the picture. These are for private and public bus operators, which ensure there is an assured demand to complement the incremental rise in production. While ZEV availability standards ensure an increase in e-bus production, ZEB availability standards ensure an increase in e-bus demand.

The Urgency of ZEB Availability Standards

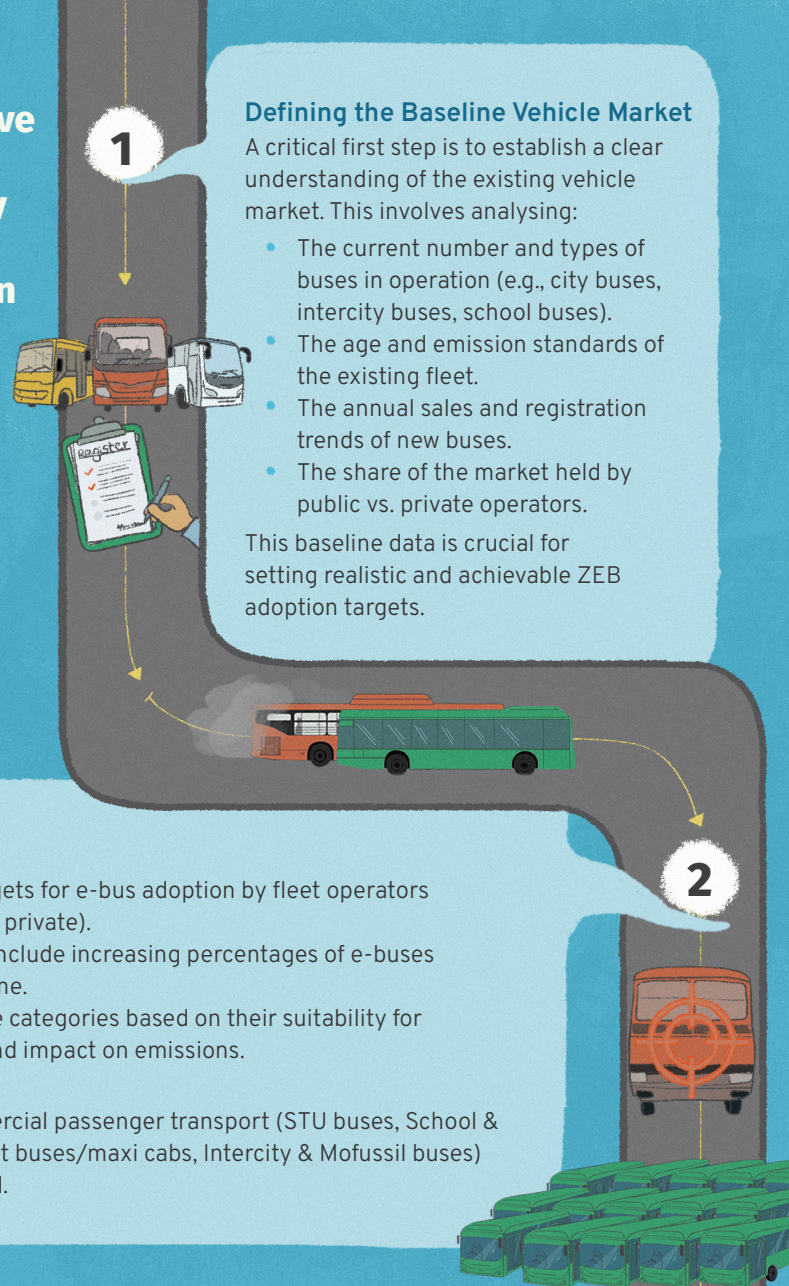
ZEB availability standards are not optional; they are a necessary complement to ZEV availability standards for manufacturers.

They create a guaranteed demand for e-buses, which is essential to incentivise manufacturers to scale-up production.

Without ZEB availability standards, even with policies aimed at manufacturers, the actual deployment of e-buses will be slow and inconsistent. It's like building a factory to make buses. The factory won't produce many buses if no one is required to buy them. ZEB availability standards create that guaranteed demand.

A Comprehensive Framework for ZEB Availability Standards Implementation in India

This section outlines a comprehensive framework for implementing ZEB availability standards in India, combining general best practices with specific considerations for the Indian context.



Defining the Baseline Vehicle Market

A critical first step is to establish a clear understanding of the existing vehicle market. This involves analysing:

- The current number and types of buses in operation (e.g., city buses, intercity buses, school buses).
- The age and emission standards of the existing fleet.
- The annual sales and registration trends of new buses.
- The share of the market held by public vs. private operators.

This baseline data is crucial for setting realistic and achievable ZEB adoption targets.

Target Setting

- Define clear targets for e-bus adoption by fleet operators (both public and private).
- Targets should include increasing percentages of e-buses required over time.
- Prioritise vehicle categories based on their suitability for electrification and impact on emissions.

For example

High-impact commercial passenger transport (STU buses, School & Staff Mobility, Tourist buses/maxi cabs, Intercity & Mofussil buses) should be prioritised.

Procurement Requirements

- Direct a certain percentage of new bus purchases to be ZEBs.
- Establish a timeline for the complete transition to ZEB-only procurement.

For example
Create compliance mechanism for only e-bus permits for new city and intercity buses from 2027 onward.

Applicability

Specify which types of fleet operators are subject to the availability standards.

- STUs
- Private bus operators (school buses, tourist buses, etc.)
- Corporate fleets

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Key Considerations

Financial Support
Provide financial incentives and access to low-cost financing to support fleet operators in transitioning to e-buses.

Infrastructure Development
Coordinate ZEV availability standards with the deployment of charging infrastructure.

Capacity Building
Offer training and technical assistance to fleet operators and maintenance personnel.

Annual review and course correction for public and private bus operators based on supply and technological progress.

8

Fleet Transition Timelines

- Set deadlines for the complete transition of existing fleets to ZEBs.
- These timelines may vary for different types of operators.

For example

- Require school, corporate, and tourist bus fleets to transition to EVs by specific deadlines.
- Direct all urban STUs to procure only e-buses from 2027 onward, targeting

100%
fleet electrification in Indian cities by 2042.

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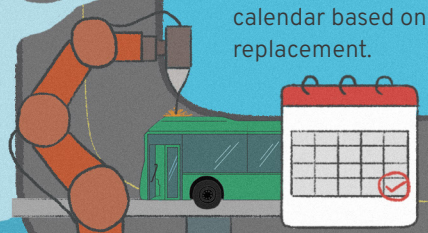
OEM Production Alignment

- Based on the projected demand from ZEB availability standards, ensure that e-bus production targets are aligned.
- Based on projected demands, create availability standards for OEMs to reserve manufacturing capacity for public e-buses.
- Create an annual demand calendar based on a standardised replacement.



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Fleet Replacement Planning

- Require all fleet operators (STUs and private) to submit long-term fleet replacement plans, outlining how they will transition to e-buses. This allows for better planning and coordination.
- STUs to submit a 15-year rolling demand forecast, updated every three years, to a designated nodal agency for centralised demand aggregation and large-scale procurement.
- Private Operators (via BOCI/local associations) submit annual fleet replacement plans in advance to the nodal agency through BOCI to enable demand aggregation, timely procurement, and smooth transition to electric fleets.

Credit incentives to complement standards

Apart from having availability standards on bus manufacturers and private, public bus operators, the government could also provide incentive tools like ZEV credits and carbon credits, respectively.

ZEV Credit System For OEMs

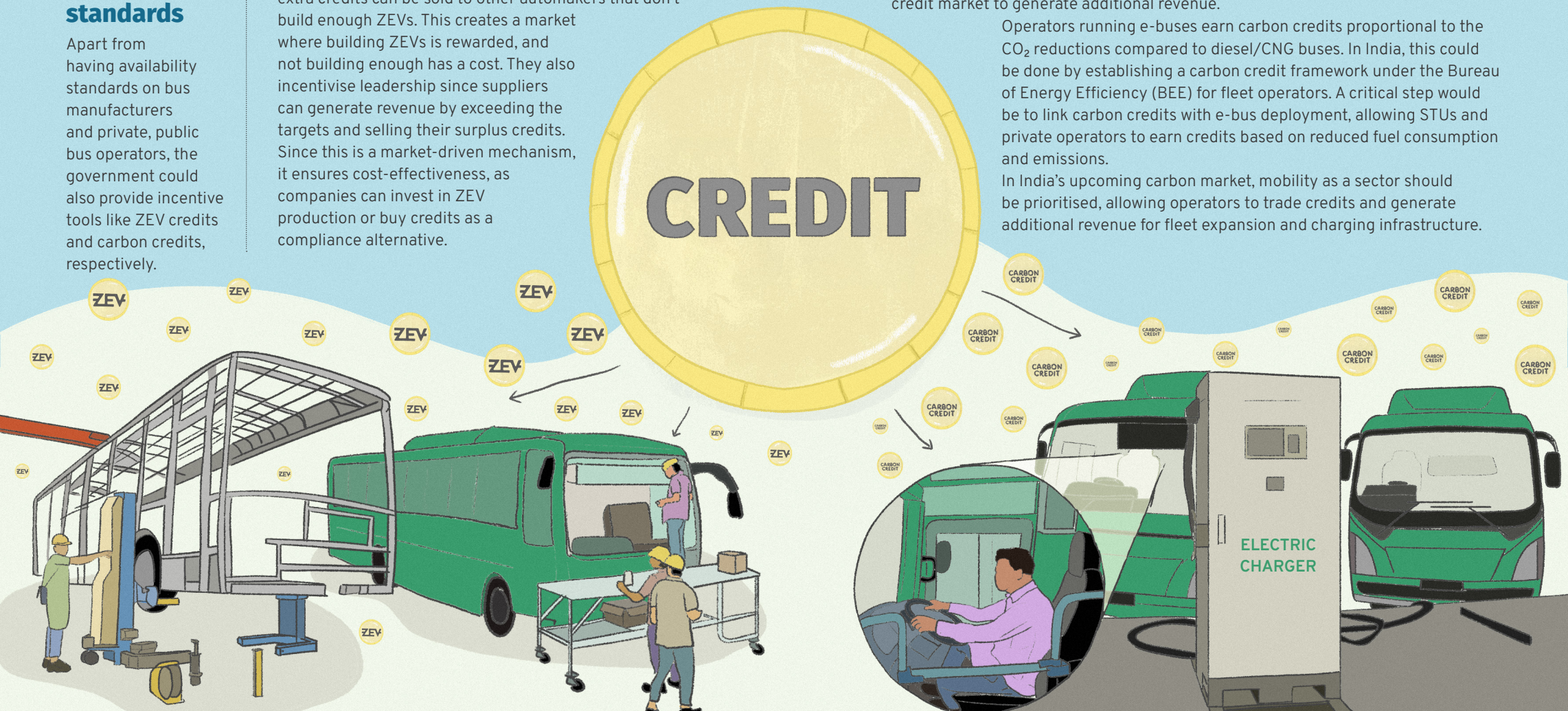
A ZEV credit system gives automakers a way to earn and trade "clean vehicle credits". Automakers that build more ZEVs than required by the rules earn extra credits. These extra credits can be sold to other automakers that don't build enough ZEVs. This creates a market where building ZEVs is rewarded, and not building enough has a cost. They also incentivise leadership since suppliers can generate revenue by exceeding the targets and selling their surplus credits. Since this is a market-driven mechanism, it ensures cost-effectiveness, as companies can invest in ZEV production or buy credits as a compliance alternative.

Carbon Credit System for Operators

While ZEV credits is for OEMs, Carbon Credit is an incentive for bus operators. A carbon credit system for fleet operators rewards public and private bus operators for reducing emissions through e-bus adoption, integrating them into India's carbon credit market to generate additional revenue.

Operators running e-buses earn carbon credits proportional to the CO_2 reductions compared to diesel/CNG buses. In India, this could be done by establishing a carbon credit framework under the Bureau of Energy Efficiency (BEE) for fleet operators. A critical step would be to link carbon credits with e-bus deployment, allowing STUs and private operators to earn credits based on reduced fuel consumption and emissions.

In India's upcoming carbon market, mobility as a sector should be prioritised, allowing operators to trade credits and generate additional revenue for fleet expansion and charging infrastructure.



7. Establishing a Nodal Agency

A dedicated nodal agency is crucial for effective coordination and implementation of ZEV availability standards. This agency can be established at the national or state level. Responsibilities of the Nodal Agency are :

Demand Aggregation

Tender Management

7.1 Continuous Monitoring and Evaluation

Regular monitoring and evaluation are essential to track progress and identify any necessary adjustments. This involves:

- Collecting data on e-bus adoption rates
- Assessing the impact of policies
- Engaging with stakeholders
- Publishing regular reports

OEM Coordination

Infrastructure Planning

Performance Tracking

Compliance Enforcement

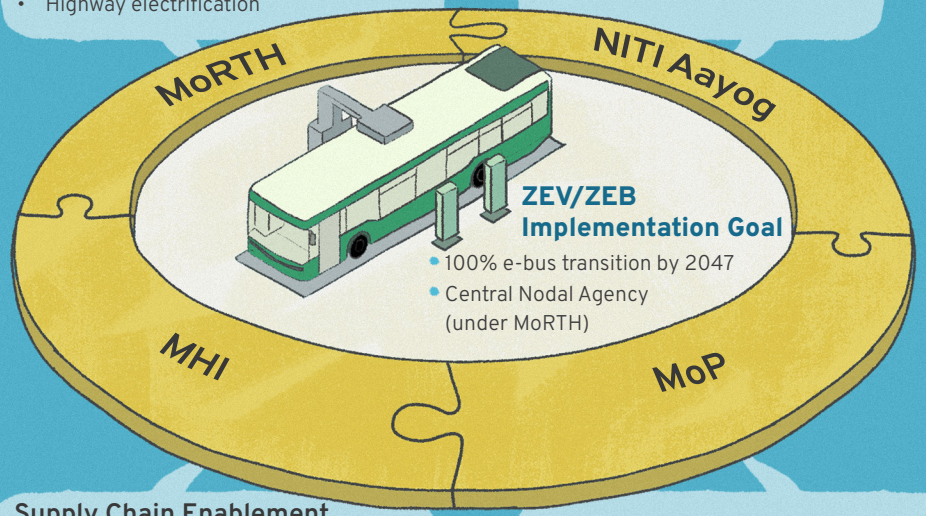
8 Defining Roles:

Ensuring Effective Governance

Successful implementation of ZEV availability standards requires clearly defined roles and responsibilities for various government ministries and agencies. This section outlines a framework for effective governance and coordination.

Deployment & Adoption
- STU/private ZEB availability standards
- Permit reform, scrappage, retrofit, leasing
- Rolling demand forecasts
- Highway electrification

Strategy & Planning
- Sets national/state targets
- Finances (VGF, Green Bonds)
- Residual value frameworks



Supply Chain Enablement
- ZEV Availability standards for OEMs
- Credit market & PLI rollout
- Demand aggregation
- Link production to ICE bus replacement

Infrastructure & Carbon Market
- Charging tariff reform
- Depot electrification (RE-based)
- Carbon credits for operators

NITI Aayog

NITI Aayog	Activity	Key Responsibilities	Monitoring and Implementation Roles
1	Policy roadmaps and centralised monitoring	Set and update national/state ZEV and ZEB targets	Track policy compliance and roadmap updates
2	Financing frameworks for e-bus adoption	Facilitate low-interest loans, Green Bonds, and VGF schemes	Monitor financing access and disbursal progress
3	Residual value framework for e-buses	Define residual value models to boost financing and resale markets	Monitor residual value realisation and secondary market growth

GOVERNMENT OF INDIA MINISTRY OF POWER

MoP	Activity	Key Responsibilities	Monitoring and Implementation Roles
1	Grid infrastructure and charging tariff reforms	Define a national tariff structure for e-bus charging	Monitor DISCOM tariff compliance and impact on costs
2	Renewable energy-powered charging for e-bus depots	Promote renewable energy-based depot charging	Track renewable installations at bus depots
3	Integrating e-buses into India's carbon market	Enable e-bus operators to earn carbon credits	Monitor carbon credit issuance and trading by fleet operators

MoRTH	Activity	Key Responsibilities	Monitoring and Implementation Roles
1	ZEB availability standards for STUs	Compliance mechanism for urban STUs to be 100% electrifed by 2042 and non-urban STUs by 2051	Track STU electrification progress; enforce compliance
2	ZEB availability standards for private operators	Issue ZEB-only permits, ensure fleet transition of private operators	Monitor permit issuance and operator compliance
3	Role of nodal agency in ZEB implementation	Establish a nodal agency to manage aggregation, tendering, and monitoring	Track demand forecasts, tender awards, and delivery
4	Promoting large-scale e-Bus leasing models for private operators	Integrate lease-based fleet models into permit conditions	Facilitate leasing options and monitor uptake
5	Strengthening charging infrastructure for intercity and highway operations	Electrify highways and terminals for long-haul e-buses	Monitor charging station deployment across highways
6	Residual value framework for e-buses	Define residual value models to boost financing and resale markets	Monitor residual value realisation and secondary market growth
7	Financial incentives for ICE bus scrappage and fleet electrification	Provide scrappage incentives linked to new e-bus procurement	Monitor scrappage-linked e-bus adoption data
8	Retrofitting ICE buses to Eeectric	Incentivise retrofitting ICE buses to electric	Certify retrofitted buses; disburse retrofit subsidies

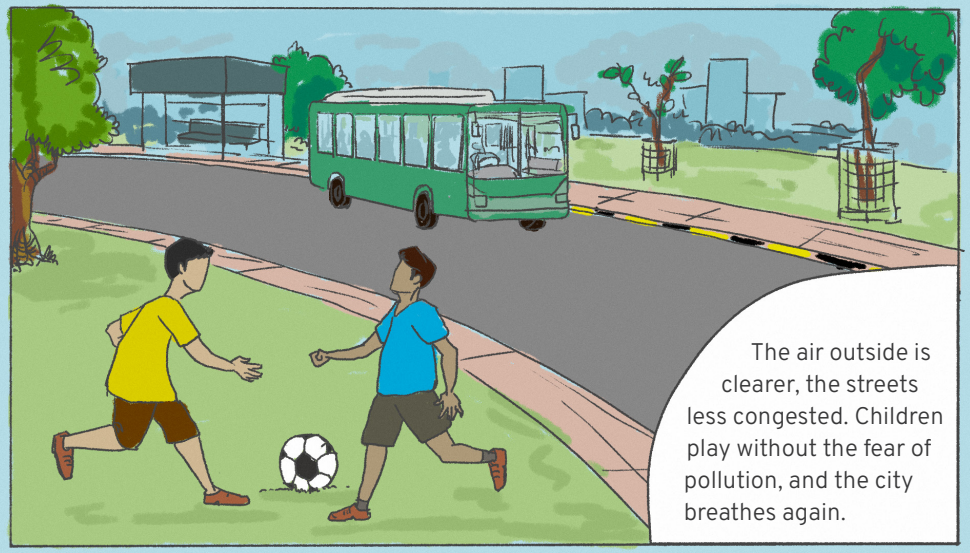
MHI	Activity	Key Responsibilities	Monitoring and Implementation Roles
1	Demand aggregation strategy for e-bus procurement	Aggregate e-bus demand across STUs/ private operators	Monitor tendering timelines and procurement status
2	Implement stricter ZEV availability standards for OEMs	Set phase-wise ZEV production quotas for OEMs	Monitor OEM compliance through standards tracking
3	Monitoring ZEV credits and availability standards	Develop and operate a ZEV credit trading platform	Track ZEV credit generation, trading, and compliance
4	Expanding Production-Linked Incentive (PLI) schemes	Disburse PLI incentives for EV components and battery manufacturing	Monitor investment inflows and localisation targets

A Vision Realised:

The Transformative Power of ZEV Availability Standards

Imagine a bustling Indian city, not choked by fumes, but alive with the quiet hum of electric buses.

The air is clean and interiors spacious. She boards comfortably, knowing her commute contributes to a healthier city.



The air outside is clearer, the streets less congested. Children play without the fear of pollution, and the city breathes again.

This transformation is driven by decisive action: ZEV availability standards that spurred e-bus production, cleaned our air, and prioritised people over pollution. The gap between aspiration and reality has been bridged, thanks to tools and mechanisms that inspired change and delivered a sustainable future.

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