BUS & CAR OPERATORS CONFEDERATION OF INDIA

ITDP INDIA

THE FEDERATION OF BUS OPERATORS ASSOCIATIONS OF TAMILNADU

Accelerating Sustainability:

Electrifying Tamil Nadu's Private Bus Sector

March 2025

Prepared by

The Institute for Transportation & Development Policy (ITDP) is a global non-for-profit organisation that works with cities worldwide to promote transport solutions that reduce traffic congestion, air pollution, and greenhouse emissions while improving urban liveability and economic opportunity. ITDP is represented in India by ITDP Pvt Ltd and works with governments, multilateral agencies, and civil society to make visible, on-the-ground improvements by providing technical expertise, policy solutions, research publications, and training programmes.

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This report reflects a collaborative effort to provide practical solutions for private bus operators transitioning to electric mobility. We hope it serves as a meaningful resource in promoting sustainable transport, benefiting operators, passengers, and society as a whole, while contributing to the broader goals of environmental sustainability and economic efficiency.

Disclaimer

This report is based on the demand aggregated solely from the data submitted by private operators and their expressed willingness to transition to e-buses under various business models. The cost analysis for lease models has been developed using standard operating cost data for private diesel buses and the costs of e-buses currently in operation in India.

While every effort has been made to ensure the accuracy and reliability of the data and calculations, the findings and recommendations presented in this report are for guidance purposes only. Readers are advised to independently verify the information and consult relevant experts before making any financial or operational decisions. Utmost care has been taken in drafting, typesetting, and reviewing this report; however, the authors, publishers, and associated contributors do not assume any responsibility for errors or omissions that may have occurred inadvertently. No claims arising from the use of this report will be entertained.

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Executive Summary

Tamil Nadu's private bus sector, operating under Stage Carriage Permits, is a crucial part of the state's public transport system, serving millions daily. With over 8,500 private buses carrying nearly 48 lakh passengers[1], these buses provide affordable and reliable transport across urban and rural areas. Operating under the same fare structure as State Transport Undertakings (STUs), private buses ensure accessibility but lack financial support, relying on efficient management to remain viable.

The sector faces growing challenges, including ridership decline post-COVID-19, rising diesel costs (60% of operational expenses), and stagnant fares, making operations unsustainable. Ageing fleets and bus shortages further compound these issues, highlighting the need for urgent reforms.

Electrification offers a solution, aligning with India's climate targets—40% public bus electrification by 2030 and Net Zero by 2070. Transitioning 8,500 private buses to electric could prevent 87.83 lakh tonnes of CO_2 emissions, equivalent to growing 3.32 crore trees for 12 years. It also promises ₹24,000 crore in fuel savings over 12 years and a 30-50% reduction in operational costs.

However, barriers such as high upfront costs, inadequate charging infrastructure, limited financing, and strict permit regulations hinder electrification. A survey of 153 private operators across the state showed 60% willingness to switch, preferring a leasing model with proper financial and policy support.

This report outlines the challenges and opportunities for electrifying Tamil Nadu's private buses and presents actionable recommendations, including innovative financial models like dry leasing, building a robust charging infrastructure network, and regulatory reforms to streamline permits exclusively for electric buses. By adopting these measures, Tamil Nadu can lead India's electrification journey, ensuring a modern, sustainable, and efficient public transport system that benefits operators, passengers, and the environment alike.

1. *Federation of Bus Operators Association Tamil Nadu (2024)*

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Private Buses: Shaping Mobility in Tamil Nadu

1.1 Introduction

Today, Tamil Nadu's reliance on buses for mobility is significant. The state's bus sector provides essential access to jobs and education for nearly two crore people daily. Tamil Nadu State Transport Corporation (TNSTC) operates 15,613 buses, serving 1.3 crore passengers each day, making it the primary public transport provider. Alongside, private stage carriage buses cater to 48 lakh passengers daily, ensuring crucial connectivity across urban and rural regions. With around 8,500 private buses operating under stage carriage permits, they form a vital part of the transport system. Despite adhering to the same fare structures as State Transport Undertakings (STUs), private operators sustain profitability through meticulous operations and cost management.

	 Private buses (excluding mini buses)	 TNSTC (excluding MTC & SETC)
Total Fleet	6,400	15,613
Passengers/bus/day	728	835
Daily Ridership (in lakhs)	48.77	130.46

Table 1: Daily Ridership Of Private And Public Buses In Tamil Nadu
(Source: TNSTC 2024, Federation of Bus Operators Association Tamil Nadu 2024)

With a common fare policy, private buses complement STUs in meeting travel demand. Issuing new permits for private buses will reduce the bus shortage in Tamil Nadu, boosting rural and urban mobility with better service coverage.

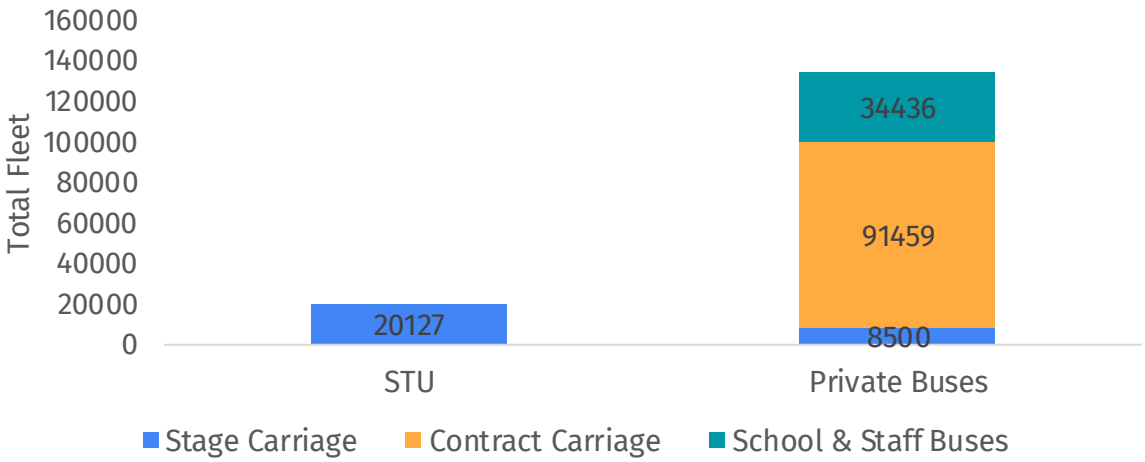


Figure 1: Total buses operated in Tamil Nadu
(Source: TNSTC 2024, Vahan Dashboard, MoRTH Road Transport Year Book 2020, BOCI)

Private operators dominate Tamil Nadu’s bus sector, operating 1.3 lakh buses which is 86% of total bus fleet in the state.

1.2 Private Bus Permits in Tamil Nadu: Types & Purpose

1. All India Tourist Permit (Tourist Omni Bus)

- This permit allows buses to operate as tourist vehicles across multiple states, including Tamil Nadu. It is issued under Rule 82 to 85 of the Central Motor Vehicles Rules, 1989 and is valid throughout India.
- It allows long-distance intercity and inter-state tourist service operations.
- It is commonly used by private operators for luxury travel and package tours.
- Passengers are typically pre-booked, and the bus cannot pick up random passengers en route like a stage carriage.

2. Contract Carriage Permit (Institution Buses, School Buses, Omni Buses)

- A contract carriage permit allows buses to transport passengers based on a pre-agreed contract without allowing individual ticket sales or picking up passengers en route.
- Institution Buses: Used by corporates, industries, and offices to transport employees.
- School Buses: Dedicated to ferrying students and staff of schools, colleges, and educational institutions.
- Omni Buses (Private Intercity Buses): Operates under contract carriage, providing point-to-point service between cities, requiring passengers to pre-book tickets before travel. They cannot pick up or drop passengers en route like stage carriage buses.

3. Stage Carriage Permit

- A stage carriage permit allows buses to operate on fixed routes with designated stops, issuing tickets to passengers on a per-stage or per-kilometer basis.
- It is used by private and government bus operators to provide local and intercity public transport services.
- These buses can pick up and drop passengers at multiple stops along the designated route.
- Buses can operate under regulated fare structures as set by the State Transport Authority.
- These permtis are commonly used for mofussil services (rural-urban connectivity), intra-city public transport, and semi-urban areas.

1.3 Permit Regulations in Tamil Nadu: Policy Milestones

In Tamil Nadu there are a total of 8,500 stage carriage buses operated by the private sector, holding only 30% of stage carriage permits. This disparity highlights regulatory limitations despite their significant role in providing mobility needs. With STUs running 20,127 stage carriage buses, private operators are crucial in meeting transport demand and addressing gaps in the public transport system.

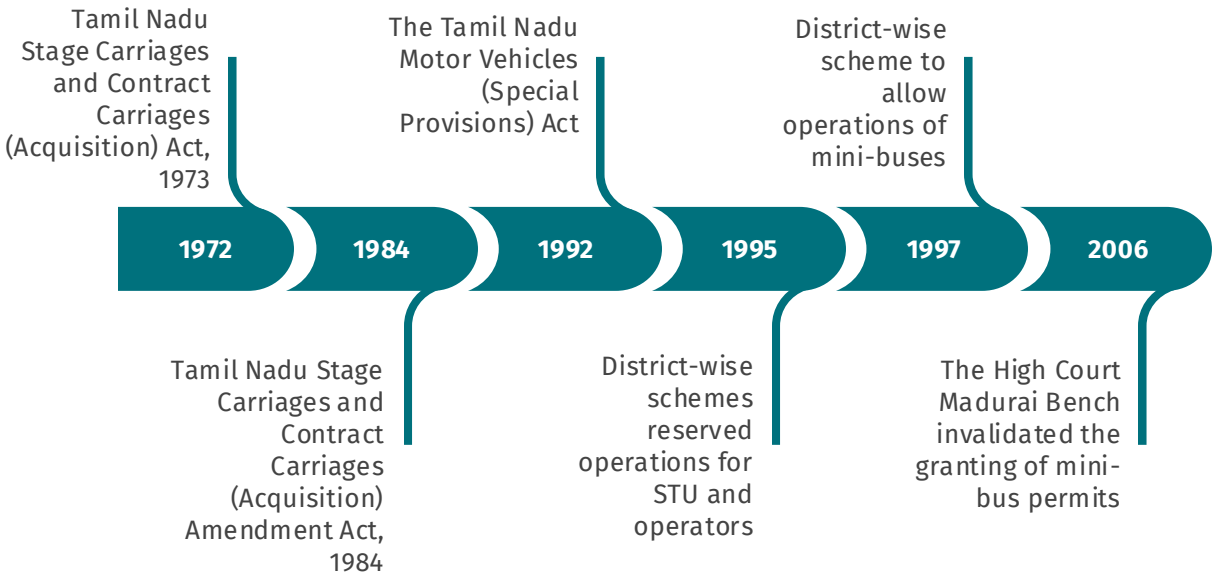
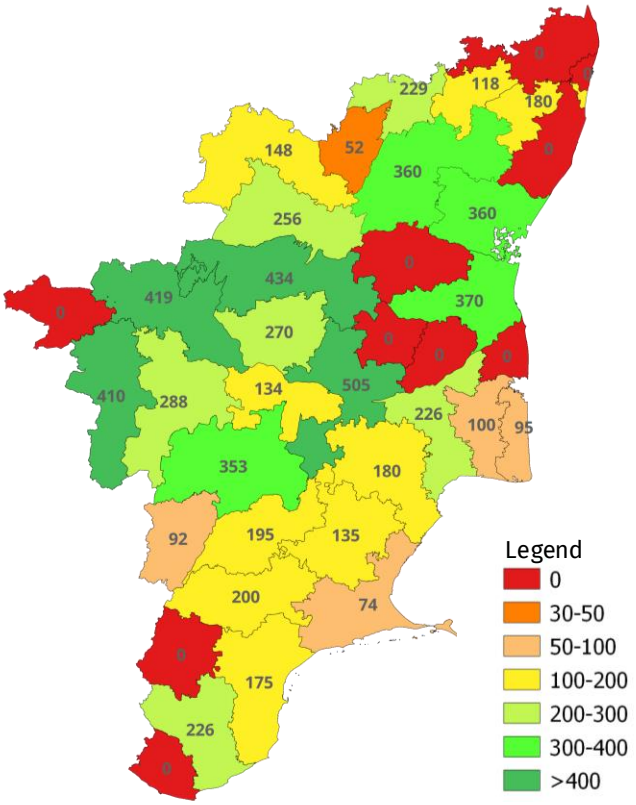


Figure 2: Timeline of major policy milestone in stage carriage permit (Source: TN MV Act, Federation of Bus Operators Association Tamil Nadu)

Starting with the Tamil Nadu Stage Carriages and Contract Carriages (Acquisition) Act of 1973, the state initiated measures to regulate bus services. Subsequent amendments in 1984 reinforced these regulations. The Tamil Nadu Motor Vehicles (Special Provisions) Act of 1992 further defined operational guidelines. In 1995, district-specific schemes reserved operations for State Transport Undertakings (STUs) and private operators, creating localised regulatory frameworks. The 1997 scheme introduced mini buses to enhance last-mile connectivity; however, this was invalidated by the High Court's Madurai Bench in 2006. These developments reflect the state's efforts to balance public and private participation in bus services, aiming to ensure service quality and accessibility, though some initiatives have encountered legal challenges.

1.4 Distribution of Private Stage Carriage Buses



Rank	Top 15 District	Total Buses
1	Tiruchirappalli	505
2	Salem	434
3	Erode	419
4	Coimbatore	410
5	Cuddalore	370
6	Villupuram	360
7	Tiruvannamalai	357
8	Dindigul	353
9	Tiruppur	288
10	Namakkal	270
11	Dharmapuri	256
12	Vellore	229
13	Thanjavur	226
14	Tirunelveli	226
15	Virudhunagar	200

Figure 3: Distribution of private stage carriage buses in TN
(Source: Federation of Bus Operators Association Tamil Nadu)

The distribution of private stage carriage buses in Tamil Nadu reveals significant regional variation, with certain districts serving as key hubs for private bus operations. Districts like Tiruchirappalli (505 buses), Salem (434 buses), and Erode (419 buses) lead in the number of private stage carriage buses. The map highlights green colour districts, each operating over 200 buses, showcasing a concentration of private buses in central and western parts of the state. However, several districts in yellow and red zones, with fewer than 200 buses, reflect limited private bus operations

1.5 Overview of Operations

Total Buses In Operation: 8,500
Tamil Nadu operates 8,500 private stage carriage buses, comprising of 6,700 standard 11m buses and 1,800 7m mini-buses.

Daily Ridership: 48.77 lakh
These buses cater to 48.77 lakh passengers daily (excluding mini-buses), showcasing their vital role in public transport.

Daily Vehicle Utilization: 430 km
With an average daily utilization of 430 km and a route length of 45 km, private buses typically operate for 14 hours, with an average of 728 pax/bus/day.

Operating Cost: ₹35-40 per km **Profit Margin: ₹3-4 per km**
Despite operating under regulated and affordable fare structures, private operators achieve profitability through effective resource management.

Operational Challenges
Rising fuel cost, cost recovery from farebox and limited profit margins highlight the need for sustainable solutions, to enhance efficiency and reduce environmental impact.

Key challenges faced by private operators in existing operation:

- **High Operating Costs**: Diesel costs constitute 60% of total operating expenses, creating significant financial pressure, particularly with rising fuel prices and dependence on imported crude oil. This makes it difficult for operators to remain profitable under regulated fare structures.

- **Cost Recovery Issues**: Regulated fares, set by the State Transport Department, are capped and increased gradually to maintain affordability for passengers. However, this restricts revenue growth, making cost recovery a persistent challenge.

- **Aging Fleet**: Nearly 59% of the buses in the private fleet adhere to older BS-III emission standards, with 49% requiring replacement. The aging fleet impacts service quality, operational efficiency, and environmental compliance.

02

Impact of Private Stage Carriage Buses on Urban Mobility in Tamil Nadu

2.1 Shortage of Buses in Tamil Nadu Cities

Tamil Nadu is currently facing a significant deficit in its city bus services, with only 12 out of 63 cities and towns having operational city buses (ITDP India). Presently, the total fleet dedicated to city services consists of 7,909 buses, including government and private buses. However, ITDP India's projections show that the demand for urban stage carriage buses is set to increase substantially. The need for this expansion is evident, as over 60 cities in Tamil Nadu have populations exceeding 1 lakh, indicating a substantial demand for reliable public transport services. Currently, Tamil Nadu has only 18 city buses per lakh urban population, which is far below the Ministry of Housing and Urban Affairs (MoHUA) benchmark of 60 buses per lakh population. This stark disparity highlights the pressing need for fleet augmentation. With the current bus shortfall in the state standing at approximately 15,800 buses, there is a significant gap that requires urgent attention to strengthen the public transport network and enhance service accessibility across the state.

By 2030, an estimated 20,300 buses will be required to serve 63 cities. By 2040, this number is expected to rise to approximately 23,300 buses across 74 cities. Looking further ahead, by 2050, the demand is projected to reach 22,200 buses covering 84 cities. The role of private bus operators is crucial in addressing this demand. With their capability for quicker fleet expansion and operational efficiency, private operators can effectively complement public sector efforts. A synergistic partnership between public and private sectors would facilitate faster fulfillment of bus demand and improve urban mobility.

Current requirement & future projections

- **2024:** 15,800 buses are needed, revealing a significant gap in capacity. Total shortfall is 7,891 for 60 cities with population above 1 lakh. (Existing buses 7,909 including public and private)
- **2030:** Anticipated demand for urban stage carriage buses is projected to be around 20,300 in 63 cities.
- **2040:** Estimated demand increases to 23,300 buses, across 74 cities.
- **2050:** Projections indicate a demand of 22,200 buses across 84 cities.

Private buses can efficiently meet this demand if the public and private sectors collaborate and complement each other's efforts.

2.2 Tamil Nadu Needs More and Cleaner Buses

Tamil Nadu's public transport system faces not just a demand for more buses but a pressing need for cleaner, sustainable solutions. Electrifying the private stage carriage fleet is essential for meeting the state's sustainability objectives, such as achieving its renewable energy target of 50% installed capacity by 2030, reducing urban air pollution under the Tamil Nadu Climate Change Mission, and cutting transport sector emissions in alignment with the Tamil Nadu Electric Vehicle Policy 2023. These efforts also align with India's national climate commitments. The benefits of this transition are significant. Electric buses produce zero tailpipe emissions, directly contributing to better air quality and reduced greenhouse gas emissions. Additionally, they are more energy-efficient than traditional internal combustion engine (ICE) vehicles, resulting in substantial fuel savings. Over their operational lifespan, electric buses also prove cost-effective due to lower fuel expenses, enhancing the financial viability for operators.

An electric bus can offer:

- Zero Emissions
- Better Air Quality
- Energy Efficiency
- Reduced dependency on fossil fuel and fuel imports
- Cost Savings

India's ambitious EV targets aims for 40% of buses to transition to electric models by 2030, placing private operators in a crucial role for adoption. The projected benefits of fully electrifying Tamil Nadu's private stage carriage bus fleet are far-reaching.

Photo: Binai Sankar

03

Electrifying Tamil Nadu's Private Buses: A Transformative Impact

3.1 Why Electrifying Private Stage Carriage Buses Is Important

- **To Scale Up Urban Mobility:** Electrifying private stage carriage buses is essential for enhancing urban mobility in 62 cities across Tamil Nadu. Notably, 52% of these existing urban stage carriage buses are privately owned and operated, highlighting the sector's significance.

- **Connected to Daily Livelihood:** These buses provide vital connectivity, linking rural areas to major urban job and educational centers, thus supporting the daily livelihood of many residents.

- **Affordability:** Private stage carriage buses operate under fare structures similar to those of State Transport Undertakings (STUs), ensuring that services remain affordable for the public.

- **Operational Discipline:** Unlike contract carriage buses, stage carriage buses adhere to designated timetables and schedules set by the Regional Transport Authority (RTA), ensuring structured and reliable services.

- **Operational Efficiency:** Private operators demonstrate effective resource management, allowing them to maintain profitability even within affordable fare structures.

- **Alignment with STU Requirements:** The e-bus variants currently available in the market, which are designed to meet STU operational needs, also fulfill the operational requirements of private operators, making electrification feasible and practical for this sector.

3.2 What Is Impact Of Achieving 100% Electrification

The electrification of Tamil Nadu's 8,500 private stage carriage buses holds immense potential for environmental and economic benefits. It is projected to reduce CO_2 emissions by 87.83 lakh tonnes over 12 years, equivalent to the environmental impact of planting 39 crore trees. On a daily basis, this transition would prevent 2,033 tonnes of CO_2 emissions, reflecting significant progress toward climate action and clean energy goals. These reductions align closely with Sustainable Development Goals (SDGs) 7 and 13, focusing on affordable clean energy and combating climate change.

	Daily Savings	Annual Savings	Lifetime Savings (12 years)
Emission Reduction	2033 tones	7.3 lakh tones	87.83 lakh tones
Fuel Savings	5.6 lakh litres	20.68 cr. litres	248.20 cr. litres
NPV of Fuel Savings	₹ 4 cr.	₹ 1400 cr.	₹ 24000 cr. (NPV)

Table 2: Total savings with electrification of existing 8500 private stage carriage buses

Electrification also delivers considerable fuel savings, estimated at 248.20 crore litres over 12 years, translating to a net fuel cost saving of ₹24,000 crore (NPV). The transition not only reduces reliance on imported fossil fuels but also ensures sustainable urban mobility by integrating with SDG 11 (Sustainable Cities and Communities) and SDG 9 (Industry, Innovation, and Infrastructure). These benefits highlight electrification as a transformative solution, ensuring long-term sustainability and economic viability while addressing critical environmental challenges.

Alignment with four Sustainable Development Goals

3.3 Benefits of Transition To E-Buses

The transition to e-buses is not just a shift from diesel to electric vehicles; it represents a transformative leap towards a modern, efficient, and inclusive public transport system. This transition has far-reaching benefits, impacting not only operators but also passengers, society, and the government. It marks the beginning of a new era in transportation that is comfortable, transparent, digitised, affordable, and environmentally friendly.

Benefits For Operators

For operators, the e-buses provides significant advantages that ease financial and operational burdens:

- **Savings in Operating Costs:** E-buses reduce fuel and maintenance expenses, resulting in lower overall operating costs.
- **Fleet Modernization:** Operators can upgrade to a modern bus fleet without the heavy upfront investment associated with ownership through lease model.
- **No Investment Risk:** Leasing eliminates the financial risks tied to capital investments, allowing operators to focus on service quality.
- **Uniformity in Fleet:** Standardised e-buses ensure uniform services, improving brand identity and operational efficiency.
- **Outsourced R&M:** Maintenance and repair are outsourced, reducing technical challenges for operators.
- **Economies of Scale through Demand Aggregation:** Aggregating demand lowers costs and improves service delivery.
- **ITMS Services:** Integrated Transport Management Systems (ITMS) enhance operational transparency and efficiency.

Benefits For Passengers

- **Modern Bus Fleet:** A fleet of clean, quiet, and comfortable e-buses enhances the commuting experience.
- **Uniformity in Service:** Standardised operations ensure consistent service quality across routes.
- **Digital Payment Services:** Online payment platforms integrated with aggregator systems simplify fare transactions.
- **Integration of NCMC:** The introduction of the National Common Mobility Card (NCMC) allows seamless travel across multiple modes of transport.
- **Improved Reliability:** Real-time bus tracking systems ensure reliable and predictable services, reducing uncertainty for commuters.

Benefits For The Society And State

The government and society as a whole reap substantial benefits from adopting e-buses:

- **Improved Public Transport:** A modern e-bus fleet elevates the quality of public transport, addressing urban mobility challenges.
- **Fleet Deficit Fulfillment:** Leasing enables fleet expansion without heavy capital investments, closing the gap in transport demand.
- **Emission Reduction:** E-buses significantly lower greenhouse gas emissions, contributing to a cleaner environment.
- **Better Air Quality:** Reduced emissions directly improve urban air quality, benefiting public health.
- **Fuel Savings:** Transitioning to electric mobility reduces reliance on fossil fuels, saving costs and ensuring energy security.
- **Achievement of SDGs:** The shift aligns with Sustainable Development Goals (SDGs), promoting sustainable urban development.

04

ITDP India & BOCI's Efforts For Private Bus Electrification In Tamil Nadu

4.1 Comprehensive Report On Private Bus Sector Electrification

Recognising the urgency of electrifying private buses, ITDP India with support from BOCI and Federation of Bus Operators Association Tamil Nadu embarked on a detailed assessment in 2022 taking the private bus sector in Tamil Nadu as a case and engaged with private bus operators, government entities, original equipment manufacturers (OEMs), non-banking financial corporations (NBFCs), distribution companies (DISCOMs), and charging point operators (CPOs) in Tamil Nadu and also at the national level. The assessment followed a structured approach,

- Involving stakeholder interactions,
- Identifying viability gaps,
- Proposing regulatory reforms, and
- Facilitating dialogues with key organisations.

Our year-long effort and engagement with various stakeholders helped initiate conversations among various govt and non-govt stakeholders both at state and national level and brought their attention to the neglected private sector electrification and the recommendation of our report on “Electrification of non-urban private sector buses” can act as a guidance for state level and national level policy to incorporate the private sector into the wave of electrification.

Link to the report: [The Road Ahead for Private Electric Buses in India: The Case of Non-urban Routes]

4.2 Stakeholders Discussion At Guidance Tamil Nadu

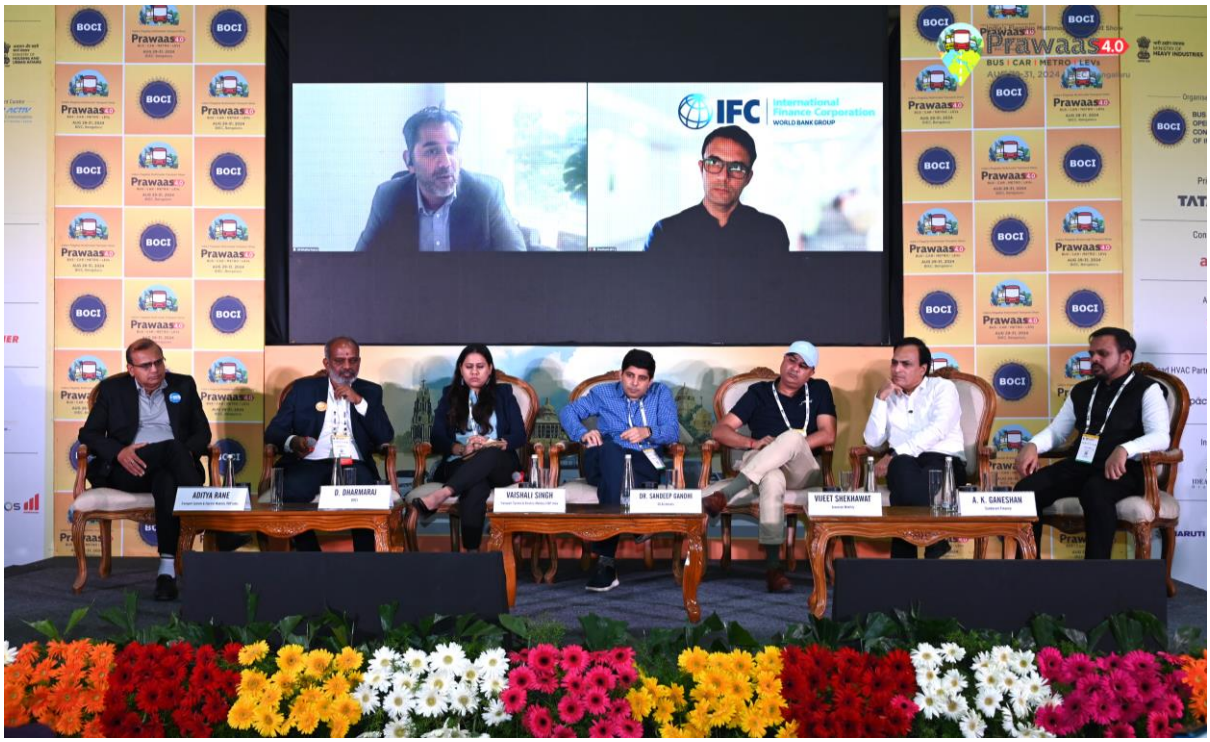
The stakeholder discussion at Guidance Tamil Nadu in December 2022 brought together industry leaders and policymakers including private bus operators, government entities, original equipment manufacturers (OEMs), non-banking financial corporations (NBFCs), distribution companies (DISCOMs), and charging point operators (CPOs) to address the critical challenges faced by the private bus sector in Tamil Nadu. The discussions identified key obstacles hindering the growth and efficiency of private bus operations, many of which align with broader systemic issues impacting the sector.

Key barriers for private sector's transition to electric buses:

- **Policy and Regulatory Barriers:** Tamil Nadu State EV Policy includes electrification targets exclusively for STUs, with no specific targets or recognition for the private sector's role in achieving electrification. Additionally, there is no provision in the permit conditions that allows private bus operators to take buses on lease, which could help reduce capital expenditure and ease the financial burden of fleet upgrades.
- **Financing Constraints:** Operators face high-interest loans and limited refinancing options, further burdened by the lack of low-cost financing or interest subvention schemes to support the transition to electric buses. This makes financing prohibitively expensive for private operators. Many rely on bus collateral for financing, which reduces their financial flexibility and hinders their ability to expand or modernize their fleets effectively.
- **Lack of Charging Infrastructure:** Insufficient availability of charging stations poses a major roadblock to electrification. This is compounded by inadequate maintenance and parking facilities, with 52% of buses parked at fuel stations overnight and 20% resorting to roadside parking, while rest are parked at Govt. bus stands and private parking.
- **Focus on STUs by Government and OEMs:** OEM primarily focused on STUs, further marginalizes the private sector. This limits opportunities for electrification and innovation in private bus operations.

4.3 National Level Stakeholders' Discussion At PRAWAAS 4.0 Bengaluru

At the PRAWAAS 4.0 event in Bengaluru in August 2024, key industry experts, including representatives from BOCI, BasiGo, GreenCell Mobility, EKA, IFC - International Finance Corporation, Sundaram Finance, and SGArchitects convened to discuss the critical role of the private sector in transitioning to electric buses. This collaborative dialogue underscored the importance of addressing financial, regulatory, and operational challenges to accelerate the adoption of electric vehicles in India's private bus sector.



Key Takeaways from the discussion:

- **Regulatory Reforms:** Policy and regulation amendments at the state level are essential to facilitate the electrification of transport. Streamlined regulations can play a significant role in simplifying the transition, particularly in areas such as permit allocation and infrastructure development. By creating a clear and supportive regulatory environment, private operators can navigate the process more effectively, while attracting investments in charging infrastructure and fleet upgrades to accelerate adoption.

- **Leasing Models to Reduce Costs:** Leasing models offer a practical solution to overcome the high capital expenditure (CAPEX) barrier in the adoption of electric buses. By leasing vehicles instead of purchasing them outright, operators, particularly small and medium-sized enterprises, can access electric buses without the financial strain of large upfront costs. This model enables operators to focus on improving service quality and operational efficiency while spreading costs over time.

- **Innovative Financing:** Low-cost financing options, including equity and debt mechanisms, can significantly ease the financial challenges faced by operators in acquiring electric buses. Such innovative financing solutions reduce operational costs and make electrification projects more attractive to private players. By addressing the high interest rates and rigid lending terms that often act as barriers, these financing mechanisms can support sustainable long-term investments in the sector.

- **OEMs' Readiness:** Original Equipment Manufacturers (OEMs) are equipped to meet the diverse needs of private operators, ensuring that electric buses are designed to suit different operational requirements. With the capability to tailor products based on route characteristics, passenger loads, and regional conditions, OEMs also provide after-sales support, maintenance, and training services. This readiness helps operators ensure a smooth transition to electric mobility while maintaining efficiency and reliability.

05

Lease Model: The Future of E-Bus Adoption for the Private Sector

5.1 Introduction To Leasing Models For Buses

The lease model for buses, particularly electric buses, has emerged as a transformative approach to overcoming the financial challenges faced by bus operators. Unlike the conventional outright purchase model, leasing allows operators to avoid substantial upfront capital expenditures and instead pay a fixed monthly lease rental. This model shifts the financial burden of bus ownership, including the costs of acquisition, maintenance, and battery replacement, to a third-party lessor. The operators, as lessees, focus solely on managing daily operations such as staff, permits, and energy costs.

Leasing has proven to be an effective strategy worldwide, particularly in countries like Chile, Colombia, and Kenya, where governments, fleet aggregators, and private operators collaborate to facilitate the transition to electric buses. By offering predictable operating costs and reducing the risks associated with long-term ownership, leasing encourages the adoption of electric vehicles (EVs) and enhances the financial viability of operators, especially small and medium enterprises (SMEs).

Why Leasing is the Most Effective Model

The leasing model addresses key barriers in the transition to electric buses, including high capital expenditure (CAPEX), limited access to low-interest financing, and maintenance uncertainties. Here's why leasing is the most effective model for this transition:

- **Financial Feasibility:** Leasing eliminates the need for high down payments and long-term EMIs required under outright purchase models. Operators instead pay manageable monthly lease rentals, significantly reducing their financial burden. For instance, a dry lease model allows operators to utilize buses without ownership costs while the lessor handles annual maintenance contracts (AMC) and battery replacements.
- **Risk Mitigation:** Maintenance, battery degradation, and technology obsolescence are significant concerns in EV adoption. Leasing transfers these risks to the lessor, ensuring operators can focus on operational efficiency without worrying about high repair or replacement costs.
- **Enhanced Accessibility:** Leasing democratizes access to electric buses for small and medium operators who may lack the financial muscle to purchase new vehicles. By lowering entry barriers, the model supports the growth of a diverse and competitive transport sector.
- **Global Success Stories:** Countries that have adopted the lease model have demonstrated its scalability and efficiency. In Chile, for instance, the government works with fleet providers and financial institutions to lease buses to operators. This collaborative framework reduces upfront investment requirements, spreads financial risk, and maintains high operational standards.

5.2 Dry Lease Model for E-Buses: A Global Perspective

The Dry Lease or Rolling Stock Operating Company (ROSCO) model, widely recognized in the railway and aviation sectors worldwide, is a proven approach to streamline asset management and operations. In railways, ROSCOs own and maintain locomotives and carriages, leasing them to train operating companies. Similarly, in aviation, leasing companies own aircraft and lease them to airlines, simplifying fleet management for operators. This model ensures efficient resource utilization, high-quality maintenance, and financial viability.

Key Features of the e-Bus Dry Lease Model

- **Ownership and Maintenance:** Fleet providers retain ownership and oversee major maintenance, ensuring the longevity and reliability of assets.
- Operational Focus: Bus operators lease the vehicles, focusing on efficient service delivery without the capital cost of fleet ownership.
- **Financial Structure:** Loans and funding are typically secured by fleet providers through financial institutions, through interest subvention scheme or long term low interest loan from development bank through government enabling scalability.
- **Public-Private Collaboration:** Governments often play a vital role in contract supervision and infrastructure provision, such as depots and charging facilities.

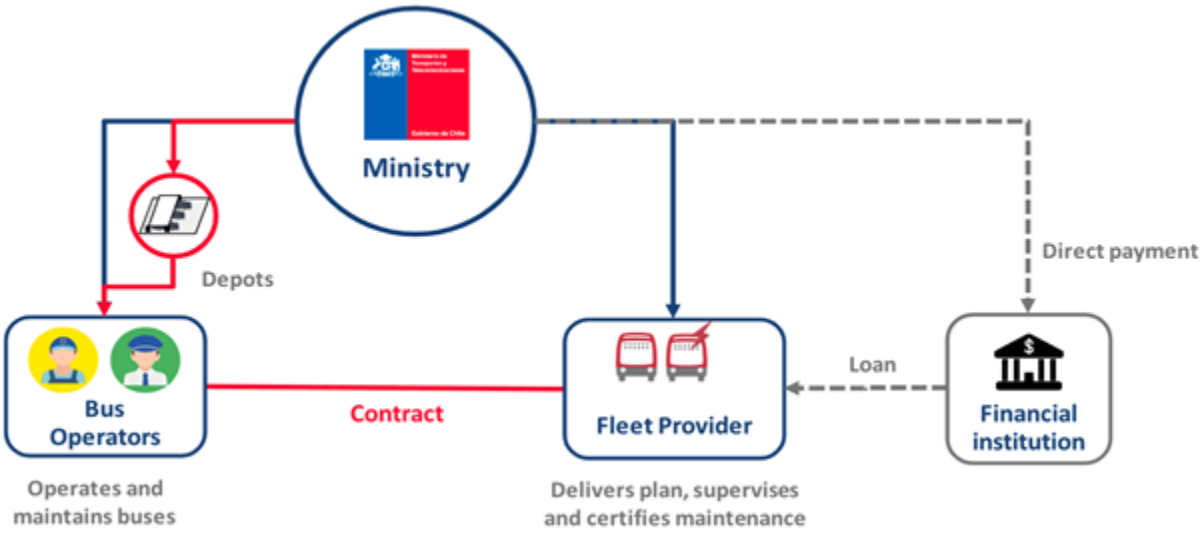


Figure 3: Working of ROSCO Model in Chile for Electric Buses (Source: https://blogs.worldbank.org/)

- **Transport for London (TfL):** TfL adopted the dry lease model for its new Routemaster buses. By commissioning their development and retaining exclusive buying rights, TfL ensured fleet quality and sustainability. Operators leased and operated 600 new buses introduced in 2013 under this framework.

- **Chile's e-Bus ROSCO Model:** The Chilean Ministry partnered with fleet providers to lease e-buses to operators. Financial institutions provided loans to fleet providers, who then managed vehicle procurement, maintenance plans, and quality supervision. Operators maintained day-to-day operations, delivering clean and efficient transport.

- **Other Regions:** Similar models operate in Colombia, Mexico, Kenya, Nigeria, and Tanzania, proving its adaptability to diverse contexts.

5.3 Case Study: BasiGo's E-Bus & Battery Lease Model in Africa

Basigo, an African-based company, specializes in enabling private bus operators to transition to electric mobility through innovative leasing and financing solutions. By addressing financial barriers and offering reliable operational support, Basigo plays a crucial role in promoting sustainable transportation across the continent.

1. Lease Option: Affordable Entry to E-Bus Operations

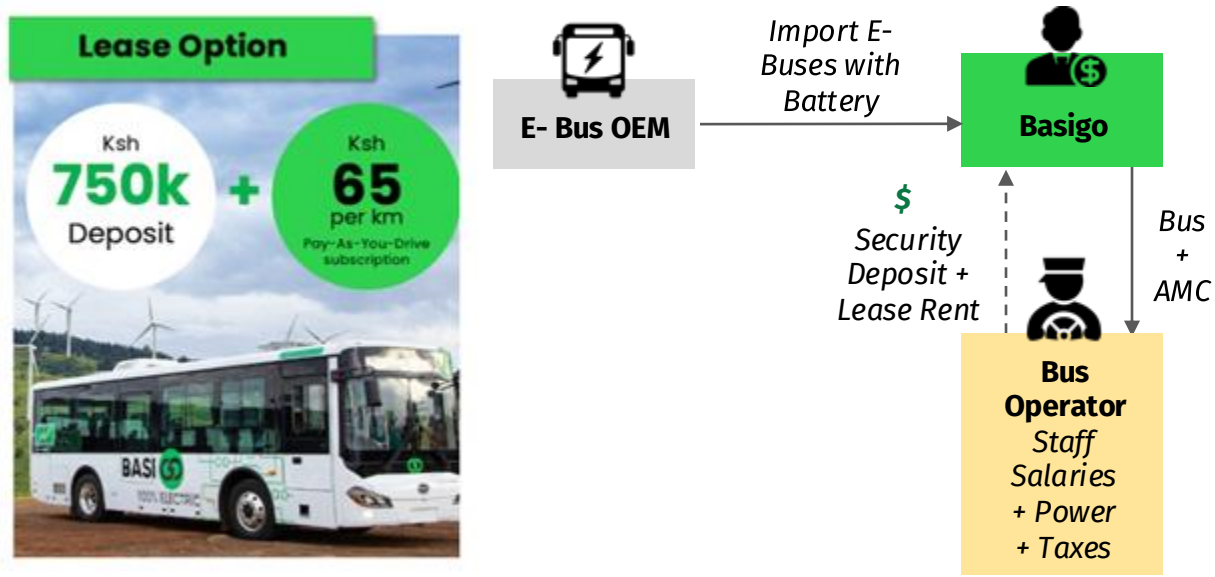


Figure 4: Pay As You Use (PAYU) Model for e-Bus
(Source: https://www.basi-go.com)

- **Cost Structure:** Operators pay a security deposit of Ksh 750,000 (~INR 4.2 lakh) and a subscription fee of Ksh 65 per kilometer (~INR 36 per kilometer) under the Pay-As-You-Drive (PAYU) model.
- **Low Entry Barrier:** Eliminates the need for high upfront investment, making e-bus adoption feasible for operators.
- **Comprehensive Support:** Includes advanced maintenance and battery management services, ensuring operational efficiency and reliability.
- **Scalability:** Operators can scale their fleet based on demand without incurring significant capital expenses.
- **Sustainability:** Enables the transition to environmentally friendly transport by reducing reliance on diesel buses.
- **Risk Mitigation:** Operators benefit from reduced financial risk as Basigo handles battery management and major maintenance.
- **Infrastructure Support:** Basigo provides charging infrastructure facilities.

2. Purchase Option: Ownership of Bus and Battery Leasing

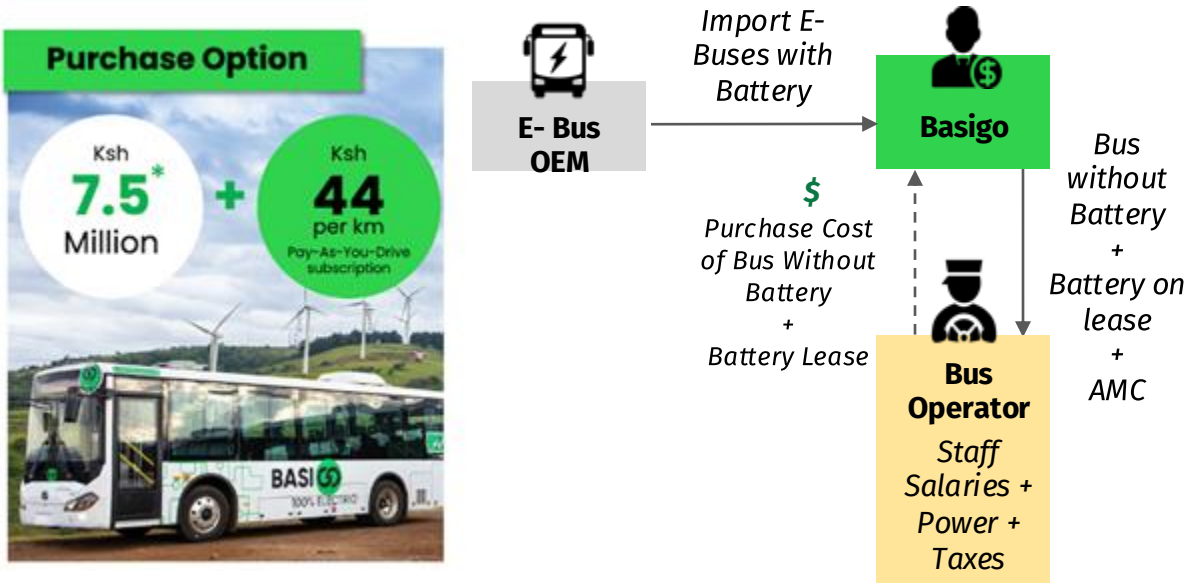


Figure 5: Battery lease Pay As You Use (PAYU) Model
(Source: https://www.basi-go.com)

- **Cost Structure:** Operators can purchase an e-bus at Ksh 7.5 million (~INR 42 lakh), which is equivalent to the cost of a diesel bus, excluding the battery.
- **Battery Leasing**: The battery is leased separately at a subscription fee of Ksh 44 per kilometer (~INR 24 per kilometer), reducing the financial burden of battery procurement.
- **Maintenance and Performance:** Basigo provides battery maintenance and performance guarantees, ensuring uninterrupted operations.
- **Flexible Ownership:** This option balances the benefits of ownership with the affordability of leasing, catering to operators with diverse financial capabilities.
- **Lower Total Cost of Ownership:** By leasing the battery, operators reduce long-term costs related to battery degradation and replacement.
- **Operational Reliability:** Operators gain access to Basigo's expertise in battery technology and proactive maintenance, ensuring smooth service delivery.

5.4 Limitations of Conventional Bus Ownership in India

The conventional ownership model has long been the standard approach for acquiring buses in India. However, as the transportation industry transitions toward electric buses, this model faces significant financial and operational challenges. For private operators, the high upfront costs and limited access to low-interest financing make the outright purchase model increasingly unfeasible, particularly in the context of electric mobility.

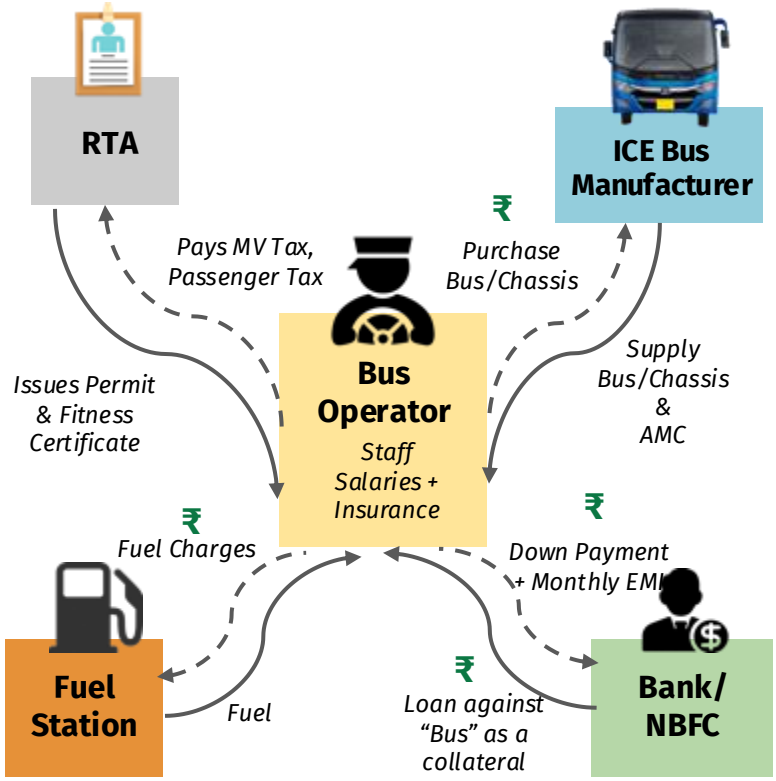


Figure 6: Conventional bus ownership model in India

Key insights of existing ownership model

- **High Upfront Costs:** Operators purchasing buses outright must make a substantial down payment, typically ranging from ₹10 to ₹12 lakhs for a diesel bus. This immediate financial burden often deters smaller operators who lack the necessary capital reserves. Electric buses, being more expensive than diesel buses, further amplify this challenge.

- **Costly Financing:** The outright purchase model heavily relies on loans from banks or Non-Banking Financial Companies (NBFCs). Operators typically pay Equated Monthly Installments (EMIs) of ₹1 to ₹2 lakhs over four to five years. The high interest rates associated with these loans increase the overall cost of ownership, making the transition to electric buses economically unattractive.

- **High Operational Costs:** Diesel buses incur significant operational costs, including fuel expenses, staff salaries, insurance, and maintenance. Monthly operational costs for diesel buses range from ₹2.5 to ₹3.5 lakhs, and when combined with EMIs, the total monthly expenditure rises to ₹3.5 to ₹5 lakhs. This limits the profitability and financial flexibility of operators, particularly in the early years of operation.

Cost To Operate Diesel Bus Per Month

- Operator invests in Bus through Bank loan
- Minimum years to achieve Capex breakeven: 2 Years
- Cost per km: ₹30 to ₹35
- Profit per km: ₹4 to ₹4.5

	Diesel bus ownership model
Down Payment	₹10 to ₹12 lakhs
EMI	₹1 to ₹2 lakh (for 4 -5 years)
Operating Cost/Month	**Operating Cost:** ₹2.5 to 3.5 lakh **EMI:** ₹1 to ₹2 lakh lakh **Total cost:** ₹3.5 to ₹5 lakh

Table 3: Diesel bus operating cost

Photo: tamilnaduprivatebuses.wordpress.com

5.5 Challenges To Procure E-buses Under Ownership Model

- **Profitability Challenges:** Diesel buses under the ownership model achieve profitability faster due to lower upfront costs and predictable operational expenses. However, electric buses under this model face delayed profitability, exposing operators to financial risks during the early years of operation.

- **Financial Risks:** Operators are often required to pledge buses as collateral for loans, reducing their financial flexibility and increasing their exposure to market uncertainties. The lack of access to low-interest loans further compounds these challenges, making fleet modernization or expansion a daunting task.

- **Unattractiveness of Electric Buses:** Due to higher upfront costs, expensive financing, and delayed profitability, the outright purchase model does not incentivize operators to adopt electric buses. This creates a significant barrier to achieving large-scale electrification in the transportation sector.

- **Delayed Break-even Point for Electric Buses:** Total Cost of Ownership (TCO) analysis reveals that stage carriage operators of electric buses will incur losses during the first two years of operations. Profit margins comparable to those of diesel buses can only be achieved after four years, underscoring the financial risks involved in this model. This delay in achieving profitability makes the outright purchase model less appealing to operators, particularly in a market with high competition and narrow margins.

- **Unsustainability of Government Subsidies:** While capital expenditure (CAPEX) subsidies or low-interest loans from state governments can cushion losses in the initial years, they do not offer a long-term sustainable solution. Over-reliance on subsidies creates uncertainty for operators and fails to address the structural issues in the financing of electric buses.

Parameter	Diesel Bus	Electric Bus
Down Payment	₹10 to ₹12 lakhs	2x-3x of diesel bus ✗
EMI	₹1 to ₹2 lakhs (4-5 years)	2x-3x of diesel bus ✗
Operational Cost/Month	₹2.5 to ₹3.5 lakhs	₹2.7 to ₹3.6 lakhs ✓
Total Monthly Cost	₹3.5 to ₹5 lakhs	Higher during initial years
Profitability Timeline	Immediate	After 4 years ✗

Table 4: Comparison: Diesel Buses vs. Electric Buses Under the ownership model

5.6 Dry Lease Model: A Sustainable Solution for Bus Electrification

The dry lease model has emerged as a financially viable and operationally efficient alternative to the outright purchase model for transitioning to electric buses (e-buses). By reducing the capital expenditure (CAPEX) burden on operators and leveraging the expertise of private players, the dry lease model addresses many of the financial and logistical challenges associated with the adoption of electric buses. This chapter explores the key features, benefits, and implications of the dry lease model, along with its potential to revolutionize public transport in India.

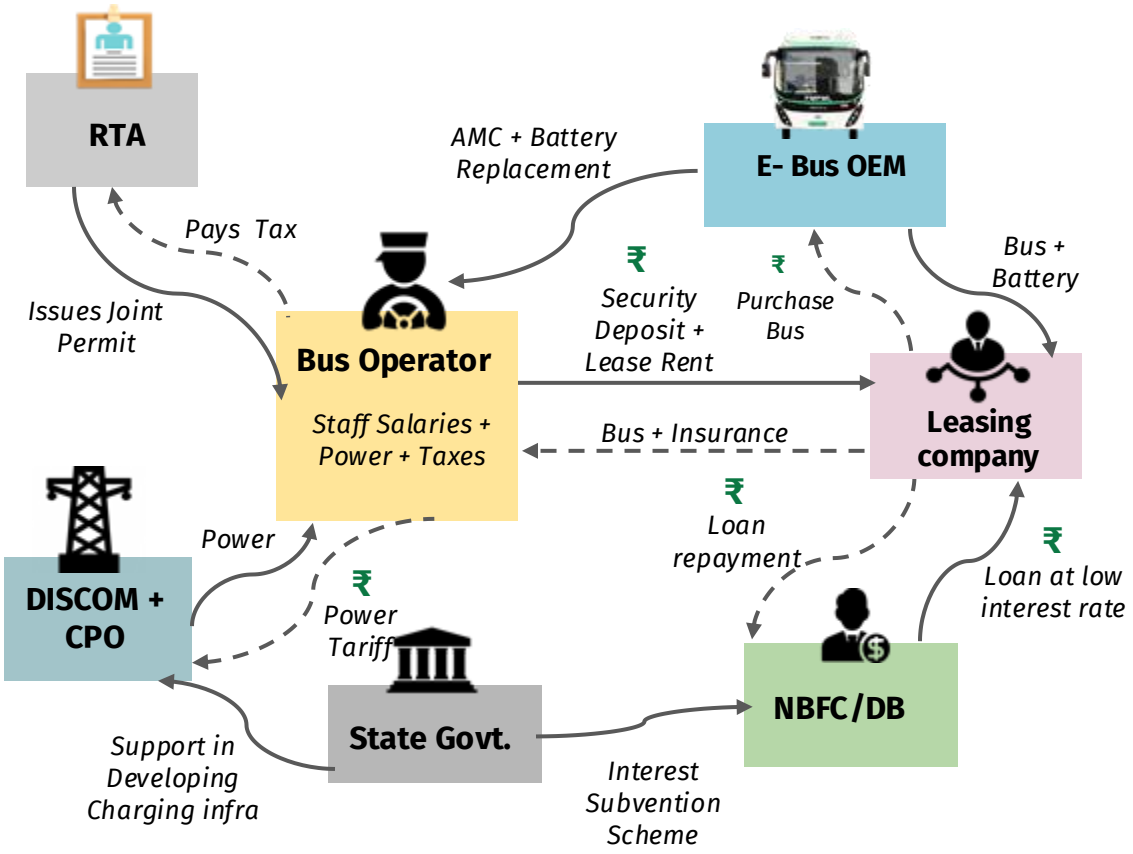


Figure 7: Recommended dry lease model for e-Buses

- **Leasing Companies or SPVs:** These entities procure e-buses from Original Equipment Manufacturers (OEMs) and manage their financing, maintenance, and insurance. They work closely with state governments to access low-cost funding and ensure compliance with public transport regulations.
- **Bus Operators:** Operators lease e-buses and focus on their core expertise of providing passenger services. They benefit from predictable lease costs and reduced financial risk.
- **State Governments:** Governments play a crucial role in creating an enabling environment for the dry lease model by offering interest subvention schemes and supporting the development of charging infrastructure.
- **Financial Institutions:** NBFCs, Development Banks, and other lenders provide the necessary funding to lessors at competitive interest rates.

Cost To Operate E-bus Per Month On Lease Model

- **Operator will lease the E-Bus from SPV ROSCO**
- **Lessor will provide:** Bus, AMC, Insurance, Battery Replacement, Interest/lease charge (₹30 to ₹35/km)
- **Operator will provide:** Bus, AMC, Insurance, Battery Replacement, Interest/lease charge (₹15/km)
- **Cost per km:** ₹30 to ₹35
- **Profit per km:** ₹4.5
- **Profit of lessor:** ₹0.5 - 2 crore (12-year life of the bus)
- **Minimum assured km:** 250km/day
- **Minimum lease tenure:** 3 years

	Electric bus on dry lease
Down Payment	Security Deposit: ₹7.5 to ₹12 lakhs
EMI	No monthly EMI in case of electric bus
Operational Cost/ Month	**Lease Charge**: ₹1.8 to 2.25 lakh **Own Cost (Staff salary & energy):** ₹0.90 to ₹1.35 lakh lakh **Total cost:** ₹2.7 to ₹3.6 lakh

Table 5: E-bus operating cost on dry lease model

Benefits of the Dry Lease Model

- **Lower Upfront Costs:** Operators are only required to pay a security deposit ranging from ₹7.5 lakh to ₹12 lakh, as opposed to the ₹10 lakh to ₹12 lakh down payment under the diesel ownership model.
- **No Monthly EMI Obligations:** In a dry lease arrangement, operators are not burdened with high monthly EMIs. Instead, they pay lease rentals, which include maintenance and battery replacement costs.
- **Predictable Operating Costs:** Monthly operational costs for an electric bus on a dry lease range from ₹2.7 lakh to ₹3.6 lakh, providing greater financial predictability and reducing risks associated with maintenance and battery expenses.
- **Enhanced Profit Margins:** By outsourcing ownership costs to lessors, operators can focus on efficient operations, enabling them to achieve profit margins comparable to those of diesel buses.
- **Cost Efficiency:** The dry lease model reduces capital investment requirements, making e-buses accessible to a larger pool of operators, including small and medium-sized enterprises.
- **Risk Mitigation:** By outsourcing maintenance, battery replacement, and insurance to the lessor, operators can focus on service delivery without worrying about unforeseen expenses.

Parameter	Outright Purchase Model	Dry Lease Model
Upfront Payment	₹10 to ₹12 lakh (down payment)	₹7.5 to ₹12 lakh (security deposit) ✓
EMI Obligations	₹1 to ₹2 lakh	None ✓
Monthly Operating Cost	₹3.5 to ₹5 lakh	₹2.7 to ₹3.6 lakh ✓
Profitability	Achievable after 4 years	Immediate profitability possible ✓
Maintenance Costs	Operator's responsibility	Included in lease ✓

Table 6: Comparison: Dry Lease Model vs. ownership model for e-Buses

5.7 Cost Efficiency: Electric Buses vs. Diesel Buses

The dry lease model has emerged as a financially viable and operationally efficient alternative to the outright purchase model for transitioning to electric buses (e-buses). By reducing the capital expenditure (CAPEX) burden on operators and leveraging the expertise of private players, the dry lease model addresses many of the financial and logistical challenges associated with the adoption of electric buses. This chapter explores the key features, benefits, and implications of the dry lease model, along with its potential to revolutionize public transport in India.

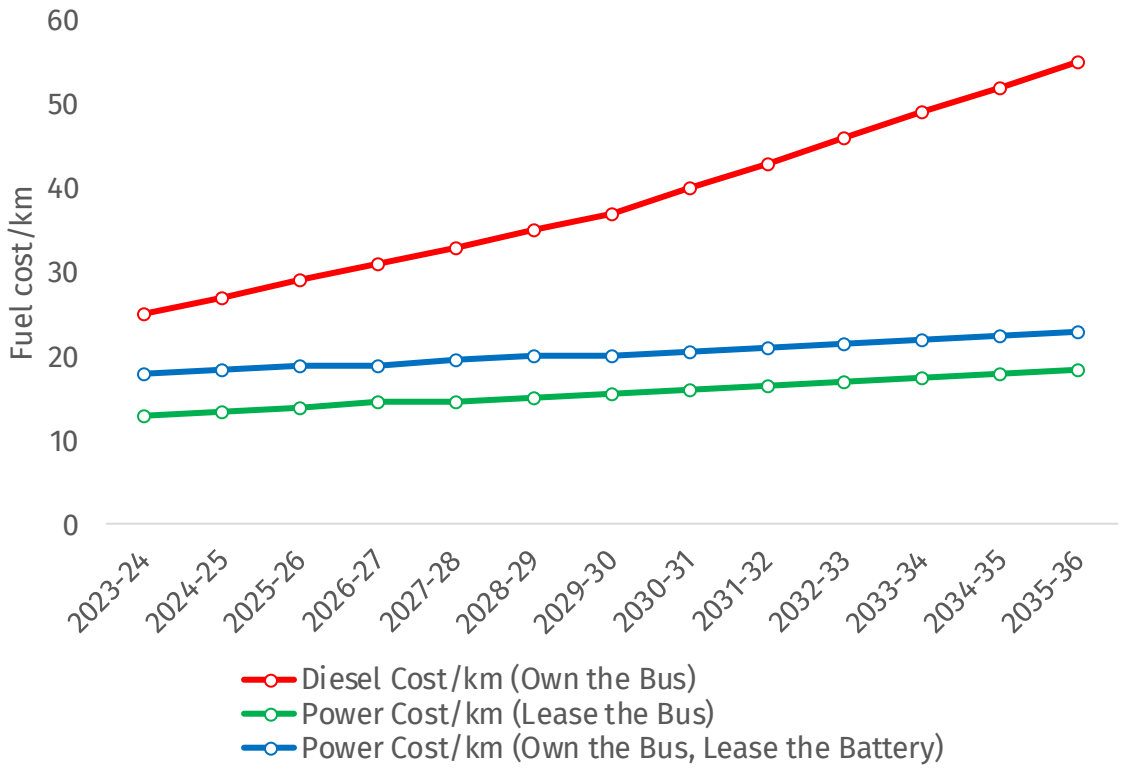


Figure 8: Comparison of fuel cost of diesel bus and e-bus

Daily Operated km		450
Monthly Operating Days		30
	Diesel	**Electric**
Milage/unit	4km	0.8km
Cost/unit	₹ 93.25	₹ 12
Cost/km	₹ 23.31	₹ 15.00

Cost savings/km	₹ 8.31
Daily Cost Savings/Bus	₹ 3,741
Monthly Cost Savings/Bus	₹ 1,12,219
Annual Cost Savings/Bus	₹ 13,46,625

Table 7: Cost savings with E-Bus

An analysis of operational costs highlights the stark difference between diesel and electric buses. Diesel buses currently incur a cost of ₹23.31 per kilometer, compared to ₹15 per kilometer for e-buses. With a daily operation of 450 kilometers, this translates to a cost saving of ₹3,741 per day per bus for electric buses. Over a month, this amounts to ₹1,12,219, and annually, operators can save up to ₹13,46,625 per bus. Such substantial savings not only offset the initial transition costs to electric mobility but also contribute to improved profit margins for operators.

The dry lease model further enhances these savings by eliminating the burden of battery replacement and maintenance costs, which are included in the lease terms. This ensures that operators benefit from the lower operational costs of electric buses without the financial risks associated with owning and maintaining these vehicles. Moreover, the predictable cost structure of electricity compared to volatile diesel prices provides operators with greater financial stability and planning capabilities. As fuel costs for diesel buses continue to rise exponentially, the case for transitioning to electric buses becomes even more compelling, offering a sustainable pathway for cost optimization and environmental benefits. By adopting electric buses, operators not only align with long-term economic goals but also contribute to the reduction of greenhouse gas emissions, making public transport more sustainable and future-ready.

06

Private Bus Operators' Views on E-Buses and the Lease Model

6.1 Objectives Of E-bus Awareness Workshop

ITDP India with support from BOCI & Federation of Bus Operators Association Tamil Nadu, conducted e-bus awareness workshops during May 2024 to July 2024 in five districts of Tamil Nadu. These workshops marked a significant step towards promoting sustainable urban mobility and fostering innovation in private bus sector. By bringing together the bus operators, the workshop provided a dynamic platform to educate, inform, and collaboratively address challenges associated with transitioning to electric buses. Below are the key objectives that guided the workshop:

- **Raise Awareness:** Educated private bus operators on e-bus technology, highlighting its benefits, value proposition, and its role in achieving sustainable public transport goals.

- **Identify Challenges:** Analyzed the regulatory, financial, and operational barriers that hinder e-bus adoption. Operators' concerns were discussed, and potential solutions were explored collaboratively.

- **Operational Requirements:** Addressed and documented the operational needs of bus operators to ensure a smooth transition to e-bus systems, such as charging infrastructure, training, and maintenance.

- **Replacement Needs:** Estimated the number of conventional buses that need to be replaced with e-buses within the next three years. Planning was initiated for phased replacements aligned with fleet age and operational demands.

- **Determine Support:** Identified the specific support required from various stakeholders—financial, technical, and policy-related—to make e-bus operations viable and sustainable.

- **Willingness for Transition:** Assessed the interest and readiness of operators in shifting to e-buses. Various scenarios for fleet replacement and operational adaptations were discussed.

The workshop successfully aligned the interests of operators, policymakers, and technology providers, creating a unified vision for the future of electric mobility. This collaboration has set a strong precedent for scaling e-bus implementation while addressing environmental, economic, and operational challenges comprehensively.

6.2 Operator Survey Details

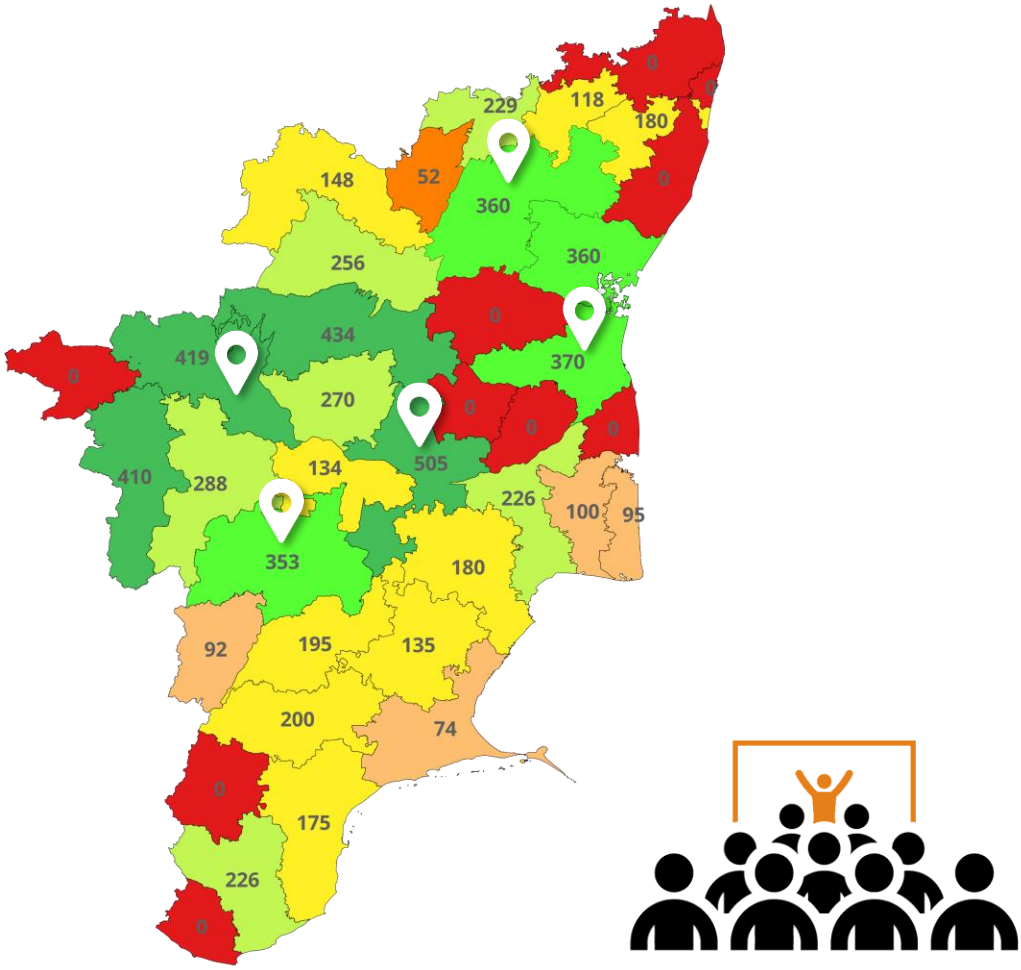


Figure 9: Surveyed green districts with 200+ buses

Rank	District	Operators surveyed	Total Buses in the district
1	Tiruchirappalli	47	505
2	Erode	53	419
3	Cuddalore	23	370
4	Tiruvannamalai	11	357
5	Dindigul	19	353
Total		**153**	**2004**

Table 8: Details of surveyed districts

With 153 operators onboard, the workshop has successfully captured nearly 30% of the private bus sector market.

6.3 Overwhelming Response By Bus Operators

Tiruchirappalli

Erode

Cuddalore

Dindigul

Tiruvannamalai

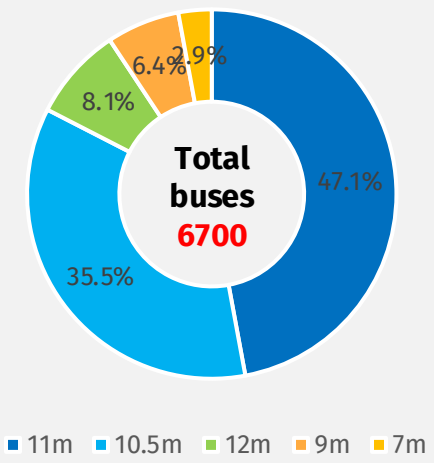
Photo: tamilnaduprivatebuses.wordpress.com

07

Operational Characteristics Of Private Stage Carriage Buses

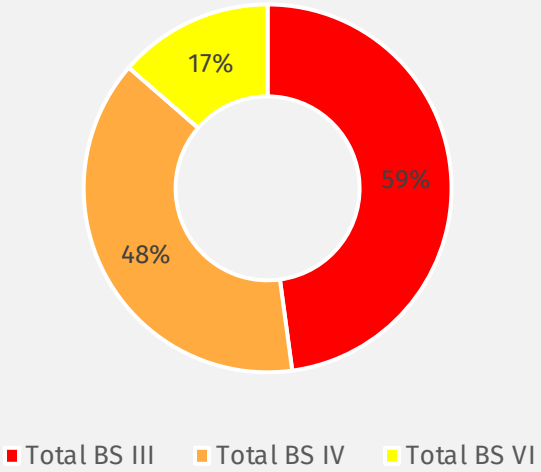
7.1 Operational Characteristics

1. Type Of Buses



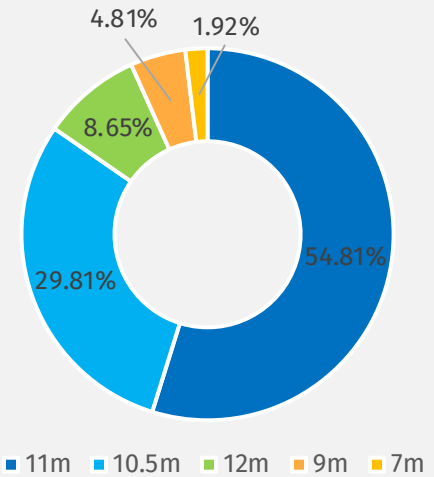
- **11-meter buses:** Dominate the fleet with 47.1%, preferred for mofussil routes due to their capacity and range
- **10.5-meter buses:** Account for 35.5% of the fleet, offering versatility and adaptability for urban routes.
- **Ashok Leyland:** Represents 98% of the existing buses, showcasing its strong market dominance and reliability.

2. Emission Standards



- **BS III Buses:** Constitute 59% of the fleet, highlighting the need for modernization and phasing out older vehicles.
- **Second-Hand Buses:** Make up 29% of the fleet, reflecting a significant reliance on pre-owned vehicles.
- **Average Bus Life:** New buses have an average lifespan of 9.5 years, while second-hand buses average 5.4 years.

3. Buses Due For Replacement



- **Fleet Replacement:** 49% of the overall fleet requires replacement, highlighting an urgent need for renewal.
- **Focus Areas:** Replacement efforts should prioritize 11-meter and 10.5-meter buses.

Type of Bus	Avg. Vehicle use/day km	Avg. daily trips/bus	Avg. route length km	Avg. Operational Hours	Avg. Pax/bus/day
7m	471	12	40	13	650
9m	391	11	35	16	850
10.5m	414	8	50	13	703
11m	366	8	45	13	747
12m	505	9	55	14	689
Avg.	**429**	**10**	**45**	**14**	**728**
Avg. Occupancy for city & mofussil routes – 72%					

Table 9: Operational Characteristics of Private Buses by Bus Type

- Private buses achieve an average daily utilization of 430 km, with a route length of ~45 km, 10 trips per bus and 14 operational hours per day.
- 12m buses have the highest daily utilization at 505 km.
- The overall occupancy rate stands at 72%, reflecting effective utilization for both city and mofussil routes.
- The data highlights the versatility of different bus types in catering to diverse operational needs.

Photo: tamilnaduprivatebuses.wordpress.com

7.2 Fleet Ownership & Total Employment

City	Avg. buses/operator
Cuddalore	3
Erode	2
Dindigul	2
Trichy	3
Thiruvannamalai	3
Market Avg.	**2**

Table 10: Average buses/operator

- **Average Fleet Size:** Private stage carriage operators in Tamil Nadu own an average of 2 buses each, which reflects a small-scale operational model.
- **Regional Differences:** Cities like Cuddalore, Trichy, and Tiruvannamalai have higher averages at 3 buses per operator, while Erode and Dindigul have lower averages at 2 buses per operator.
- **Total Operators:** This small-scale model leads to a large number of operators, with approximately 3,200 private operators across Tamil Nadu.
- **Market Characteristics:** The decentralized ownership pattern allows a broad distribution of services but may pose challenges in achieving economies of scale and uniform service quality.

Staff Category	Avg. staff/operator
Drivers	4.82
Conductors	4.67
Cleaners	2.15
Mechanics	1.81
Admin Staff	1.59
Avg. staff	**15.04**

Table 11: Staffing Patterns in the Private Bus Sector

- **Staffing Ratio:** On average, each operator employs 15 staff members, translating to 7 staff per bus, ensuring adequate human resources for efficient operations.
- **Key Roles**: The workforce includes drivers (4.82) and conductors (4.67) per operator, reflecting their critical roles in daily bus operations.
- **Support Roles:** Additional roles include cleaners (2.15), mechanics (1.81), and admin staff (1.59) per operator, ensuring maintenance and administrative support.
- **Total Workforce:** The private stage carriage sector employs approximately 48,000 people across Tamil Nadu, demonstrating its significance as a source of employment in the region.

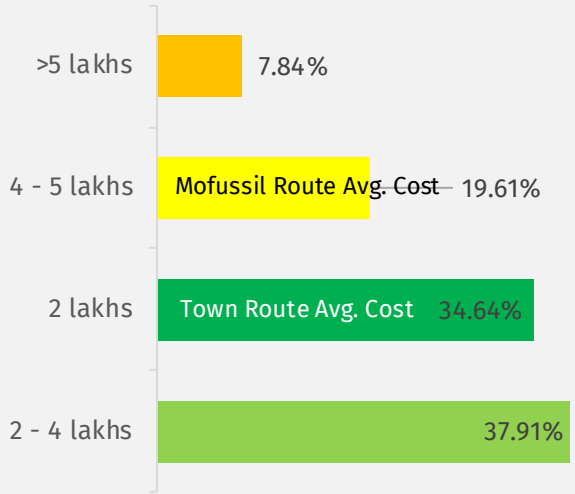
7.3 Cost of Operating Diesel Bus & Profit Margin

1. Fare Structure

Distance (Km)	Ordinary (₹)	Town (₹)	EXP (₹)
2	4	5	6
4	5	6	8
10	8	9	12
20	13	14	20
40	18	19	27

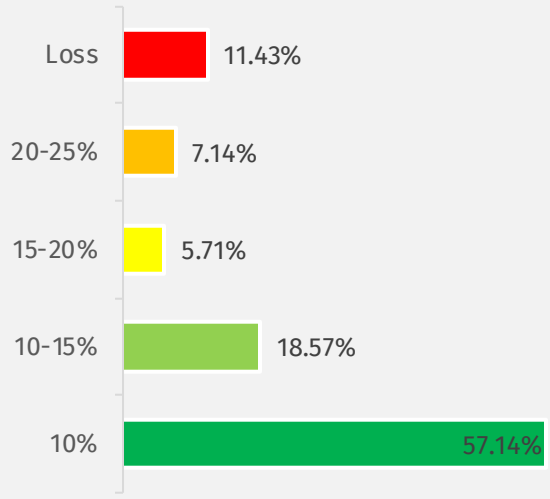
- **Regulated Fares:** Unlike contract carriages, fares are regulated by the State Transport Department. (Jan 2018)
- **Fare Structure:** Fare increases are gradual, set at 58 paise per passenger-km for ordinary services and 75 paise per km for express services.
- **Affordability and Accessibility:** This ensures affordability for the common people and accessibility to public transport.

2. Monthly Operating Cost/Bus



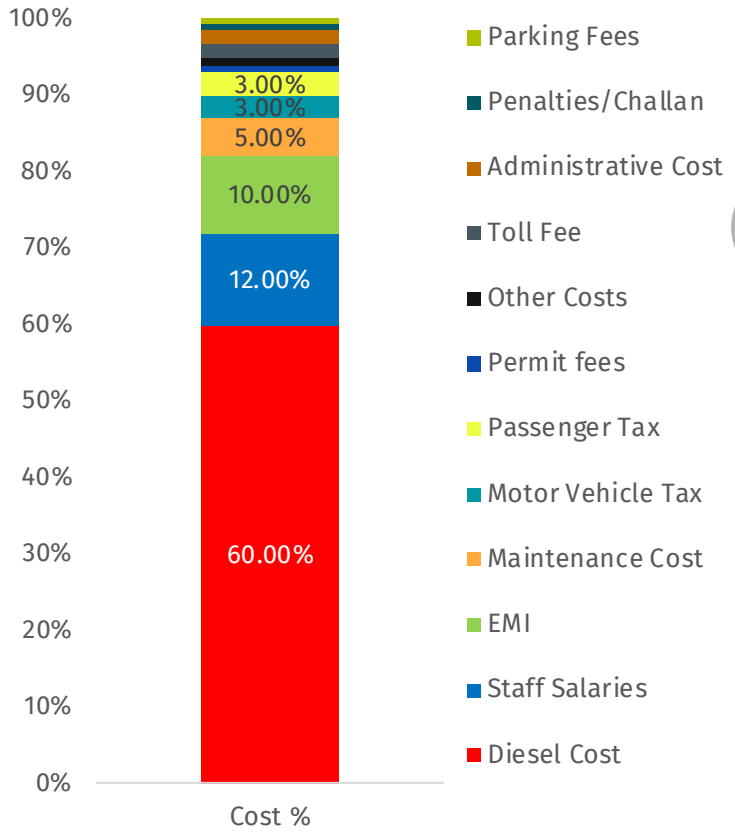
- **Town Routes:** Higher operating costs due to frequent stops, lower speeds, and increased wear and tear, contributing to the 2-4 lakh range (37.91%).
- **Mofussil Routes:** Lower operating costs (around 2 lakhs, 34.64%) due to better fuel efficiency, higher speeds, and fewer stops.

3. Profit Margin



- **Average Profit Margin:** Private operators maintain an average profit margin of 10% per km, showcasing their ability to sustain operations effectively.
- **Profitability through Efficiency:** Despite operating under the same fare structure as STUs, private operators achieve profitability through efficient management, highlighting the critical role of operational efficiency.

Cost Of Operating Diesel Bus/Km



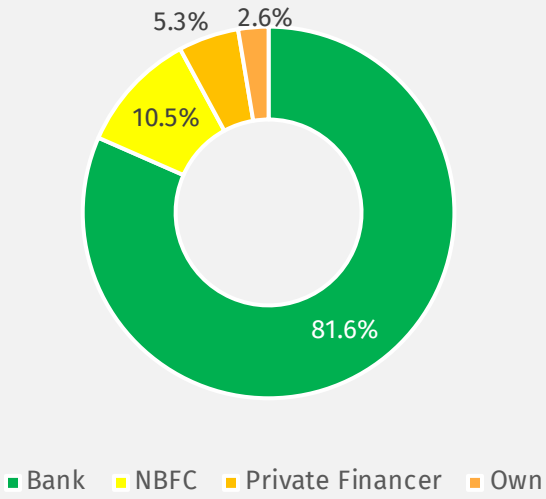
The average monthly operating cost per bus ranges between ₹2-4 lakhs, with an average profit margin of 10.94%. Diesel costs alone account for a staggering 60% of the operating expenses, making it the largest cost driver for private bus operators. This reliance on diesel makes the sector highly vulnerable to fluctuations in fuel prices, which are expected to rise further, putting additional pressure on operating margins.

Other significant cost contributors include staff salaries (12%), which ensure smooth operations, and smaller components such as maintenance costs, taxes, and EMIs, each contributing to the remaining expenses. These diversified cost elements highlight the operational challenges faced by private bus operators in managing profitability while maintaining service quality.

Transitioning to electric buses (e-buses) could offer a transformative solution. E-buses have the potential to reduce overall costs by up to 50%, primarily by cutting fuel expenses, which could drop by 30% or more. The shift to electric mobility not only promises financial benefits but also aligns with broader goals of sustainability and reduced carbon emissions. The data underscores the urgency for operators to adopt cost-saving measures and sustainable practices, such as transitioning to e-buses. Such changes will not only improve financial viability but also ensure resilience against rising diesel prices and support a cleaner, more efficient public transport system.

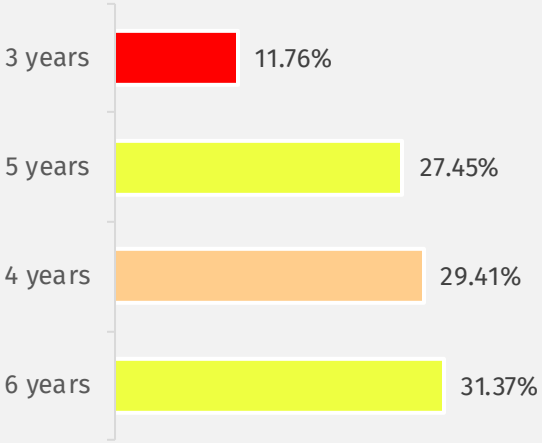
7.4 Sources Of Finance

1. Sources Of Finance



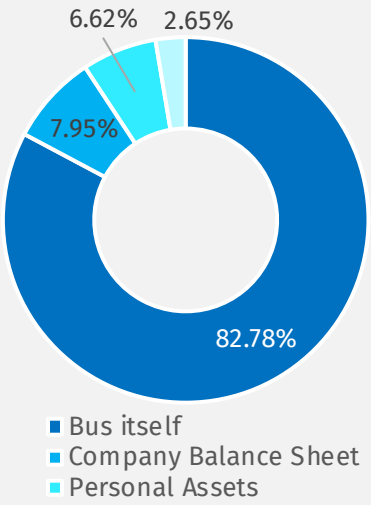
- **Banks (81.6%)** are the primary source of capital, indicating strong reliance on formal financial institutions.
- **NBFCs (10.5%)** provide supplementary financing, especially where bank loans may not be easily accessible.

2. Loan Tenure



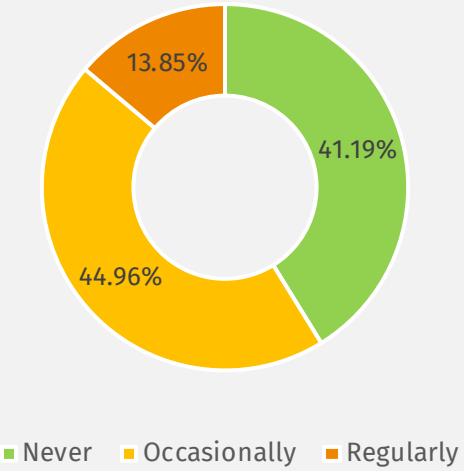
- The majority of loans for private bus operators have repayment periods of **4 to 6 years (88.23%),** with **6 years** being the most common (31.37%).
- Avg. loan tenure is **4.7 years**

3. Collateral



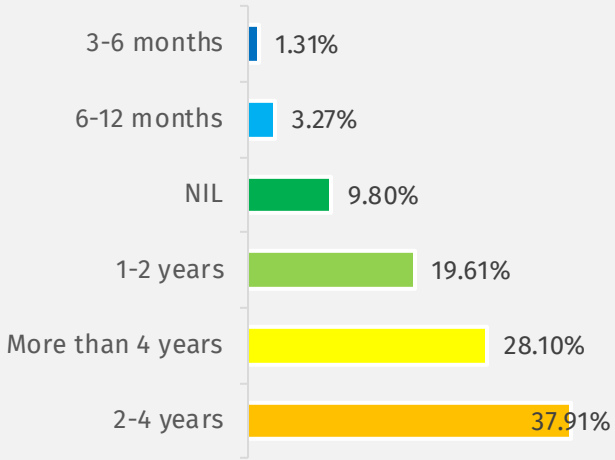
The **determined resale value** of diesel buses makes them a preferred collateral option, facilitating easier access to loans from banks.

4. Refinancing



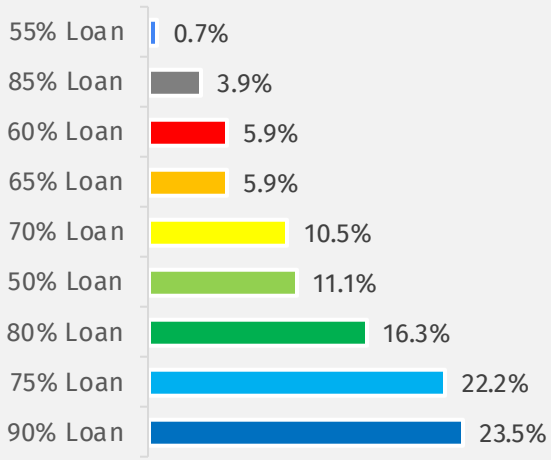
- **41.19%** of operators never refinance their buses, indicating reliance on initial financing or full loan repayment without refinancing.
- However, **44.96%** of operators refinance the loans which indicates the significance of refinancing.

5. Refinancing Tenure



- The majority of refinancing occurs within **2-4 years (37.91%)**, reflecting a common mid-term strategy.
- **28.10%** of operators opt for refinancing terms longer than 4 years, indicating long-term financial planning.

6. Loan To Purchase Cost



- **90% financing** indicates that many operators are eligible for high loan amounts, due to strong credit profiles or collateral.
- **75%** and **80%** are also common, suggesting moderate credit profiles among operators.

7.5 Operational Challenges And Support Needed For Transition

	Major challenges shifting to e-buses	Rating out of 5
1	Cost of Diesel	4.6
2	Cost recovery from the Ticket Revenue	4.5
3	Availability of new Permits	4.4
4	Cost of Permit	4.4
5	Lack of Bus Parking & Maintenance Facilities	3.6
6	Hiring & Managing Staff	3.6
7	Access to Finance	3.3

Table 12: Challenges in shifting to e-buses

Operates rated each challenge on a scale of 1 to 5, with 1 being the least challenging and 5 being the most challenging.

The **cost of diesel** and the difficulty in **recovering costs from ticket revenue** are the most significant challenges, directly affecting the financial viability of operations.

	Support required	Rating out of 5
1	Provision of Charging Infrastructures	4.8
2	Battery size to support without opportunity Charging	4.7
3	Permits that allows leasing of buses	4.7
4	Parity between purchase costs of e-bus & Diesel	4.6
5	Lower Interest rates	4.5
6	Scrapping incentives for old diesel buses	4.5
7	Availability of new permits	4.3
8	Reduced taxes and permit fees	3.9

Table 13: Support Required For Transition To E-buses

Operates rated each support on a scale of 1 to 5, with 1 being the least required and 5 being the most required.

- **Charging Infrastructure:** The provision of reliable charging infrastructure is the most critical support required, ensuring smooth and efficient e-bus operations.
- **Battery Size:** Suitable battery configurations to eliminate the need for opportunity charging are vital for uninterrupted service.
- **Permits for Leasing:** Permits allowing leasing of buses can encourage operators to adopt e-buses with reduced financial risks

08

Operator Willingness to Shift to E-Buses on Lease Model

8.1 Scenario Development Assumptions: Guiding Operator Decisions

To evaluate the preferences and decision-making process of bus operators, two scenarios has been developed comparing diesel and electric bus ownership and operational models. These scenarios were built on carefully analyzed assumptions to ensure accurate financial and operational insights. Key considerations included the cost of fuel and electricity, fuel efficiency, inflation rates, and the daily assured kilometers over a period of 12 years. For diesel buses, assumptions reflected market conditions, such as a fuel cost of ₹90 per liter and an average efficiency of 4 km per liter. Similarly, electric buses were evaluated with a unit electricity price of ₹₹11 and a fuel efficiency of 0.9 km per unit.

	Diesel Non-AC Bus (12m)	Electric Non-AC Bus (12m)
Purchase Cost	₹0.50 Crores	₹1.20 Crores Or ₹0.75 Crores (without Battery)

Table 14: Assumptions for Purchase cost of bus

	Own Diesel Bus	Lease E-Bus	Own E-Bus & Lease the Battery
Fuel And Electricity Unit Price	₹90	₹11	₹11
Fuel Efficiency	4 km/Ltr	0.9km/Unit	0.9km/Unit
Inflation Rate	8%	3%	3%
Daily Assured Km For 12 Years	250km	250km	250km
Fuel Cost/Km In FY 2023-24	₹22.50	₹12.50	₹12.50
Battery Lease Fixed Cost/Km	-	-	₹6.50
Fuel Cost/Km In FY 2023-24	₹22.50	₹12.50	₹19.00

Table 15: Assumptions for fuel cost/km

These assumptions formed the basis for developing realistic scenarios, enabling operators to make informed decisions. Operators were presented with a choice between owning diesel buses, leasing e-buses, or owning e-buses with leased batteries. By weighing these options, operators could evaluate the economic viability of transitioning to electric mobility versus continuing with conventional diesel buses. The results highlight the importance of informed decision-making in fostering sustainable transport solutions.

8.2 Scenario 01 - Pessimistic Business-as-usual

This scenario, termed Pessimistic Business-as-Usual, presents operators with three business models to choose from: owning a diesel bus, leasing an electric bus (e-bus), or owning an e-bus and leasing its battery. Under this scenario, there are no financial or operational incentives to encourage a switch to e-buses. Loan interest rates remain the same for diesel and electric buses, and new permits are issued equally for all bus types. Additionally, the government does not provide any support for setting up charging facilities. Operators were asked to evaluate these models based on their financial implications, including monthly operating costs, down payments, and other factors, to make an informed choice.

Attributes/Bus Type	Own Diesel Bus	Lease E-Bus	Own E-Bus & Lease the Battery
Monthly Instalment (EMI)	₹1.5 lakh/month (4 yrs)	No monthly EMI	₹2 lakh/month (4 yrs)
Interest Rate	8-10%	-	8-10%
Monthly Operating Cost	₹5 lakh	₹3.5 lakh (includes lease charge: ₹1.8 to 2.25 lakh)	₹5 lakh (includes battery lease charge: 60,000 or ₹6-₹8 per unit of electricity consumed)
Down payment	₹12.50 lakhs	No Down Payment	₹18.75 lakhs
Security Deposit	-	₹₹12 lakhs	₹4.5 lakhs (Battery)
Charging facility at City Center by Govt.	-	No	No
Driving Range	400 km	300 km	300 km
New Permits for All Buses	Yes	Yes	Yes
Operator's preference in %	**65.78%** ✓	**21.05%** ✗	**13.15** ✗

Table 16: Operator's preference for pessimistic business as usual scenario

- **Preference for Diesel Buses:** 65.78% of operators prefer owning diesel buses due to lower down payments (₹12.5 lakhs) and higher driving ranges (400 km). Diesel buses also have familiar operational and financial structures, making them the default choice in the absence of incentives.
- **Minimal Interest in Owning E-Buses and Leasing Batteries (13.15%):** High down payments (₹18.75 lakhs) and battery leasing costs make this model financially burdensome. Limited driving range (300 km) further discourages operators.
- **Key Insight:** Without targeted incentives or policy support, operators gravitate towards conventional diesel buses, highlighting the need for interventions to drive the transition to e-buses.

8.3 Scenario 02 – Incentivising Operators

This scenario, termed Incentivising Operators, introduces financial and operational incentives to encourage operators to adopt electric buses. The incentives include lower interest rates (4-5%) for e-buses, government support for charging infrastructure, and issuance of new permits exclusively for electric buses. Operators were presented with three business models: owning a diesel bus, leasing an e-bus, or owning an e-bus and leasing its battery. These options were evaluated based on their financial implications, operational support, and overall feasibility under the incentivized conditions.

Attributes/Bus Type	Own Diesel Bus	Lease E-Bus	Own E-Bus & Lease the Battery
Monthly Instalment (EMI)	₹1.5 lakh/month (4 yrs)	No monthly EMI	₹2 lakh/month (4 yrs)
Interest Rate	8-10%	-	4-5%
Monthly Operating Cost	₹₹5 lakh	₹3.5 lakh (includes lease charge: ₹₹1.8 to ₹2.25 lakh)	₹4 lakh (includes battery lease charge: 60,000 or ₹6-₹8 per unit of electricity consumed)
Down payment	₹₹12.50 lakhs	No Down Payment	₹10.75 lakhs
Security Deposit	-	₹12 lakhs	₹4.5 lakhs (Battery)
Charging facility at City Center by Govt.	-	Yes	Yes
Driving Range	400 km	300 km	300 km
New Permits for All Buses	No new permits	Yes	Yes
Operator's preference in %	**12.41%** ✗	**59.47%** ✓	**28.10** ✗

Table 17: Operator's preference for optimistic scenario – Incentivising operators

- **Leasing E-Buses (59.47%):** The most preferred option due to the absence of monthly EMIs and a lower operating cost of ₹₹3.5 lakh (including lease charges). A no down payment requirement and government-supported charging facilities further enhance its appeal.
- **Owning E-Buses and Leasing Batteries (28.10%):** Gained moderate preference due to reduced down payment (₹10.75 lakhs) and manageable operating costs (₹4 lakh). The availability of permits and charging facilities makes this option viable for some operators.
- **Key Insight:** The introduction of targeted incentives, such as lower interest rates and government-backed infrastructure, significantly shifts operator preferences toward e-buses, with leasing models emerging as the most favored option.

8.4 Subsidy Vs Lower Interest Rate

This scenario compares two financing models for electric buses: a 5% purchase subsidy versus a 2% interest rate on loans. Under the 5% purchase subsidy, operators benefit from a direct reduction in the purchase price by ₹3.75 lakhs, resulting in higher monthly EMIs of ₹1.36 lakhs over four years. In contrast, the 2% interest rate offers reduced EMI payments of ₹1.22 lakhs per month, resulting in lower total payments over the loan period. Operators were tasked with selecting their preferred option based on the financial implications of each model.

	5% Purchase Subsidy	2% Interest Rate on Loan
Cost of Bus without Battery	₹75 lakhs	₹75 lakhs
Purchase Subsidy	5% (₹3.75 lakhs) reduction in Purchase Price	-
Monthly Instalment (EMI)	₹1.36 lakhs/month for 4 years	₹1.22 lakhs/month for 4 years
Total Money paid over 4 years	₹82.87	₹77.73
Operator's preference in %	**23.43%** ✗	**76.56%** ✓

Table 18: Operator's preference subsidy vs lower interest rate

Preference for Low Interest Rate (76.56%):
- The majority of operators prefer the 2% interest rate as it reduces their total payments over four years to ₹77.73 lakhs.
- Lower monthly EMIs (1.22 lakhs) improve cash flow, making this option more sustainable for long-term operations.

Lower Preference for Subsidy (23.43%):
- Despite a ₹3.75 lakh reduction in the upfront purchase price, higher EMIs of ₹1.36 lakhs make the 5% subsidy less attractive.
- Total payments over four years (₹82.87 lakhs) exceed those of the low-interest loan option.

Key Insight: The results emphasize the importance of low-cost financing in enabling operators to manage operational expenses effectively. Operators value lower interest rates over direct subsidies, highlighting the need for affordable and accessible financing solutions to drive e-bus adoption.

8.5 Who Should Be The Lessor For E-bus

Operators were asked to evaluate five business models for e-bus adoption, based on a 5-point rating scale, where 5 represented the most preferred model and 1 the least preferred. Each model was assessed considering initial capital investment, operational flexibility, and financial feasibility. The rating exercise was designed to capture operator priorities, emphasizing minimizing financial risk and ensuring sustainable operations.

Business Model	Initial capital investment	Rank out of 5
Lease the Bus + Battery from Private Aggregator	₹12 lakhs (Security deposit)	4.2
Lease the Bus + Battery from Govt. Aggregator	₹12 lakhs (Security deposit)	3.4
Own the Bus and Lease the battery from Private Aggregator	₹18.75 lakhs (down payment) + ₹4.5 lakhs (security deposit for battery)	3.1
Own the Bus and Lease the battery from Govt. Aggregator	₹18.75 lakhs (down payment) + ₹4.5 lakhs (security deposit for battery)	3.1
Own the bus and the battery	₹30 lakhs (down payment)	2.1

Table 19: Business model preference for bus operators

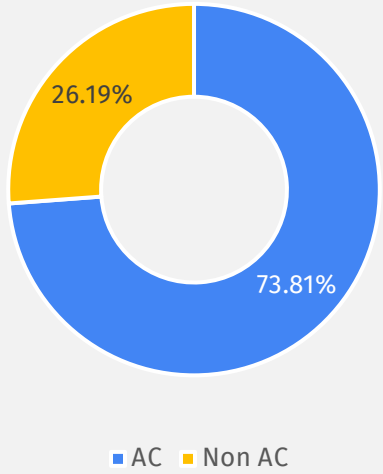
Operators strongly favor leasing models that require **lower upfront costs** and **offer flexible ownership** options, with the highest preference for leasing the bus and battery from **private aggregators**, rated at **4.2 out of 5**. This model's affordability, with a security deposit of just ₹12 lakhs, makes it the most attractive option for operators aiming to minimize initial capital investments. Leasing from **government aggregators** follows with a score of 3.4, slightly lower due to perceived operational challenges and flexibility concerns.

Ownership models that involve significant upfront costs are less preferred. The option to own the bus and lease the battery from either private or government aggregators scored **3.1**, while outright ownership of both the bus and battery received the lowest rating at **2.1**, due to the high initial capital requirement of 30 lakhs. These results highlight the importance of financial sustainability and lower barriers to entry for operators when adopting e-buses.

The findings reflect Operators show a strong preference for models with **lower upfront costs** and **flexible ownership**, with private and govt. leasing ranking highest, indicating that minimizing initial capital investment is critical for operator buy-in and financial sustainability.

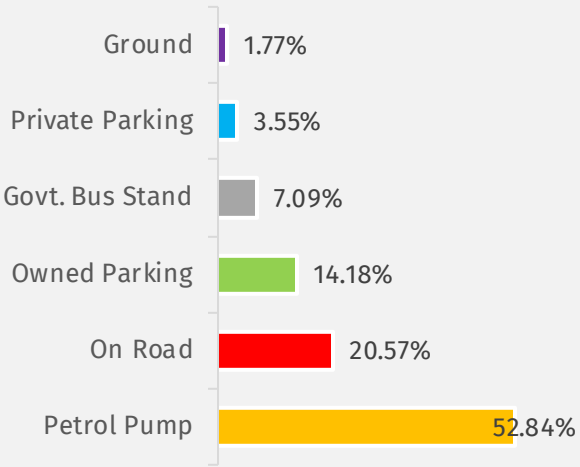
8.6 Other Details Captured From Operators

1. Preference For AC Electric Bus



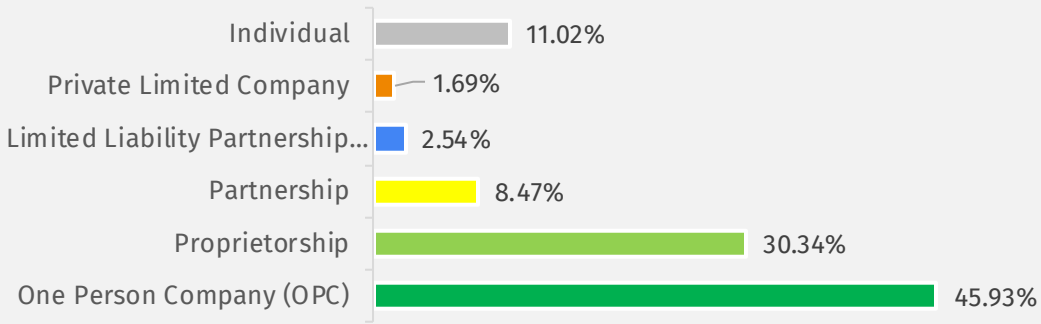
- **Cost-Competitiveness: 73.81% of operators** prefer AC electric buses if their operating costs match or are lower than diesel buses, emphasizing the importance of cost parity in decision-making.
- **Passenger Comfort:** The preference for AC buses highlights operators' focus on enhancing passenger comfort, provided it aligns with financial sustainability. AC electric buses should be exempted from the 5% GST to keep fares affordable and promote sustainable transport.

2. Existing Parking Locations



- **Dependency on Petrol Pumps:** Over **52.84% of operators** use petrol pumps for overnight parking, highlighting the lack of dedicated parking facilities for buses.
- **Roadside Parking: 20.57% of operators** park their buses on roads, reflecting the limited availability of secure and designated parking spaces.

3. Operator's Legal Entity



Most operators function as formal legal entities, with the majority structured **as One Person Companies (45.93%)** and **Proprietorships (30.34%),** indicating that formal legal structures dominate the sector.

8.7 Final Aggregated Demand

The demand aggregation was based on a two-pronged approach that combined existing operational data of diesel buses with insights gathered from a detailed operator survey:

- **Existing Diesel Bus Data:** Operational patterns, such as route length, daily trips, operational hours, and passenger capacity, were analyzed to determine the baseline requirements. Metrics such as fuel efficiency, average kilometers traveled, and bus utilization patterns provided the foundation for estimating the equivalent needs for electric buses.

- **Operator Preferences:** A survey captured the preferences of operators regarding business models for e-buses. Notably, 60% of operators preferred the lease model for e-Bus adoption, which minimizes upfront investment and aligns with their financial constraints. This preference was factored into the demand estimation to ensure the projection reflected the financial and operational realities of operators.

- **Lease Model Adoption:** By combining the number of buses due for replacement with the percentage of operators willing to shift to an e-bus lease model, the total demand for e-buses was calculated. The methodology ensured that the projections are not only realistic but also aligned with operator preferences for sustainable adoption.

Attributes	Total State level demand
Buses due for replacement in next 3 years	3266
Operators willing to shift to e-buses lease model	1633 Operators
Total e-Bus requirement	1959 e-buses
Daily assured km	430 km
Daily energy requirement/bus	672 kWh
Preferred bus size	11m
Preferred variant	A.C. (Subject to exemption from 5% GST)
Avg. route length	45km
Avg. daily trips/bus	10
Avg. operational hours	14 hours
Avg. pax/bus/day	728 pax
Total land size required for overnight charging	29.39 Ha.
Total daily energy requirement for all buses	1316.44 MWh

Table 20: Aggregated demand for e-Bus based on operator's willingness and bus replacement

The aggregated demand analysis highlights a significant opportunity for transitioning to electric mobility in the private bus sector. Over the next three years, 3,266 buses are due for replacement, providing a window for phasing out diesel buses in favor of e-buses. Based on operator preferences, 1,633 operators, or a substantial percentage of the total, have expressed willingness to adopt an e-bus lease model, resulting in a projected requirement of 1,959 e-buses at the state level.

This aggregated demand also holds significant implications for OEMs. Standardizing vehicle specifications and operational requirements can streamline production, reduce variability, and enhance supply chain efficiency. Additionally, the scale of demand offers economies of scale, enabling cost reductions that lower the Total Cost of Ownership per kilometer for operators. By consolidating demand at the state level, stakeholders can ensure more competitive pricing, better service agreements, and long-term financial sustainability for all parties involved. This strategic approach to aggregation and standardization paves the way for a seamless and impactful transition to electric mobility.

Photo: tamilnaduprivatebuses.wordpress.com

09

Next Steps To Be Taken

9.1 Strategies for State Government & Stakeholders

The transition to electric mobility in the private sector is critical for building a sustainable, efficient, and inclusive public transport system. State governments play a pivotal role in facilitating this shift by adopting a structured approach to policy, infrastructure, and operational frameworks. Below are the key steps state governments can implement to ensure a smooth and effective transition to e-buses in the private sector:

1. Regulatory Reforms:

The first step involves recognizing the leasing model for e-buses under the Stage Carriage Permit Conditions. State governments, such as Tamil Nadu, must amend relevant provisions of the Motor Vehicles Act to enable leasing as a legitimate operating model. These reforms will allow private operators to adopt e-buses without ownership burdens, making the transition more financially viable.

Key actions include:

- Amending permit conditions to incorporate leasing options for operators.
- Ensuring that leased buses meet state-level public transport quality standards.
- Establishing guidelines for operations, including safety and maintenance protocols.

2. Establish a Framework for Leasing

Drafting a standardized framework for leasing is critical for creating a transparent, commercially viable environment for private operators and financiers. This framework should define contract terms for bus purchase and lease, supported by a bankable structure for debt financing.

The framework should address:

- Clear leasing terms, including payment structures and ownership rights.
- Risk-sharing mechanisms between operators and financiers.
- Incentives for aggregators to ensure the scalability of the leasing model.

3. Establish an E-Bus Leasing Company

The creation of a dedicated Special Purpose Vehicle (SPV) or Rolling Stock Company (ROSCO) is essential for e-bus electrification. This entity, supported by 25% private/government equity and 75% debt financing, will supply buses, aggregate demand, and provide operational and maintenance support.

Core responsibilities of the leasing company:

- Procurement and allocation of buses to operators.
- Facilitating demand aggregation for cost efficiency.
- Upskilling operators to ensure smooth e-bus operations.

4. E-Bus Pilot Program

Conducting a pilot e-bus project in one of the surveyed cities (such as Trichy or Erode) is essential to assess the energy, operational, and financial feasibility of e-buses. A well-designed pilot program will allow stakeholders to identify challenges and fine-tune implementation strategies before scaling.

Pilot program goals:

- Evaluate energy requirements and operational efficiency.
- Test financial models such as leasing and pay-per-use.
- Build operator capacity through training on e-bus technology and operations.

5. Charging Infrastructure and Special Tariff

Charging infrastructure is the backbone of e-bus electrification. The state government must allocate land for public charging stations and introduce a special tariff capped at ₹11/kWh to ensure affordability for operators.

Steps for implementation:

- Allocate land parcels for charging stations in urban and semi-urban areas.
- Partner with private players to develop charging facilities through public-private partnerships.
- Implement a special electricity tariff to lower operational costs for e-bus operators.

6. Policy for New Permits Exclusively for E-Buses

To address the fleet deficit in the state and accelerate e-bus adoption, the state government must introduce a policy to issue new Stage Carriage permits exclusively for e-buses. This crucial step should be integrated into the State EV Policy and adopted by the Home Department to ensure seamless implementation.

Policy Objectives:

- To address the fleet deficit in the state, the government must issue new permits for private stage carriage buses, but ensure these permits are issued exclusively for e-buses. This approach will not only bridge the fleet gap but also accelerate the adoption of electric mobility, aligning with the state's sustainability and environmental goals.

9.2 Role Of PSUs In Accelerating E-bus Adoption

Public Sector Undertakings (PSUs) hold a pivotal position in facilitating the transition to electric buses (e-buses) in India. Their financial strength, technical expertise, and policy alignment make them ideal players for addressing the challenges in e-bus deployment. Below is an exploration of the roles PSUs can play and recommendations for their involvement in electrifying public transport.

Relevance and Possibility

- **Policy Support:** The Indian government's push for electric mobility under initiatives such as FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) and NITI Aayog's EV roadmap provides a strong foundation for PSU participation. These frameworks encourage large-scale adoption of e-buses and promote partnerships between public and private stakeholders.
- **Financial Capacity:** PSUs often have access to low-cost capital and government-backed funding, enabling them to take on high-capital projects like e-bus leasing and infrastructure development. This positions them as key enablers for financially constrained urban transport corporations and private operators.

Existing Precedents:

PSUs such as NTPC, Convergence Energy Services Limited (CESL), and Energy Efficiency Services Limited (EESL) have already demonstrated successful models in clean energy and electric mobility programs, making them well-suited to expand their roles in the e-bus ecosystem.

NTPC's Investment in BMTC's E-Bus Program:

- **NTPC's Role:** NTPC partnered with Bangalore Metropolitan Transport Corporation (BMTC) to deploy e-buses by investing in charging infrastructure and supporting fleet leasing.
- **Business Model:** NTPC's involvement reduced the financial burden on BMTC, enabling e-bus operations without significant upfront capital expenditure.
- **Outcome:** The program highlighted the feasibility of PSU-driven e-bus adoption while ensuring financial sustainability for operators.

CESL (Convergence Energy Services Limited):

- CESL has pioneered e-bus aggregation and leasing models, deploying e-buses across multiple states at scale.
- It supports operators through tenders and financial structuring, reducing the Total Cost of Ownership (TCO).

EESL (Energy Efficiency Services Limited):

- EESL provides financial and technical assistance for e-bus programs.
- It focuses on demand aggregation to lower the per-unit cost of buses and batteries, benefiting smaller operators.

REC Limited and PFC Limited:

These PSUs offer financial backing for green projects, including e-bus leasing models, facilitating infrastructure development and operational scaling.

TANGEDCO (Tamil Nadu Generation and Distribution Corporation Limited):

- TANGEDCO can play a critical role by supporting the development of charging infrastructure in Tamil Nadu.
- It can introduce special tariffs for e-buses, ensuring affordable and reliable electricity for operators while contributing to the state's electrification goals.

9.3 Summarized Actions

Step	Actions	Key Actions	State Departments	Non-Govt/Pvt Sector/PSU
1	**Regulatory Reforms**	• Amend Stage Carriage Permit Conditions to include leasing models for e-buses. • Ensure leased buses meet public transport quality standards. • Establish operational guidelines for safety and maintenance.	• Transport • Home	
2	**Establish a Framework for Leasing**	• Draft a framework defining contract terms, payment structures, and ownership rights. • Include risk-sharing mechanisms for operators and financiers. • Provide incentives for aggregators to scale the leasing model.	• Home • Finance	• BOCI • NBFC • OEMs • PSU • Dev. Bank/IFC

Step	Actions	Key Actions	State Departments	Non-Govt/Pvt Sector/PSU
3	**Establish an E-Bus Leasing Company**	• Create a Special Purpose Vehicle (SPV) or Rolling Stock Company (ROSCO). • Facilitate bus procurement, demand aggregation, and operator upskilling. • Secure 25% equity and 75% debt financing for operations.	• Home • Finance	• NBFC • PSU
4	**Conduct an E-Bus Pilot Program**	• Select cities like Trichy or Erode for pilot projects. • Evaluate energy requirements, operational efficiency, and financial models. • Train operators on e-bus technology and leasing operations.	• Regional Transport Dept. • ULB	• BOCI • OEMs • TANGEDCO
5	**Develop Charging Infrastructure and Implement Special Tariffs**	• Allocate land parcels for charging stations in urban and semi-urban areas. • Introduce a special electricity tariff (₹11/kWh) for e-bus operations.	• Energy • Transport • ULB	• OEMs • TANGEDCO
6	**Policy for New Permits Exclusively for E-Buses**	• Issue new permits for private stage carriage buses exclusively for e-buses. • Integrate this into the State EV Policy to address fleet deficits and promote electric mobility.	• Industries • Home • Transport	

9.4 Conclusion

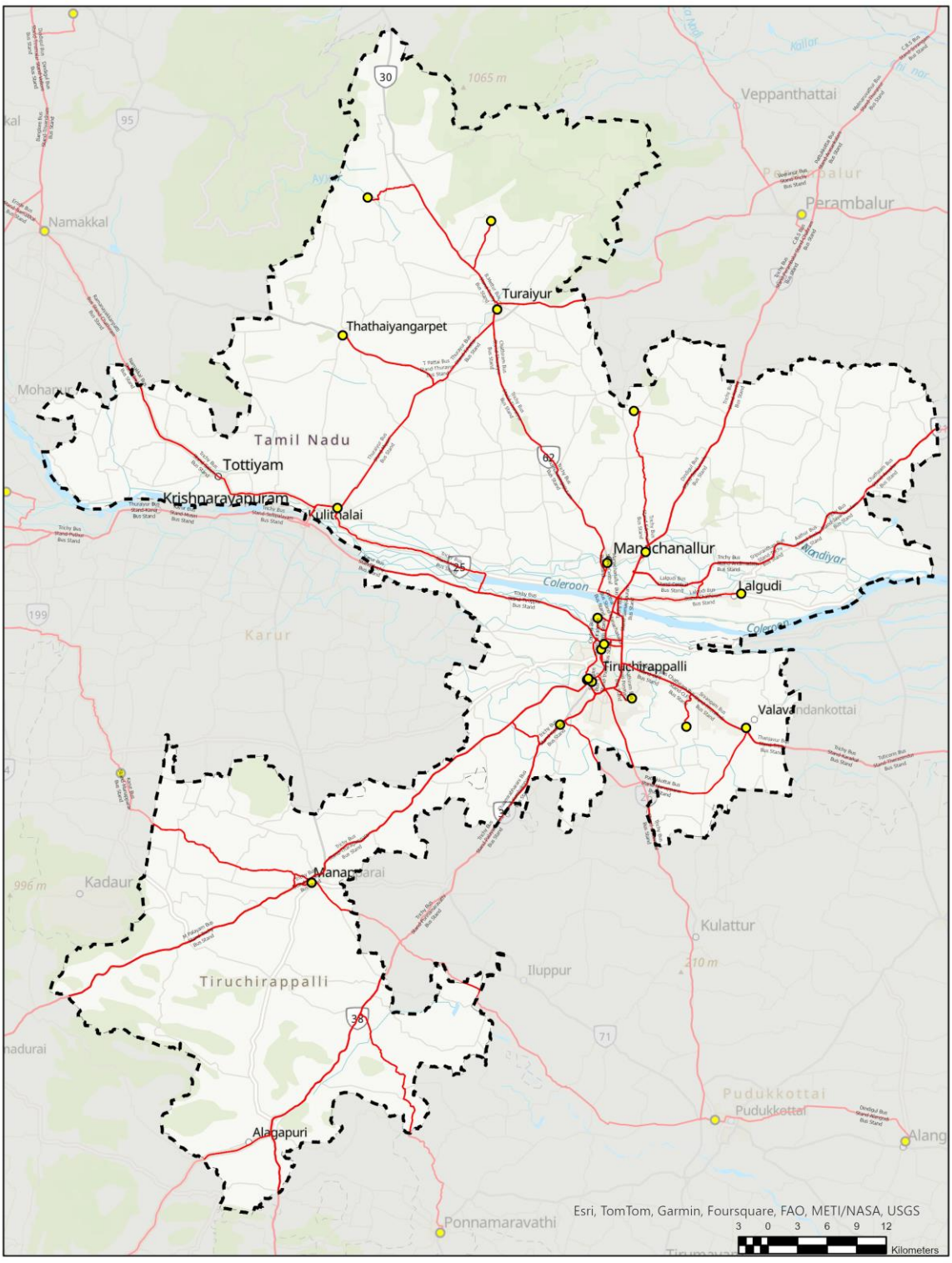
The electrification of the private bus sector in Tamil Nadu represents a transformative opportunity to modernize public transport, aligning it with sustainability and inclusivity goals. By adopting e-buses, the state governments can foster a system that is environmentally friendly, cost-efficient, and passenger-focused. This transition requires comprehensive measures, including regulatory reforms, robust charging infrastructure, and financial frameworks such as leasing models that lower entry barriers for operators. Public Sector Undertakings (PSUs) can play a crucial role by investing in infrastructure, fleet leasing, and providing affordable electricity tariffs to support this shift. It is not just about replacing diesel buses but about building a modern, transparent, and efficient transport system that benefits operators, passengers, and society at large.

Collaboration between stakeholders, including state governments, private operators, PSUs, and financial institutions, is essential to make this shift a success. The outlined steps—ranging from pilot programs to exclusive permits for e-buses—will ensure a smooth transition while addressing challenges like high upfront costs and infrastructure needs. This initiative will not only improve the quality of public transport but also contribute to environmental preservation, energy savings, and economic growth, creating a more sustainable and resilient future for all.

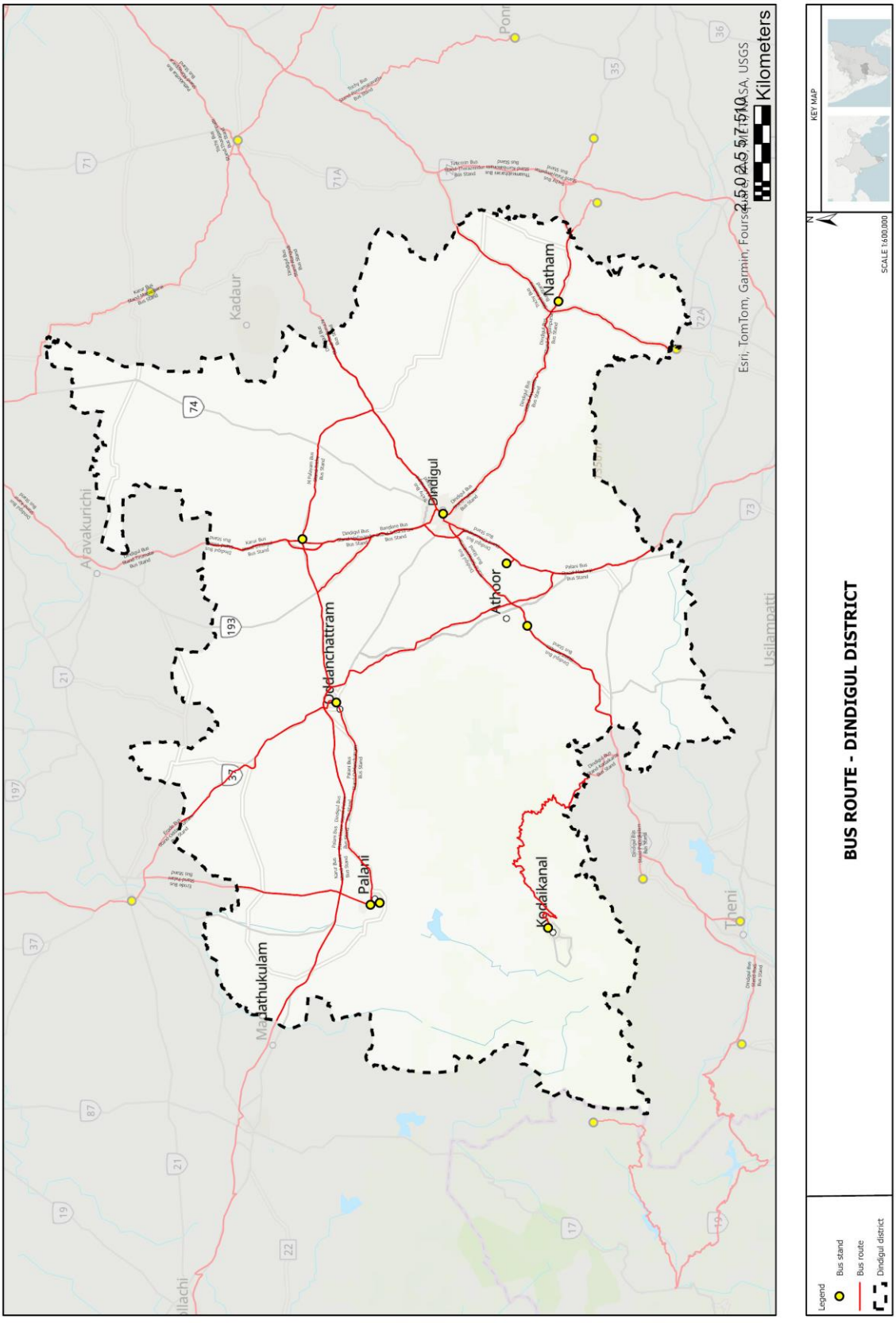
10

Annexure

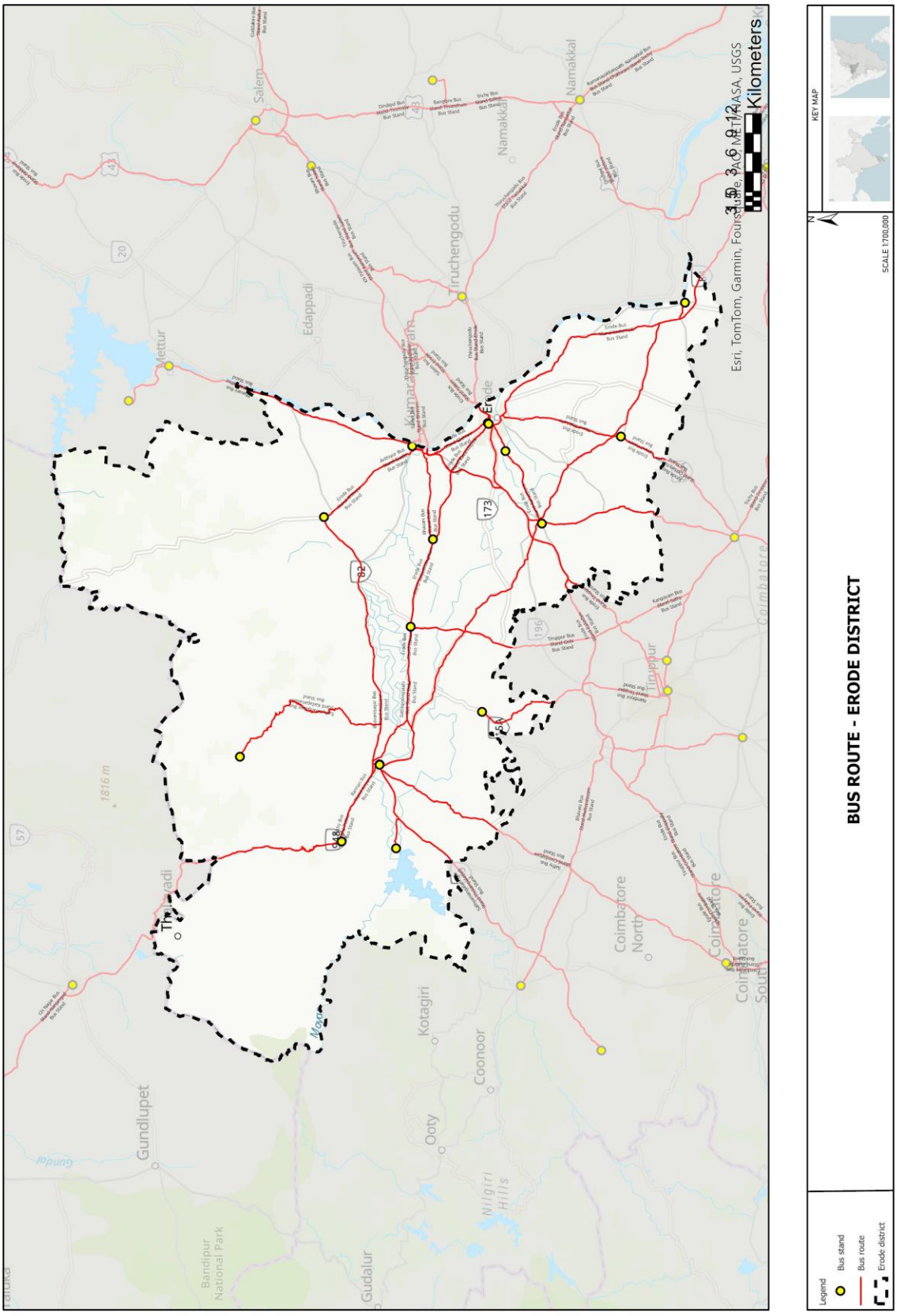
Map of Private Stage Carriage Bus Network - Tiruchirappalli District



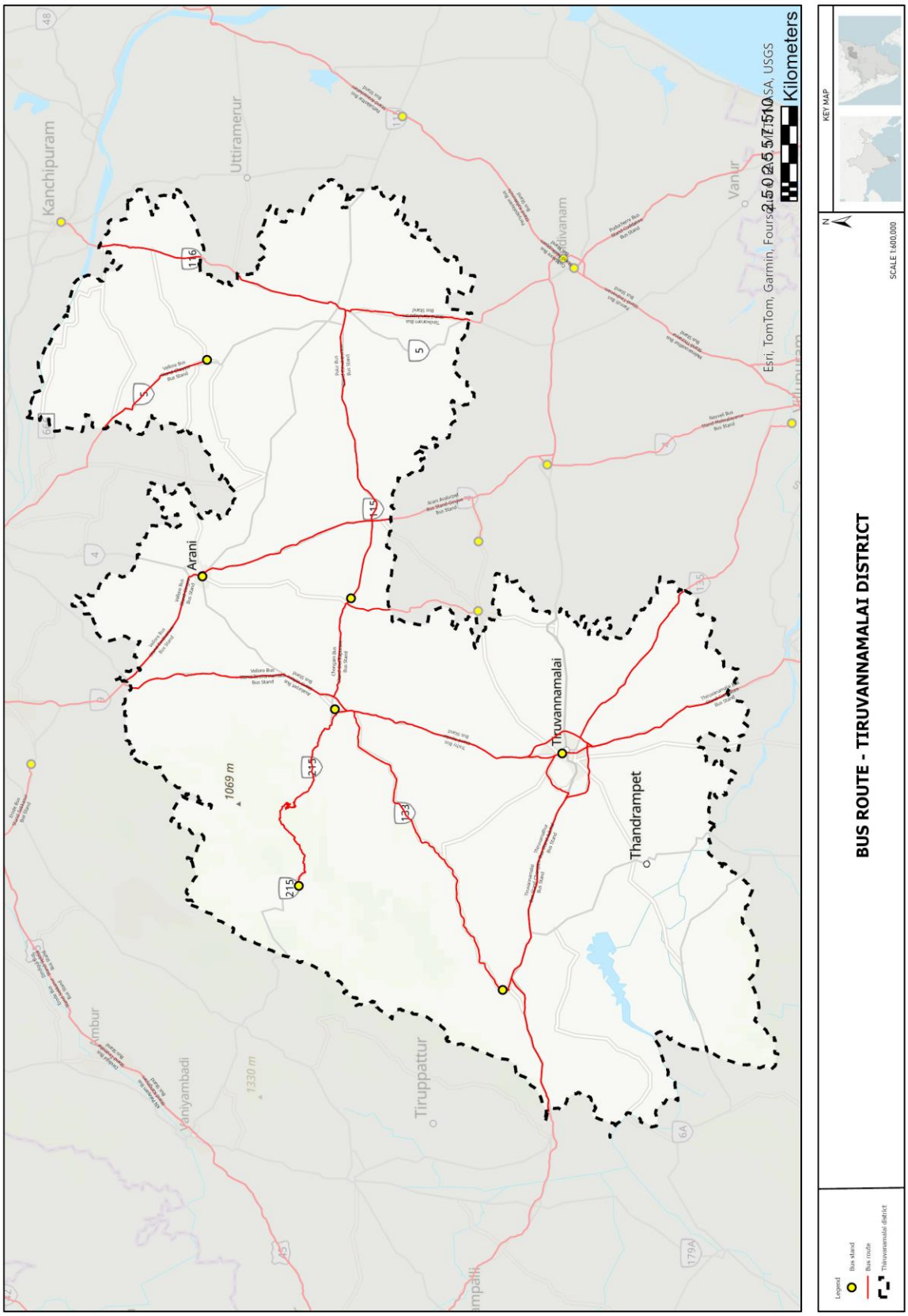
Map of Private Stage Carriage Bus Network - Dindigul District



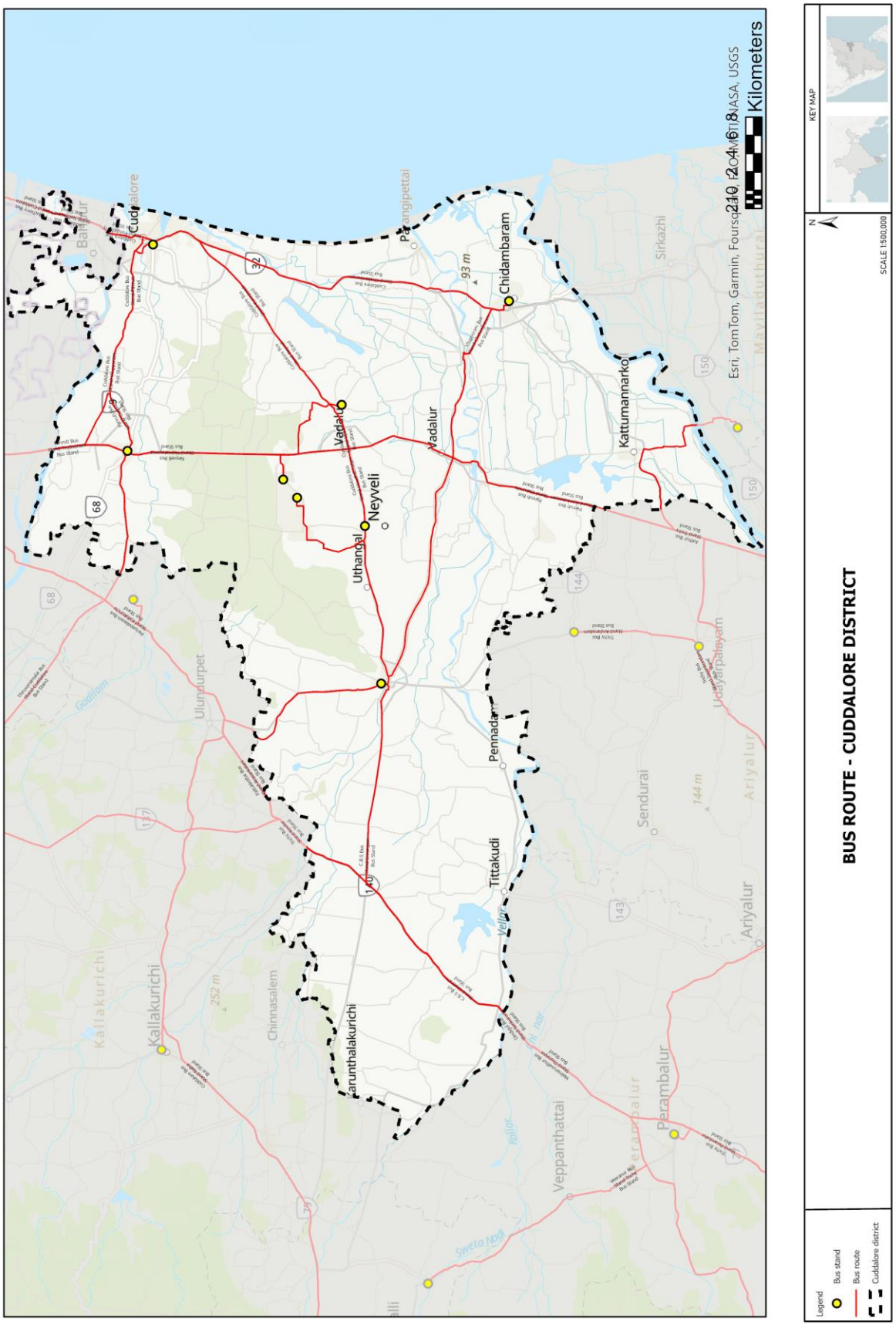
Map of Private Stage Carriage Bus Network – Erode District



Map of Private Stage Carriage Bus Network - Tiruvannamalai District



Map of Private Stage Carriage Bus Network - Cuddalore District

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