WRI INDIA

CONFERENCE PROCEEDINGS

A summary of expert perspectives on viable financing pathways for electrifying India's public transport

SUSTAINABLE AND INNOVATIVE FINANCE FOR GREEN AND HEALTHY TRANSPORTATION (INSIGHT 2022)

Date: September 14 to 16, 2022 | New Delhi, India | Avinash Dubedi, Aparna Vijaykumar, and K. P. Aswathy

BACKGROUND

Convergence Energy Service Limited (CESL) and World Resources Institute India (WRI India) organized a two-day international conference titled "International Conference on Sustainable and Innovative Finance for Green and Healthy Transportation—(INSIGHT 2022)" on September 15–16, 2022, with the support of the Ministry of Road Transport and Highways (MoRTH), Ministry of Heavy Industry, Ministry of Power (MoP), and National Institution for Transforming India (NITI Aayog).
This was preceded by a one-day workshop on "Carbon Markets: Regulations, Infrastructure and International Experiences" on September 14, 2022, which was organized in collaboration with the World Bank under the Forum for Decarbonizing Transport under the NDC Transport Initiative for Asia.

The two-day conference was inaugurated by Nitin Gadkari, Hon'ble Minister of Road Transport & Highways, with special remarks by Kailash Gahlot, Hon'ble Minister of Transport & Environment, Government of Delhi, and Amitabh Kant, Hon'ble Sherpa of India's G20 Presidency. The conference provided a platform to discuss key learnings from the Grand Challenge (GC), which was the world's biggest tender for e-buses; the scope and challenges involved in scaling up the GC to a national program; the role of financiers and original equipment manufacturers (OEMs) in the nationwide e-bus procurement and regulatory architecture mandates; global experience with e-bus business models; the necessity for cross-sectoral collaborations; and the role of the public and private sectors in scaling electric vehicles (EVs).

CONTENTS

DISCLAIMER: The content of these conference proceedings reflects the views of the conference participants and does not necessarily reflect the views of the World Resources Institute or other conference partners. These proceedings aim to faithfully reflect the conversations and content generated at the conference but for ease of readability some wording has been edited. For questions or comments about this report, contact Aparna Vijaykumar, Program Manager (Electric Mobility) at Aparna.Vijaykumar@wri.org.

The one-day workshop on carbon markets focused on potential carbon market infrastructure, learnings from global experience, key drivers/enablers of the carbon market, the impact of internal carbon markets in India, and innovative approaches to ensure environmental integrity.

Some of the key highlights and takeaways of the conference and workshop were the following:

- Carbon markets are an effective driver for reducing emissions, offering the lowest-cost emission reductions.
- Building international commitment on emissions reduction, adoption of climate targets by corporates, and monitoring and reporting mandates on climate disclosures are the key enablers of the carbon market in India.
- The Indian carbon market is going to cross the US$500 million mark by 2025 and is poised to become a $10 billion industry by 2030.
- An independent regulatory body is needed to oversee the procurement of electric buses, based on similar models in the power sector. A case in point is Solar Energy Corporation of India's model for payment security.
- Decoupling batteries from EVs, higher warranties, and a robust business model for second life applications of batteries are key solutions to tackle the challenges associated with the resale value of EVs.
- The GC aggregation model was a win-win situation for all stakeholders of the value chain: for the commuters in terms of moving toward more comfortable public transport, for state transport undertakings in terms of achieving total cost of ownership parity, and for OEMs by building supply chains and engineering intellectual property.
- Accelerated bus electrification requires multilateral and cross-sectoral collaborations among bus operators, OEMs, IT companies, grid and energy utilities, and various state and central ministries.

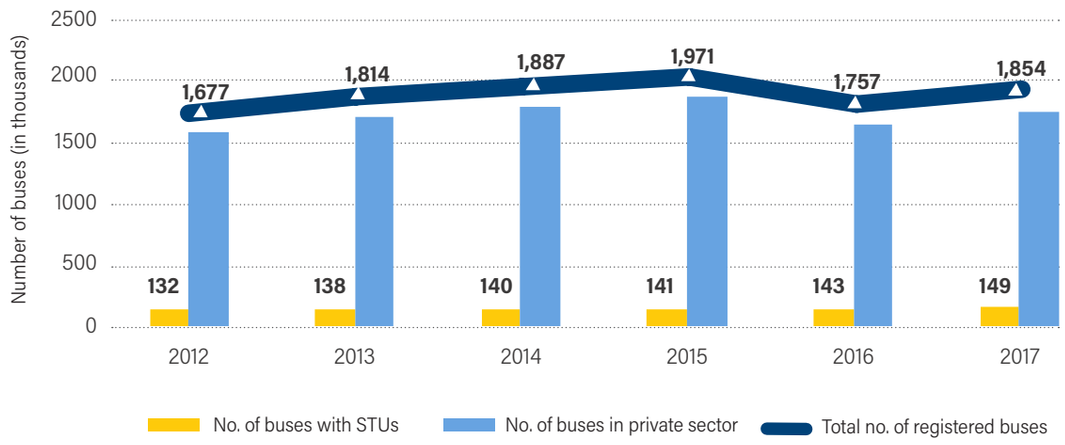
1. INTRODUCTION

Evolving technologies and innovative business models are key to meeting mobility needs and mitigating greenhouse gas (GHG) emissions, sectoral air pollution, and oil import dependence, thereby improving public health (NITI Aayog and RMI India, 2017). India's transport sector is responsible for about 10 percent of the total national GHG emissions, and road transport alone contributes to about 87 percent of the sectoral emissions (Paladugula et al., 2018). Internationally, clean transit is one of the most significant components of sustainable mobility. However, in India, the pace of growth of the urban population and the resulting travel demand have outstripped the supply of bus-based transit services in recent decades.

India has 1.8 million buses, of which 0.14 million buses are owned and operated by state transport undertakings (STUs), and there is an additional requirement of 0.20 million more buses (WRI India, 2021) (Figure 1). Hence, cities are losing ground to travel by personal vehicles, with low and declining mode shares for public transport. India needs to focus its bus services on the needs of users and thereby augment on-road services. A large majority of buses today are run by fragmented, unorganized players that barely break even on daily operations. Unreliability, poor vehicle maintenance, safety hazards, and high levels of uncertainty across operations all point to a broken customer experience.

In this context, electric buses (e-buses) offer lower operating cost compared to their diesel or compressed natural gas (CNG) counterparts. Although this should lead to the acceptance of e-buses by STUs, their high capital cost (about 2–4 times higher than conventional alternatives) is one of the major hurdles to

FIGURE 1 | Public bus transport projections for India



Notes: STU = state transport undertaking.

Source: National Investment Program for Bus-based Public Transport Systems in India

their adoption. This has encouraged transport agencies to adopt new business models, with a shift toward purchasing e-bus services for long-term contracts rather than purchasing the bus, which considerably reduces the financial and operational risks of bus agencies.

The event was envisaged against the backdrop of a recently concluded tender for 5,450 e-buses under the Grand Challenge (GC) across five cities in India. The lowest price discovery (INR 37.90/km ($0.46) for 9 m non-AC e-buses and INR 43.49/km ($0.53) for 12 m non-AC e-buses) resulting from de-risked contracting and several other reforms led to a scaled-up program for 50,000 e-buses, which the NITI Aayog entrusted CESL to execute. This large-scale target calls for addressing risks in the financing of e-buses. The implementation requires cross-sectoral collaborations with the support of governmental agencies at the central and state levels. There are also plans to integrate solar power to charge these e-buses in an effort to decarbonize public transport. The switch from fossil fuel to renewable energy would lead to significant avoidance of GHG emissions, thereby allowing the creation of tradable carbon assets and the subsequent monetization of carbon credits.

2. E-BUSES IN INDIA

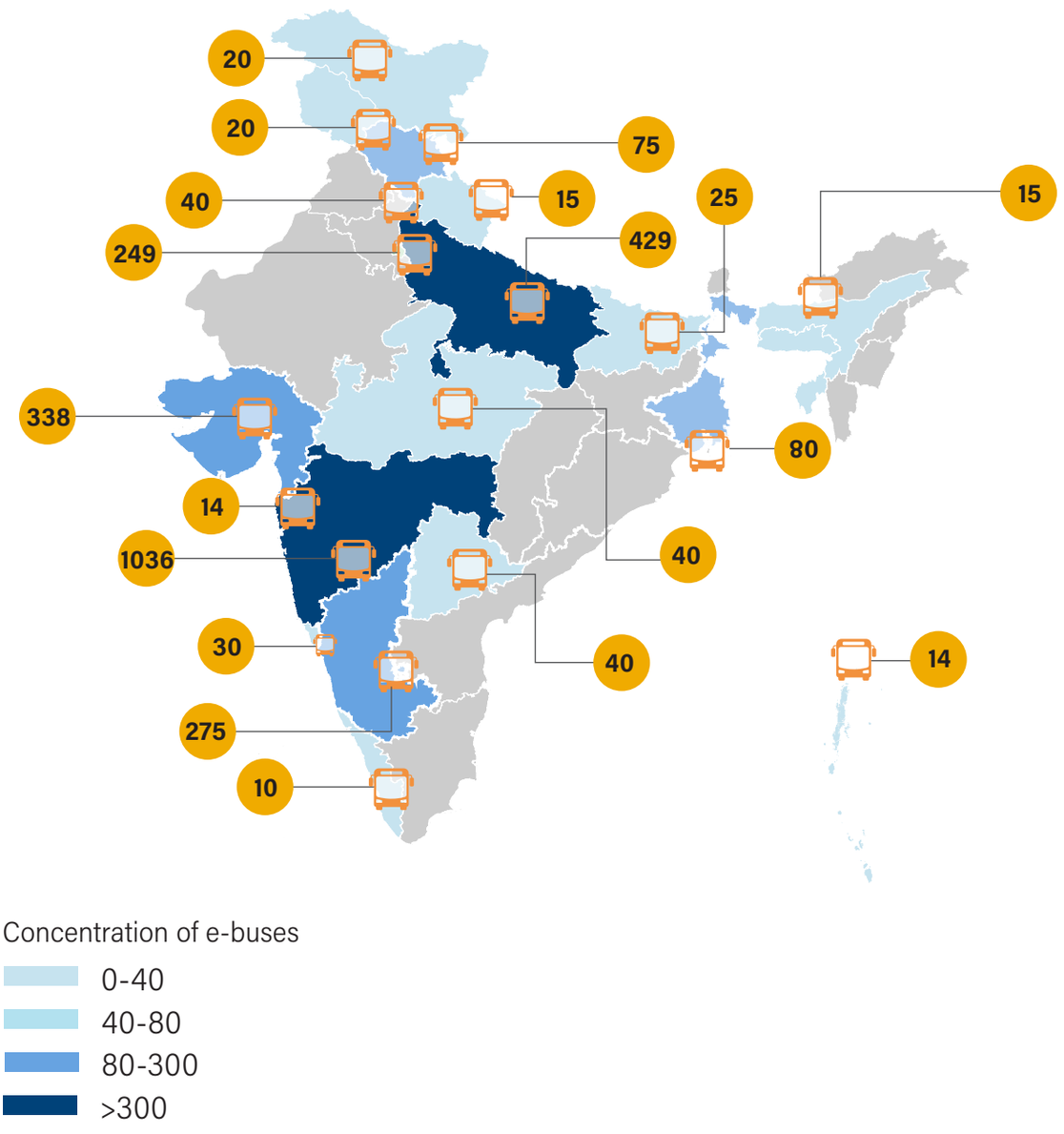
The Government of India has instituted several fiscal and regulatory measures to accelerate the adoption of electric vehicles (EVs) in India, with a special focus on e-buses. The Faster Adoption and Manufacturing of (hybrid and) Electric Vehicles (FAME) scheme, launched in 2015, was aimed at providing incentives for EV purchases, and this kickstarted e-bus procurement in India. The first phase of this scheme facilitated the deployment of 425 e-buses in 10 cities across India (Singh, 2022). However, the scheme faced several challenges: lack of funding for cities to make outright e-bus purchases, lack of experience in handling the operational requirements of purchased e-buses, and lack of standardized gross cost contract (GCC) terms.

The second phase of FAME was launched in 2019 with a total budget outlay of INR 100,000 million with a deployment target of 7,000 e-buses under the GCC-based procurement model. Around 3,000 e-buses have been deployed/tendered under this scheme (Figure 2). The lack of standardized operational parameters,

varying technical specifications, variation in the volume of buses procured by tier I, II, and III cities, and lack of capacity in cities to adopt the GCC model led to this low uptake of e-buses despite FAME I and II. This failure impelled the government to reevaluate alternative options for boosting the e-bus adoption rate.

To address these gaps in implementation, the scheme refocused on larger metropolitan cities with a population of more than 4 million through an aggregate procurement model where a central agency became the program manager subscribing demand from cities and was responsible for all of the activities until deployment. In June 2021, the Department of Heavy Industries entrusted CESL with the responsibility for aggregating e-bus demand.

FIGURE 2. Status of e-bus deployment in India as of September 2022

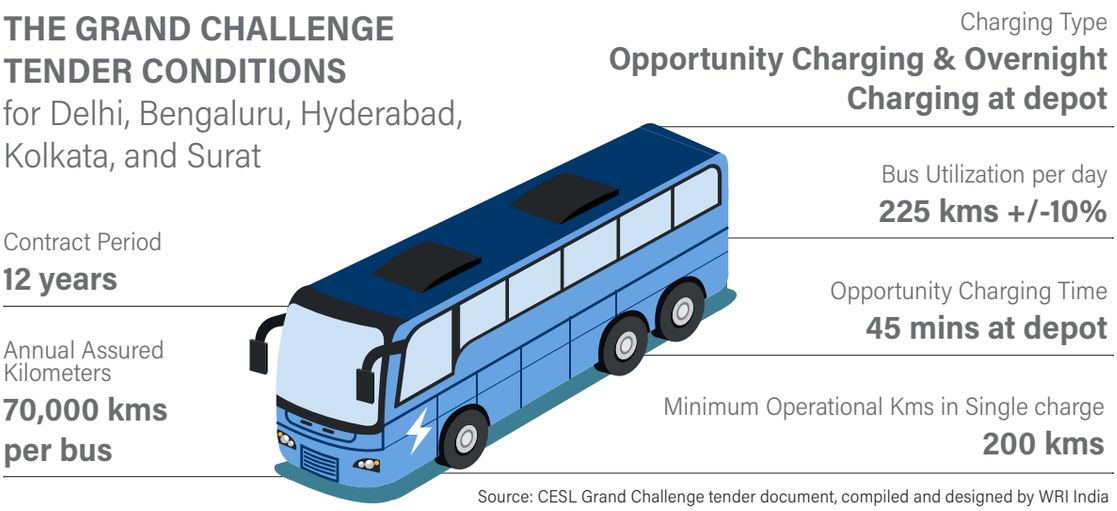


DISCLAIMER: This map is for illustrative purposes and does not imply the expression of any opinion on the part of WRI concerning the legal status of any country or territory or concerning the delimitation of frontiers or boundaries.
Sources: Author-generated map, compiled by WRI India.

3. SUCCESS OF THE GC

CESL launched the GC on September 30, 2021, to aggregate demand from nine cities having a population of over 4 million (Mumbai, Delhi, Bengaluru, Hyderabad, Ahmedabad, Chennai, Kolkata, Surat, and Pune) under the GCC model. The GC was the world's largest tender for e-bus procurement. It aggregated demand across five cities (out of nine) in India and homogenized tendering conditions to procure e-buses (Figure 3). The GC tender discovered the lowest bid rates for e-bus operations in Indian cities, up to 48 percent lower than those from previous tenders.

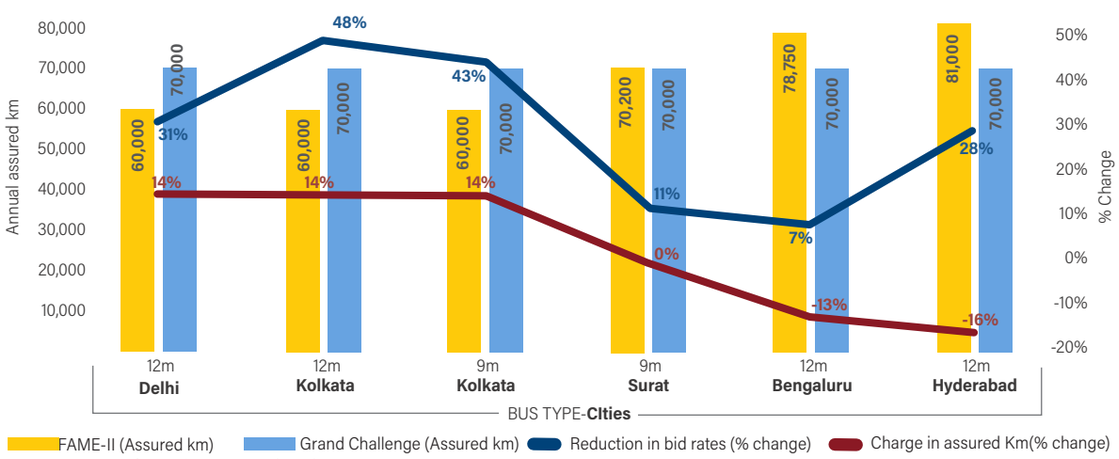
FIGURE 3. Key tender conditions of the Grand Challenge



Source: CESL Grand Challenge tender document, compiled and designed by WRI India

The sheer size of the tender itself (5,450 e-buses) was instrumental in reducing the bid rates. As part of the tendering process, consultations were held with transit agencies, financing institutions, e-bus manufacturers, NITI Aayog, and think tanks. These consultations helped revise the terms of contract, which led to a devolution of project risks. This helped boost the confidence of bidders, enhanced healthy competition, and led to record low prices of INR 37.90/km ($0.46/km) for 9 m non-AC e-buses and INR 43.49/km ($0.53/km) for 12 m non-AC low floor e-buses. There was an approximately 48 percent reduction in the bid rate for 12 m e-buses and a 43 percent reduction for 9 m e-buses when compared to the FAME II GCC rates in Kolkata (Figure 4).

FIGURE 4. Comparison of reduction in assured kilometers versus bid rates in FAME II and Grand Challenge for e-buses



Source: Press Information Bureau (2021).

4. NEXT PHASE OF E-BUS PROCUREMENT

The success of the GC had given CESL valuable experience and expertise in demand aggregation. Acknowledging these learnings gained by CESL and the need for the involvement of a central agency in such programs, NITI Aayog has invited CESL to scale up the GC to a national-level e-bus program. The National E-Bus Program (NEBP) will seek to aggregate demand from public bus transport agencies, facilitate tendering of e-buses, and support the creation of infrastructure to operate 50,000 e-buses across Indian cities by 2030.

5. CONFERENCE OUTCOMES

This section highlights the key lessons and insights provided by the panelists and keynote speakers during the event. The sessions, spread over three days, helped in understanding the wide scope of carbon markets, how carbon credits can be leveraged to generate large-scale emissions reduction, the challenges in procuring and operating e-buses in the country, and the quantum of financing support needed for large-scale e-bus procurement. Moreover, INSIGHT 2022 provided a common platform to different stakeholders, ranging from government representatives, OEMs, transport agencies, financial institutions, academicians, and multilateral agencies to build upon strategies that can fast-track decarbonization of the transport sector.

5.1 Key lessons and entry points for action

1. Carbon credits present an opportunity for enterprises to generate large-scale emissions reduction and treat them as tradable assets

Carbon markets are an important tool for achieving the goal of net-zero emissions in the most effective way. They mobilize resources and reduce the cost of implementing countries' targets under Nationally Determined Contributions (NDCs). Article 6 (Union Nations, 2015) of the Paris Agreement allows countries to cooperate with each other to achieve these emissions reduction targets (World Bank, 2022).

The Government of India has charged the Ministry of Environment, Forest, and Climate Change (MoEFCC) and the MoP with the task of developing the requisite legal, institutional, and technical framework for implementing domestic carbon markets. The MoEFCC is partnering with various organizations in undertaking assessments to understand the country's climate finance needs, the role carbon markets can play in fulfilling these needs, developing the required infrastructure, and participating in the Article 6 mechanism for carbon markets. Within Article 6 of the Paris Agreement, Article 6.2 creates the basis for bilateral action to reduce GHG emissions, while Article 6.4 is expected to create the basis for a multilateral mechanism similar to the Clean Development Mechanism (CDM) for trading GHG emissions among countries.

From the perspective of India, Article 6.4 is primarily an instrument for rewarding the market, where investors can capitalize on emissions reduction. Carbon credits present an excellent opportunity for enterprises to generate large-scale emissions reduction and treat these as tradable assets. Under a well-designed framework, these credits can function as a reward mechanism for achieving sustainability.

ENTRY POINTS FOR ACTION: While developing the framework for our national carbon market, India should identify and prioritize sectors and technologies that most need market levers, to enable their transition to low carbon pathways. This also requires balancing the demand and supply sides of the market with well-thought-out market principles. The existing regulatory framework has to be leveraged to achieve this goal.

2. A framework to facilitate voluntary carbon markets will help combat climate change and provide access to the compliance market

The voluntary carbon market—which allows private companies and individuals to purchase carbon credits on a voluntary basis—has gained traction in recent years, and it is growing tremendously in India. The emergence of the voluntary carbon market helps infuse better technology and investments in emissions reduction projects. This can also build a foundation for introducing carbon markets in countries where climate policies are yet to establish carbon market schemes. However, from an environmental perspective, voluntary carbon markets cannot replace compliance markets, in which emissions trading is governed by legal and regulatory requirements. Although voluntary markets are important, they can only complement a compliance market. Voluntary carbon markets can provide a preliminary compliance arena in which challenges can be tested to develop the systems necessary to transition to a compliance market.

Subsequently, voluntary carbon markets are expected to grow further, driven by the growing net zero commitments of corporates. This in turn raises the concern as to whether real emissions reductions are being achieved. A framework is needed to scrutinize the voluntary carbon market to ensure that its players will help combat climate change.

In India, the Bureau of Energy Efficiency (BEE) has been successfully implementing the PAT (Perform Achieve and Trade) Scheme, which is a regulatory instrument to reduce specific energy consumption in energy-intensive industries (BEE, 2021). The scheme aims to enhance the cost-effectiveness of energy savings by upgrading technologies and taking innovative actions to minimize energy consumption. The excess energy saved through this scheme is issued as Energy Saving Certificates (ESCerts), which are a tradable instrument. According to BEE, one of the challenges it faces is surplus certificates due to limited participation or the limited trading period, and it is now working on reallocations to ensure complete recovery of surplus ESCerts.

ENTRY POINTS FOR ACTION: To address the challenges of the compliance market and to meet its NDC commitments, India must further develop voluntary carbon markets with new technologies and systems as they are not bound by stringent regulations. This would generate demand by adding more participants to the pool and linking more industries for trading surplus ESCerts issued under the PAT scheme.

3. Aggregating e-bus demand from cities is challenging but is the key enabler for lowest price discovery

The GC tender concluded by CESL aggregated demand across five cities in India and homogenized tendering conditions to procure e-buses on a GCC basis. Panelists unanimously agreed that the sheer size of the tender itself (5,450 e-buses) was instrumental in reducing the bid rates.

As part of the tendering process, CESL anchored the role of a program manager and facilitated consultations with transit agencies, financing institutions, e-bus manufacturers, NITI Aayog, and think tanks. These multiple consultations enabled the active involvement of transit agencies and OEMs and helped revise the terms of contract, which led to a devolution of project risks. This also helped boost the confidence of bidders, enhanced healthy competition, and led to record low prices of INR 37.90/km ($0.46/km) for 9 m non-AC e-buses and INR 43.49/km ($0.53/km) for 12 m non-AC low floor e-buses.

The panelists highlighted that aggregating e-bus demand across cities homogenizes demand, which in turn helps achieve price parity between operating e-buses and conventional fuel buses. They also opined that the holistic approach adopted for standardization also helped build a well-defined roadmap for large-scale deployment.

ENTRY POINTS FOR ACTION: The GC can explore opportunities to leverage clean air finance from government interventions such as the National Clean Air Program or merge finances through carbon credits and CDMs. The central agency can develop a knowledge exchange platform for e-bus operations

by gathering and consolidating operations-related data across the country. This knowledge can be made available to all stakeholders, such as e-bus manufacturers, bus fleet operators, transit agencies, financing institutions, and researchers, to help develop the e-bus ecosystem.

4. A holistic approach, incorporating global benchmarks and standards, is necessary for upcoming e-bus procurements

The success of the GC triggered the proposed scale-up of this model to procure and operate 50,000 e-buses across the country. This e-bus program will enable STUs to replace their old fuel-run buses with e-buses. The MoRTH has initiated this process, and 25 STUs have approached the ministry with their scrappage demand (for a total of about 30,000 buses). However, the key challenge in this procurement will be the absence of FAME or a national-level subsidy. STUs will require sufficient viability gap funding from state governments or the central government to participate in this upcoming tender.

STUs should explore the scope for improving non-farebox revenue streams, such as asset monetization, public charging infrastructure at depots, and app-based premium bus aggregator services. This would improve their financial security, which will ultimately positively impact the payment security mechanism.

In addition, this procurement targets tier II and tier III cities, besides mofussil and intercity operations. According to the Association of State Road Transport Undertakings, STUs currently operate about 0.35 million buses, out of which 0.15 million buses connect all cities and rural areas. Electrifying intercity buses would be a value addition as they are the main revenue generation operations for STUs.

Long-distance intercity services differ from intracity operations with respect to travel conditions; travel demand; traffic congestion; region specific characteristics such as topography, road characteristics, and temperature variations; and so on. Considering this, the panel suggested incorporating global benchmarks or standards in the upcoming tender, which may include standards for fast charging, technical specifications, an intelligent transport system, and more customer-friendly features for long rides. This will eventually attract more private vehicle users to public buses.

The GC procures e-buses under the GCC (as will the upcoming e-bus program), in which the business model is shifting from the purchase of buses to the purchase of a service through a 12-year contract. For an STU, replacing existing conventional buses through the GCC model creates driver redundancy. A dry lease model where STUs will provide drivers for operating e-buses (the revised GCC model) will solve this problem to some extent. However, a driver capacity building program with credible certifications is urgently required for smooth operations.

ENTRY POINTS FOR ACTION: Large-scale procurement of e-buses across the country requires a comprehensive approach, starting from the pre-tendering stage. It is essential to analyze the travel and traffic characteristics of the cities participating in the e-bus procurement, as they vary from city to city and will impact the average e-bus utilization. Also, as intercity services (a new addition in the NEBP tender) differ from intracity operations, terms and contracts should be standardized separately for these services. Global standards must be evaluated and analyzed from the standpoint of adaptation to Indian conditions (by considering the type of operation and characteristics of the city). While aggregating the demand across the country, the unique demand of each city/STU must be carefully analyzed, and the tender conditions must be customized accordingly.

5. OEMs need to introduce solutions to improve the involvement of financial institutions in e-bus procurement

A non-subsidy procurement model for operating e-buses for 12 years in the NEBP tender increases the financial risk of OEMs, who have to rework the total cost of operations (TCO) for e-buses without a subsidy to arrive at a competitive bid rate. To accelerate e-bus penetration, panelists across different sessions suggested formulating a model similar to Solar Energy Corporation of India's (SECI's) model. SECI has been designated as the implementation agency for setting up a payment security mechanism (PSM) for solar projects to

enable timely payments if the purchasers delay making payments (Srivastava, 2014). A similar PSM for e-bus procurement can provide guarantees to mitigate the weak credit of STUs/transit agencies and improve funding viability. This will eventually boost the confidence of financial institutions (FIs) to invest in e-buses.

OEM representatives agreed that in this drive for change, manufacturers must consider the quality and sustainability of products. They emphasized that it is essential to develop zero emission buses with an operating life of at least 15–20 years, as the quality of products has a direct positive impact on the environment.

In large procurements, the future power demand and availability of charging infrastructure must be estimated, and a roadmap for incorporating renewables must be drawn up. Panelists pointed out that efficient electric supply, adaptive infrastructure, new urban planning approaches, robust financing and tender models, cross-sectoral collaborations, and robust PSMs are the key enablers for a national-level e-bus procurement program.

In any large project, stakeholders rely on resource availability. Financing is an integral part of any successful transport system. Financing in public transport is unique and entirely different from financing in other sectors. The services offered should therefore be attractive, affordable, and convenient, to encourage commuters to use public transport.

ENTRY POINTS FOR ACTION: A holistic roadmap is required to estimate the future power demand, energy requirement, and opportunities for renewable charging and to deliver high-quality, sustainable products. This will enable OEMs to evaluate the supply chain readiness of their current production capacity and estimate the scope for further expansion. At the same time, a central nodal agency can be assigned exclusively for e-bus procurement, which can institute a PSM. A collaborative effort among OEMs, transit agencies, central and state governments, and the proposed nodal agency would accelerate the effort, and this can facilitate the active involvement of FIs in e-bus procurement.

6. Technology and data interventions in e-bus planning will optimize the cost of operations

Running bus operations in Indian cities is a complex undertaking that involves planning, design, operations management, and most importantly, timetables, which need to tie in seamlessly with their scheduling. At INSIGHT, Optibus, a software solution provider for transportation planning needs, presented its optimization and visualization tool, Route Planning and Analysis, which can replicate real-world scenarios It is a software platform that improves the planning, scheduling, operation, and management of e-buses. It helps STUs plan their routes or schedules, which are selected or prioritized for e-bus operations, and finalize the depot or charging locations. As e-bus operations differ from conventional bus operations, traditional methods of planning may not apply. Appropriate selection of routes, schedules, and charging locations helps optimize the number of chargers, charging time, and so on, which eventually helps bring down the overall cost of e-bus operations.

The battery is the core part of an e-bus and constitutes 40 to 50 percent of its cost. The ideal use of battery science, engineering, and data will help the EV value chain maximize the socioeconomic potential of lithium-ion batteries (LIBs) by lowering the TCO, reducing waste, minimizing the carbon footprint, and ensuring clean energy access. A model that covers different aspects of the battery, such as aging, degradation, thermal conditions, and the temperature environment, is an essential requirement. This model can incorporate elements from battery health assessments for reuse, predictive health analytics, battery algorithms, and dismantling and rebuilding processes.

For instance, Nunam Technologies—a private enterprise that promotes second life applications of batteries—looks at three areas: incentives, flow of information and use of resources for better life-cycle management through producer ownerships, and holistic value maximization through a focus on productivity and value preservation. A model such as that used by Nunam Technologies (a circular economy model in the EV

ecosystem) will help OEMs and financiers monitor battery health performance and estimate the battery replacement frequency. It is important to intervene during the lifetime of LIBs through health prognosis, buyback, and battery lifetime monitoring in the journey from mobility to storage.

ENTRY POINTS FOR ACTION: All transport agencies/STUs planning e-bus procurement should utilize technology interventions to select feasible routes/schedules for e-bus operations, and prioritize the charging locations (i.e., depot, bus stations, terminal stations) to ensure cost-effective e-bus operations without any driving range anxiety. Similarly, OEMs should work on battery health assessment to use batteries optimally and initiate robust R&D in battery second life. Optimal route/schedule planning, charging infrastructure planning, and buyback scope of batteries will ultimately help reduce the total cost of e-bus operations. There is a clear need to establish a central repository of operational and battery-level information that future tenders can draw on, ensure safety, and optimize operations.

6. NEXT STEPS

The conference aimed to bring together the perspectives of multiple stakeholders on e-bus procurement for a smooth EV transition. As the outcome of the conference suggests, a holistic approach encompassing cross-sectoral collaborations is essential for achieving this goal. The following are the action items that emerged from the conference:

- Design instruments to de-risk private investment in public bus transit.
- Establish a central agency to absorb off-taker/counterparty risks.
- Increase the flexibility of the tendering process to include more players. Allow non-OEMs, including financial aggregators, to participate independently in the upcoming NEBP as primary bidders, as it could lead to more realistic bidding.
- Consider other models such as Battery as a Service or Charger as a Service for STUs to optimize financial performance, as well as strategies to utilize power from renewable sources (such as solar) for e-bus charging.
- Bring government agencies, national and international industry experts, civil society organizations, and academia on a common platform to exchange knowledge, enable cross-sectoral collaborations, identify global best practices, and promote partnerships for a smooth EV transition.

PARTICIPANTS

MINISTRIES, GOVERNMENT OF INDIA:

Shri Nitin Gadkari, Hon'ble Union Minister of Road Transport & Highways
Shri Kailash Gahlot, Hon'ble Minister of Transport & Environment, Government of Delhi
Amitabh Kant, Hon'ble Sherpa for India's G20 Presidency
Tarun Kapoor (IAS), Advisor to the Hon'ble Prime Minister of India
Alok Kumar (IAS), Secretary, Ministry of Power, Government of India
Giridhar Aramane (IAS), Secretary, Ministry of Road Transport and Highways, Government of India
Arun Goel (IAS), Secretary, Ministry of Heavy Industries
Sudhendu J. Sinha, Advisor (Infrastructure Connectivity – Transport and Electric Mobility) NITI Aayog

STU/TRANSIT AGENCY REPRESENTATIVES:

Ashish Kundra (IAS), Principal Secretary, Transport, Government of NCT of Delhi
VC Sajjanar (IPS), Managing Director, Telangana State Transport Corporation
Surya Kiran, Executive Director, Association of State Road Transport Undertakings
Ashish Kumar Singh (IAS), Additional Chief Secretary (Transport and Ports), Government of Maharashtra

INTERNATIONAL DELEGATES:

Erik Solheim, Former Executive Director of UNEP; Former Minister of International Development and Minister of Environment, Norway
Mohamed Hegazy, Road Sector Co-Lead, UNFCCC Climate Champion, Egypt
Karby Leggett, Global Head of Public Sector and Development Organizations, Standard Chartered Bank
Hector Gomez Ang, Director, South Asia, International Finance Corporation
Dr. Andy Palmer, Executive Vice Chairman and Chief Executive Officer, SWITCH Mobility
Gene Gwee, Regional Underwriter, Multilateral Investment Guarantee Agency
Dr. Steve Fawkes, Managing Partner, Energy Pro Ltd.
Rebecca Manuel, Managing Director, Global Partnerships, CDPQ
Dario Dubolino, Head of Policy, European Commission's Directorate General for Mobility and Transport

OEMs AND OPERATORS:

Nishant Arya, Vice Chairman & Managing Director, JBM Group
Girish Wagh, Executive Director, Tata Motors
Prasanna Patwardhan, Chief Managing Director, Prasanna Purple Mobility Solutions
Sameer Aggarwal, Chief Executive Officer, RevFin
Suman Mishra, Chief Executive Officer, Mahindra Electric
Chetan Maini, Co-founder, Vice Chairman, SUN Mobility
Akash Passey, President, Bus Division & Electromobility, Volvo Eicher Commercial Vehicles

FINANCIERS AND OTHER PANELISTS:

Kaustubh Kulkarni, Managing Director, J.P. Morgan
Saurabh Agarwal, Managing Director, Infrastructure, South Asia CDPQ India
Dr. Vinayak Mishra, Senior Economist, Japan Bank for International Cooperation
Ajay Rao, Regional Managing Director, South Asia, U.S. International Development Finance Corporation
Manish Chourasia, Managing Director, Tata Cleantech
Tanya Singhal, Founder and Director, SolarArise
Himraj Dang, Former Executive Director, Olympus Capital
Ekta Mehra, Senior Sector Specialist, KfW
Uday Khemka, Vice Chairman, Sun Group

REFERENCES

BEE (Bureau of Energy Efficiency). 2021. National Carbon Market: Draft Blue Print for Stakeholder Consultation. New Delhi: BEE. https://beeindia.gov.in/sites/default/files/NCM%20Final.pdf.

A. N. Srivastava (Director, Ministry of New and Renewable Energy). 2014. "Draft Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects," September 8. Letter. https://www.seci.co.in/web-data/docs/Draft-Scheme-Solar-Park-and-Ultra-Mega-Solar-Power-Projects-for-comments.pdf.

NITI Aayog and RMI India (Rocky Mountain Institute India). 2017. India Leaps Ahead: Transformative Mobility Solutions for All. New Delhi: NITI Aayog and RMI India. https://rmi.org/insight/india-leaps-ahead-transformative-mobility-solutions-for-all/.

Paladugula, Anantha Lakshmi, Nazar Kholod, Vaibhav Chaturvedi, Probal Pratap Ghosh, Sarbojit Pal, Leon Clarke, Meredydd Evans, et al. 2018. "A Multi-Model Assessment of Energy and Emissions for India's Transportation Sector through 2050." Energy Policy 116. Elsevier: 10–18.

Press Information Bureau. 2021. "Electric Vehicle Operational in Medium and Heavy Passenger Vehicle Category Register an Increase." Press release. Ministry of Road Transport & Highways, New Delhi. https://pib.gov.in/PressReleasePage.aspx?PRID=1742666

Singh, Vaishali. 2022. "Rollout of Electric Buses in India." PowerPoint presentation. ITDP (Institute for Transportation & Development Policy). https://www.itdp.org/wp-content/uploads/2022/05/Rollout-of-Electric-Buses-in-India_Vaishali-Singh.pptx.pdf.

United Nations. 2015. "The Paris Agreement." https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf#page=9.

World Bank. 2022. "What You Need to Know About Article 6 of the Paris Agreement." Climate Explainer Series. https://www.worldbank.org/en/news/feature/2022/05/17/what-you-need-to-know-about-article-6-of-the-paris-agreement.

WRI India. 2021. National Investment Program for Bus-Based Public Transport Systems in India. Supported by Shakti Sustainable Energy Foundation, New Delhi. https://shaktifoundation.in/wp-content/uploads/2021/11/Annex-1-National-Investment-program-for-bus-based-public-transport-systems-in-India.pdf.

ACKNOWLEDGEMENTS

We are delighted to gratefully acknowledge our co-organizer of this conference, Convergence Energy Services Limited (CESL), especially Ms. Mahua Acharya, Ex-CEO, CESL, and Mr. Vishal Kapoor, CEO, CESL for their guidance and support in organizing the event successfully.

The authors would like to express their gratitude to Nitin Gadkari, Hon'ble Union Minister of Road Transport & Highways, Kailash Gahlot, Hon'ble Minister of Transport & Environment, Government of Delhi, Amitabh Kant, Hon'ble Sherpa for India's G20 Presidency, Tarun Kapoor, Advisor to the Hon'ble Prime Minister of India, Alok Kumar, Secretary, MoP, Giridhar Aramane, Secretary, MoRTH, Arun Goel, Secretary, MHI, Sudhendu J. Sinha, Advisor, NITI Aayog, and other representatives from ministries, international delegates, panelists, experts, and participants for their valuable time and perspectives on viable financing pathways for electrification of public transport.

The authors would also like to extend thanks to our colleagues who provided valuable inputs and production support, especially Revathy Pradeep, Priyansh Doshi, Yash Pratap, Mahak Dawra, Riddhi Patel, Bhaumik Gowande, and Anshika Singh. We specially appreciate the efforts of our colleagues Ankita Rajeshwari, Rama Thoopal, and Safia Zahid for their communication and design support.

ABOUT THE AUTHORS

Avinash Dubedi is Program Head, Transport with the Sustainable Cities and Transport Program at WRI India..
Contact: avinash.dubedi@wri.org

Aparna Vijaykumar is Program Manager — Electric Mobility at WRI India.
Contact: Aparna.vijaykumar@wri.org

K.P. Aswathy is Senior Program Associate — Electric Mobility at WRI India.
Contact: Aswathy.KP@wri.org

ABOUT WRI INDIA

World Resources Institute India is a research organisation that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being.

Our challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

WRI INDIA

1ST FLOOR, GODREJ & BOYCE
PREMISES, GASWORKS LANE,
LALBAUG, PAREL
MUMBAI 400012, INDIA
WWW.WRI-INDIA.ORG