Non-Urban E-Bus Policy Recommendation

Exploring the Role of Private Sector as a Catalyst for Accelerating Transition to E-Bus in India.

SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

SGA sustainable mobility solutions

SGArchitects
6151/8, Sector D, Pocket 6
Vasant Kunj
New Delhi - 110070
www.sgarchitects.in

Key Contributors

Sandeep Gandhi, Ph.D.
SGArchitects

Satyajit Ganguly, Transport Planner
SGArchitects

Knowledge Partners

Council of Energy Environment and Water (CEEW)

Institute of Transportation and Development Policy (ITDP) India

Cover Picture Credits
Satyajit Ganguly
(SGArchitects)

ACKNOWLEDGEMENT

The authors and editors would like to express gratitude to Shakti Sustainable Energy Foundation.

We would like to thank the various individuals, Institutional/technical/knowledge partners, and organizations, who helped make this document possible. We are thankful to CEEW and ITDP for providing technical inputs and valuable guidance in the development of this report.

We are thankful to the industry partners including PMI Foton, Tata Motors and Olectra Greentech and charging infrastructure providers Tata Powers and Jio BP for providing valuable information, data, technical support, and guidance in the study.

We would also like to thank BOCI and all the public/private bus operators for their inputs and feedback. Finally, we would like to thank the different Government functionaries, Mr. S. Krishnan, IAS, Additional Chief Secretary, Industries Department, Government of Tamil Nadu; for their participation as case examples. We especially acknowledge Guidance, Tamil Nadu for their valuable inputs in the policy recommendation

December 2022

Contents

1 Background

A study titled “Exploring the role of the private sector as catalyst for accelerating transitions of E-Bus in India”, has been undertaken as a joint effort by S G Architects (SGA), and the knowledge partners of the project: Council of Energy Environment and Water (CEEW) and Institute of Transportation and Development Policy (ITDP) India. The aim of this study is to accelerate electrification of private buses operating under State Transport Undertakings (STUs) and State Transport Authority (STA) Permits on non-urban routes and remove any doubts on their viability. This study has been undertaken in five states in India, including Kerala, Ladakh, Madhya Pradesh, Tamil Nadu, and Uttar Pradesh.

This study was undertaken in three stages. The first stage documented the findings from interactions with operators, to identify the gaps and bottlenecks in electrification of stage carriage buses on non-urban routes, especially by private operators. The second stage involved a deep dive into identifying viability gap for operating electric buses (e-buses) on such routes by the operators. This involved data collection on specific routes, developing business models for different electric bus models on such routes and undertaking pilots (on select routes) and deriving findings on the performance of buses. The third stage involved consolidating these findings to identify policy gaps and develop policy recommendations that can help achieve the aim of this study.

This piece reports the findings from the stage three of the study and includes policy findings to catalyse the adoption of e-buses on non-urban stage carriage routes both by public and private operators. These findings are based on stakeholder interactions and demand assessment using secondary data and modelling effort. Additional insights were captured through interaction with different stakeholders at a roundtable hosted by GUIDANCE, TN (TN Industries Department), in collaboration with the project team, in Chennai on December 22, 2022. These have been used to achieve the following:

- Provide technical inputs to support the revision of the Electric Vehicle (EV) Policy by identifying gaps and appropriate recommendations.
- Validate and quantify the latent market for e-buses in India and help provide a nuanced plan to accelerate the uptake of e-buses in non-urban and peri-urban sectors.
- Develop a strategy to increase private investment in the charging infrastructure provision.

The findings for this stage of the study have been presented in this report in two parts in the chapters below. These include stakeholder and demand insights and policy recommendations.

2 Stakeholder and Demand Insights

The study team conducted a total of **12 individual meetings (three in Leh, one in Tamil Nadu, three in Madhya Pradesh, three in Uttar Pradesh and two in Kerala)** with **24 operators** from five geographies **(five in Leh, five in Uttar Pradesh, three in Madhya Pradesh, four in Kerala and five in Tamil Nadu)**, over a period of six months. Separate meetings were also conducted with three OEMs, three non-banking finance corporations/development banks and two Charge Point Operators (CPOs) were contacted and insights on non-urban e-bus electrification captured. These interactions were concluded with a roundtable hosted by GUIDANCE, Tamil Nadu (part of State Industries Department), which was participated by 10 different stakeholders including representation from two OEMs (Tata Motors and Switch Mobility), two CPOs (Tata Power and JioBP), three operators (BOCI, TN Chapter, All Omni Bus Owners Association and Staff Bus Association) one NBFC (Sundaram Finance)

Meetings with the operators were used to capture the insights on bottlenecks in adoption of e-buses. These were captured on survey forms. Additional information on sample bus routes and current bus operational characteristics on those routes was also captured. This information was used to develop business models using eight different bus models from three OEMs. The outcomes of these models included estimated average per km profit overall (12 years' service life of bus), during the first four years (during the loan tenure) and during the following eight years. These insights along with findings on cost per km and earning per km for different types of electric buses on varied routes, were shared with the operators to gather their feedback. This feedback along with findings of the business model was subsequently shared and discussed with other stakeholders including:

- Bus Manufacturers (OEMs) - Tata Motors, PMI Foton and BYD Olectra
- Charging Point Operators (CPOs) - Tata Power and JioBP
- Development banks including KFW and World Bank

Findings from these discussions (including individual meetings and roundtables) were recorded as stakeholder insights and the same is presented in this section for each of the four categories of stakeholders consulted.

2.1 Bus Operators

Insights have been captured from private and public stage carriage bus operators on the bottlenecks in electrification of their fleet operating on non-urban routes. The key findings from these interactions that can be used to develop a favouring policy framework is as following:

- **Subsidy** - For outright purchase, operators look forward to capital cost reduction to a level where the cost of an electric bus is not more than 1.5 to 2 times the cost of the currently available equivalent ICE bus models (based on business models for different models of electric buses on 27 routes). This may be achieved through multiple means, including subsidies and affecting price reduction by aggregating demand. Since direct subsidies if offered are on limited units, it may have a catalysing effect, but other strategies of price reduction (such as demand aggregation) may be required for a long-

term impact. The model suggests that an overall ***reduction by 15-20% on the bus cost may help in cushioning the losses during the first four years*** (during the loan tenure). Thus, extending subsidy schemes to private operators to the tune of between Rs. 10,000 to Rs. 12,500 per Kw-h may be helpful, especially in the absence of price reduction by other measures.

- **Interest rate and loan tenure** - One of the biggest demerits of going electric in the outright purchase model, is the upfront capital cost requirement. In the absence of appropriate interest subvention schemes this will result in significant interest costs to the operators. This assessment in the model is based on the prevailing interest rates of loan from banking and non-banking corporations. The model highlights the losses during the loan tenure for the operators. Operators are not able to sustain these losses in the initial years even if the operations would result in overall profits over the life cycle of the bus. Increase in loan tenure (in the absence of reduction in interest rates) results in higher interest costs and adds to the overall TCO of the bus. Operators therefore seek significantly lower interest rates (between 4% to 6%) than current market rates (about 9%) coupled with the increase in tenure to at least six years to ensure profitability even during the loan tenure.
- **Charging infrastructure** - Private bus operators cannot invest in charging infrastructure which needs to be made available by a third-party service provider on the lines of public charging infrastructure available at designated terminal points of the routes. Additionally popular bus parking spots should be identified, and CPOs encouraged and permitted to install charging stations (for the right capacity) at such locations. Public bus charging stations should also be made available every 30km on National and State highways.
- **Lease Model** – Government and operators favour a GCC model to an outright purchase model to cushion the impact of high capital investment requirement. In case of private operators, the favourable model is a lease model (a mix of wet and dry lease options), where bus including the annal maintenance contract (AMC) and insurance is provided by the lessor, while the staff, permit, taxes (GST, etc. on fare) and energy cost is borne by the lessee.
- **Permit Conditions** - Use of electric buses by private operators requires revision to permit conditions[1]. This may be required in terms of revising the schedule and operational hours for buses to accommodate charging time, and changes in ownership conditions to allow operation of leased buses. Additional permits also need to be made available as demand increases. These permits can be better designed to meet financing and operating requirements of electric buses.
- **Electricity Cost** - The model currently assumes Rs. 9 per kW-h as the total cost of electricity (including service charge by charging infrastructure provider). It is expected (given the estimated scale of demand) that the service cost by charging infrastructure providers will not exceed between Rs. 1.5 to 3.0 per kW-h. It is suggested that power rates should be subsidised under a special category for electric vehicles and these rates should be available at all public/semi-public/private charging stations regardless of its location (example industrial area or residential area). The power rates at these charge points should ideally not be higher than the rates at which DisComs (Distribution Companies) purchase power from TransCos (Transmission Companies). The key is to

[1] Permit conditions will need to be revised by the State Transport Authority (STA) under the State Transport Department.

control the overall cost of per unit energy to less than Rs. 8-9 per kW-h, by keeping charging infrastructure specific service charges to the minimum, and by avoiding commercial electricity rates for the EV charging consumers.

- **Fare Revision -** Fare for non-urban and Mofussil services, fixed by the TN Transport Department (under the current permit conditions) is the lowest fare in India i.e. 58 paisa/km. Operators face an uphill task to recover operational costs with such low fares. These fares are even more unviable with electric bus operations, given the high capital expenditure. Therefore, for electric bus operations fare revision is required. Revision in fare rate to match the surrounding South Indian states at INR 0.90 - 0.95 per km is suggested.

2.2 Electric bus OEMs

A current project team has captured insights from representatives of E-bus OEMs. The insights included collection bus specifications for different models. These specifications were then fed in a business model which included details of different routes in different geographies. The findings of these business models were then presented to the OEMs and their feedback collected. These suggest the following:

- **Regulations and Approvals** – Buses are mandated to be ARAI approved before being allowed to be sold in the open market. It is suggested that no additional approval requirements should exist at state level for electric buses. This will ease the development of additional bus models suited to the needs of different types of operators.
- **Capacity** - Buses to be operated on non-urban routes require higher seating and lower standing capacity. The capacity of E-buses for non-urban routes should be at par with that available in the current ICE variants. These capacities are approximately 55 for bus length >10.5m, approximately 40 for bus length between 8.5m to 10.5m and approximately 30 for bus length <8.5m. Additionally these buses need some provision for carrying luggage. OEMs are confident that seating capacity comparable to similar diesel bus variants can be provided in the E-buses and overhead racks for luggage can be added. To accelerate this adoption, the upcoming bus procurement for 50,000 e-buses under the CESL aggregator demand can include non-urban models as options to be taken up by the STUs plying these regions / sector routes.
- **Battery and charger performance** - Fast charging capabilities are crucial for non-urban operations which require opportunity charging. The charging duration needs to be minimised to minimise the layover time. Operators seek a minimum 200 kw-h chargers with an efficiency of 90% or higher. It is also expected that battery performance and life will not be adversely affected using fast chargers and that the stated rate of charging shall be maintained at least till 95% state of charge (beyond which trickle charge is expected, till 100%). Hence these chargers promise a rate of charge which achieves 95% SoC from 20% SoC in under 40 minutes for a 150 Kw-h battery or 20% to 95% SoC for a 260 Kw-h battery in under 70 minutes - in all weather conditions
- **Capital cost of the bus** - As private operators try to consolidate their model inventory to increase the scale of E-bus orders, it is expected that larger orders in excess of 500

buses or more will drive down the per unit price of each bus (from the current ex-showroom market price) by between 15-25%. Prompt government to support demand aggregation by encouraging and enabling creation of unions, trusts, conglomerate companies, or other forms demand aggregation models.

- **Alternate ownership models** - Operators are keen for alternate modes of ownership - instead of outright purchase, they look forward to a mix of wet and dry lease model where the Lessor provides the bus, complete annual maintenance (including, servicing, maintenance, spares, tyres, battery replacement, etc.) and insurance, while the lessee provides the staff, pays for the energy, and pays any taxes/permit fees etc. The expected per km cost of such a lease model to the operator is required to be between Rs. 23 - 34 for >10.5m length bus models, Rs. 11-19 for 8.5m - 10.5m length bus models and Rs. 2 - 9 for <8.5m length bus models, for different routes[2]. OEMs are open to offer lease models to potential users, provided permit conditions allow the use of leased buses and minimum guarantee of kilometres operated is offered. Recommendation is to push for recognition of stage-carriage permits under this model, where ownership and operations can be provided by different entities. Furthermore, the permits can be made transferrable by a simple administrative fee to make this more market friendly. Therefore, OEMs and NBFCs should jointly explore lease model options for private operators
- **Demand** - A total scale of E-bus orders required to put India on the path to achieve a 100% electric fleet of stage carriage by 2050, is estimated to be about 391,000 by 2030, or an average 50,000 units per year. OEMs will need to expand capacity to meet this demand.

2.3 Charging Point Operators (CPOs)

The project team has captured insights from private and public stage carriage bus operators and OEMs on the demand for charging infrastructure and the road map for developing the same across the state. Two CPOs, i.e., Tata Power and Jio BP were contacted, and meetings conducted to gather their insights. The key findings from these interactions is as following:

- **Charging infrastructure demand** - Charging infrastructure demand does not grow proportional to e-bus demand. Up to 8 buses on non-urban routes and five buses on urban routes can utilise a single fast charger when a large fleet of E-buses is concentrated on a few routes. However, when the e-bus services are being rolled out during the initial years, the supply of buses is expected to be disaggregated and the charger requirement can be as high as one charger for every 1.5 buses on non-urban routes and one charger for every 2 buses on urban routes. This means that the demand for development of charging infrastructure is higher in the initial years and tapers down over the next 10-15 years. Based on the required pace of e-bus adoption in India, a total of 17,500 fast charging stations may be required for E-buses in 2023. This demand can increase to 93,500 stations in 2030. This requires a total investment of about 37,500 crores till 2030.
- **Charging as a service** - Since individual private operators have a limited fleet size (usually not more than 5-10 buses), operators cannot develop, own, and manage private

[2] With a minimum guarantee of between 1,20,000 to 1,60,000 km per year

bus charging infrastructure. This is especially true for non-urban services which will rely on opportunity charging. Therefore, charging infrastructure for non-urban services has to be provided by a third-party service provider like Tata Power and Jio-BP. Like any public charging infrastructure, public bus charging infrastructure will require land to be provided by the government, while the cost of infrastructure development is borne by the charging service provider - to be recovered from per kW-h service charge.

- **Charging Infrastructure Developer** - State may form an SPV or use existing state agencies (such as existing DisComs) to develop, maintain and provide charging infrastructure and charging services at a regulated tariff, to E-buses. This infrastructure may also be developed as a shared station with electric heavy goods vehicles (e-HGV) and electric medium goods vehicles (e-MGV). It is expected that providing electrical connections and electricity supply to the stations would be the responsibility of the local DisCom. The e-bus charging service provider may be the same as that for other vehicles, and the charging station location may also be common for different vehicle types. The responsibility of the charging service provider may or may not include development of infrastructure and procurement of equipment, but will include service, maintenance, upkeep, and operations of the infrastructure. The cost of the same shall be recovered as a part of the service charge. This requires in some cases, capacity development of the DisCom staff, and specifications as well as statutory requirements to be understood and/or adopted by the same. The fast charger units to be used at these charging station may be acquired directly through government open tender format or the acquisition may be routed through DisComs.
- **Charging service tariff** - Average per charger energy consumption is expected to increase from 500 kW-h per day in 2023 to 1,300 kW-h per day in 2030, peaking at 2,100 kW-h per day in 2035[3]. With an average per day energy consumption of about 930 kW-h per day for the first 10 years, charging service providers can offer the services at a premium of between Rs. 2.60 - Rs. 3.0 per kW-h (covering the cost of the charging infrastructure, interest, maintenance and profit over a 10-year period)[4] which would be over and above the prevalent per unit electricity rates offered by DisCom for charging services. This premium can reduce to less than Rs. 1.3 to Rs. 1.50 per kW-h in successive years, with average daily energy demand per charger exceeding 2,000 kW-h.
- **Land for Charging Infrastructure** - Since charging for non-urban bus operations cannot be limited to operator owned facilities (it will require opportunity charging), they need to be accessible at route terminating points. This means that charging infrastructure needs to be set up as per estimated demand at bus terminals catering to non-urban and mofussil services. Such facilities need to be designed to be accessible by all types of e-bus operators and not just STU buses. This will require in some cases changes in the regulations to allow access by private stage and contract carriage buses in the bus terminals, and/or such charging facilities may need to be in separate enclosures within

[3] The bus demand is expected to be diffused over a larger geography in the initial years. This will result in a low utilization of chargers. It is expected that each fast charger will cater to an average of 1.5 buses, linearly increasing to 8 buses over a 15 year period on non-urban routes, while on urban routes each charger is expected to cater to an average of 2 buses initially, linearly increasing to 5 buses in 10 years.

[4] Total Fast charging infrastructure development cost is assumed as Rs. 40,00,000

the existing sites. Additional public bus charging stations will be required (for example at highways). Land for such infrastructure needs to be provided by the government.

- **Daily Energy Demand** - With the projected growth in e-buses, the daily energy demand for charging of just stage carriage-based e-buses is expected to increase from little over 8 GW-h in 2023 to 120 GW-h in 2030 to 260 GW-h in 2050. Additional energy demand is expected from contract carriage buses. It is recommended that electricity distribution companies (DisComs) consider a dynamic or a time and demand-based energy pricing system. However dynamic EV energy pricing may need to be decoupled from dynamic industrial or residential energy pricing, to avoid high energy price especially for public transport and intermediate public transport modes (IPT).
- **Power Quality** – CPOs require continuous uninterrupted power supply along with steady harmonics and voltage to ensure uninterrupted charging service to EV owners. This is also essential for efficiency in charging time needed. Thus, DISCOMs must enable quality and stability in the supply of power.

2.4 Financing Corporations

The project team has had broad interactions with development banks including KfW[5], World Bank and Asian Development Bank (ADB). Discussions were also held with CESL and government of India undertaking to facilitate bus demand aggregation. These interactions covered possible financing solutions for electrification of non-urban routes. Additional insights were provided by operators in terms of impediments faced while accessing credit. The broad findings from these interactions include the following:

- **Financial viability, interest rate and loan tenure** - The TCO models developed for E-bus operations on different non-urban routes in five states suggests that given a 12-year life cycle of an E-Bus, the operators can make profit at par with or exceeding that of ICE buses over the service life of the bus. However due to the higher capital cost involved (and lower operational cost) the operations will not be profitable during the loan tenure (when the loan is being serviced). This viability cannot be improved by simply increasing the loan tenure, which in the absence of reduced interest rates will adversely impact profitability. To address thus operators, need to access finance at lower interest rates with increase in loan tenure. Model outputs suggest that break even or average profitability during the loan tenure can be achieved without adversely affecting the profitability over the service life of the bus (between Rs. 3.0 to Rs. 4.5 per km). This can be achieved if the interest rates are reduced to between 3.0 to 6.0% (compounded) per annum and the tenure is increased to between six and eight years. This will need to be coupled with interest rate reset option every 3-4 years to safeguard the lender against the fluctuation in repo rates.
- **Loans for purchase of replacement batteries** - Since the cost of a replacement battery is significant, operators will require credit facility by banks or non-banking financial corporation (NBFCs), on purchase of battery packs during the service life of the bus. The tenure of these loans can be 4 years with comparable concessions on the interest rates as suggested for the bus.

[5] KfW ; Kreditanstalt für Wiederaufbau ("Credit Institute for Reconstruction").

- **Low interest rate loans and streamlined process** - Development banks can offer loans to the government for electric bus purchase at a significantly reduced interest rate of between 0-1.5%. Additionally financial corporations often ask for additional collaterals on loans for buses. It is feared that this will become the norm for private operators in case of loans for electric buses (due to high capital cost of buses). Operators are not keen to offer collateral other than the hypothecation of the bus. State government may need to step in and establish norms for interest rate and credit conditions for both banks and NBFCs
- **Interest rate reduction pathways** - A potential pathway to reduce interest rates is to utilise capital from loans provided by development banks (channelized by government through banking or non-banking institutions) to extend loans to the operators at reduced interest rate of 1.5-1.75% on a maximum of 50% of the sanction amount. The interest on the remaining 50% of sanction amount can be lower than market rate at say 7.5-8.0%. This will mean that the overall interest rate for the buyer/operator will reduce to between 4.5% to 5.0%. A total of between 8,000 to 10,000 crores will be required from development banks in this pathway to finance the expected demand over the next seven years. Risk mitigation for banks and NBFCs through government supported Guaranteed Emergency Credit Line (GESL)/ loss pool can also be an effective pathway for interest rate reduction.
- **Financing demand for bus charging stations** – Using estimates of e-bus demand from literature (Gandhi et al., 2021) and the expected growth trend in charger demand[3] - it is estimated that if electrification vision in India aligns with a net zero emission target for 2050, especially for public buses, a total investment of about 37,500 crores in e-bus charging infrastructure will be required till 2030, just for stage carriage buses. It is expected that if minimum demand guarantees exist for an initial time (this may be varying guarantees starting from year 1 to year 10) charging infrastructure can be developed and entirely paid for by private players, recovering the cost using an affordable service charge which does not adversely affect profitability. The government may only need to provide access to earmarked land to develop charging infrastructure. This can be at existing bus depots and stations. The service charges are expected to be higher for the first 10 years, till the demand picks up. The Government can influence reduction of these charges by additional fiscal and non-fiscal policy measures. This may include providing chargers at subsidised rates by aggregating demand at state or national level.

3 Policy Recommendations

Based on the stakeholder insights a set of policy recommendations have been drafted. These recommendations can be included in an EV policy at the State or the National level. This chapter includes the objective of these recommendations, strategy for implementation and suggested incentives.

a. Objective

The objective of this policy is to catalyse accelerated electrification of stage carriage buses on non-urban routes by both public and private operators.

b. Strategy

To achieve electrification of stage carriage buses on non-urban routes through an incentive-based strategy using a range of measures targeting e-bus adoption and EV ecosystem development.

c. Incentives

The range of incentives that can be included to catalyse acceleration of stage carriage e-bus adoption on non-urban routes can be categorised as fiscal incentives for adoption, non-fiscal incentives for adoption and incentives for development of EV-ecosystem. These have been presented below:

d. Fiscal and Non-Fiscal Incentives for adoption

Fiscal incentives to catalyse acceleration of e-buses include incentives which offer monetary benefits including subsidies, as a motivator and demand generator. Non-fiscal incentives include incentives without direct monetary implication on the government. These may include measures such as regulatory relaxations. The proposed fiscal and non-fiscal incentives to accelerate e-bus adoption on non-urban routes have been listed below:

- Direct fiscal incentive of Rs. 10,000 per kW-h with a total upper limit of Rs. 30,00,000 per bus should be offered to all operators of stage carriage buses. A total of 55,000 buses needs to be incentivised over a two-year period all over India. State wise fleet size to be incentivised will vary. A thumb rule of incentives for one e-bus for every 25,000 population can be used.

- Banking and non-Banking Financial Corporations shall offer a low-interest loan to operators on the purchase of approved models of e-buses for a maximum of six-year tenure and approved models of e-bus batteries for a maximum tenure of four years, with no additional collateral requirement. The reduced compounded interest rate shall vary between 4% to 6% based on the loan tenure, bus model and the credit profile of the consumer. The State Government shall directly finance the reduced interest rates to the Banking and Non-Banking Corporations through interest subvention schemes and/or support the same in accessing low-cost finance from different sources such as

development banks. Additional support in the form of limited Loss pool or GESL can be used to safeguard the banks/NBFCs against bad loans shall be used to influence lower interest rates to operators for the purchase of e-buses.

- State government shall play an active role in the incorporation of a company (SPV) or a division within an existing government entity (such as the State Transport Undertaking or STU) to allow aggregation of bus demand by different private operators and/or availability of buses to the stage carriage bus operators (especially private operators) on a lease model. The State government shall establish a fund for purchase of minimum 500 e-buses (with specifications for operations on non-urban routes). These buses shall be owned, maintained, serviced, and managed either by the newly constituted SPV or the STU. This entity shall then offer the buses on a lease model to operators. The lease tenure shall be a minimum of three years, with lease payable on a quarterly basis. The lease cost may vary based on the age of the model, and the maximum service life of bus models offered can be 12 to 15 years. The average per quarter lease cost of a bus of length >10.5m (minimum 50-seater) shall be between Rs. 7,50,000 and Rs. 10,50,000 and between Rs. 4,50,000 and Rs. 6,50,000 for an 8.5m to 10.5m length bus (minimum 38-seater) depending on vehicle model (AC, Non-AC, etc.), permit conditions (such as maximum operational kilometres, number of charging, cycles, etc.) battery pack size and route characteristics. Additionally, state governments shall also create an enabling environment to encourage OEMs and other organisations to offer electric buses on a lease model on a commercial basis.

e. EV Ecosystem development incentives

Incentives are required to accelerate setting in place the EV ecosystem that is necessary to accelerate e-bus adoption. The components of this ecosystem may include charging infrastructure and battery management systems. The details of proposed policy provision to encourage setting in place an enabling EV ecosystem to accelerate e-bus adoption are as following:

- Identification of land parcel within existing bus terminals, depots or at other government sites in the vicinity of such bus terminals/depots for the development of fast charging stations for buses. The area requirement of such a land parcel is expected to be between 70 to 120 SqM. per bus charging station. This land parcel shall be offered at nominal (long term) lease cost or for free to charging service provider (CSP) companies. A separate special purpose vehicle (SPV) may need to be established by the State Governments for bus charging service provision. The CSP shall invest in the development, operations and maintenance of the charging infrastructure including all equipment and manpower and recover the cost from the consumer on a per unit basis as per norms laid out by the state. This cost shall include the energy costs and additional service charge. The energy cost shall be at the rate offered by the DisComs which shall not exceed the rate at which electricity is purchased from the TransCo by the AME[6]. The service charge shall not exceed Rs. 3.0 per kW-h. The State may offer minimum daily energy consumption guarantee per charger. This may vary annually over a 10-year

[6] AME: Average Monthly Earnings.

period from 500 kW-h in year one to 1,350 kW-h in 10th year. The service life of electronic equipment at each charging station shall be 10 years. The chargers should have specifications that promise a rate of charge for at least 75% state of charge (SoC). For example, it should achieve 95% SoC from 20% SoC in under 40 minutes for a 150 kW-h battery or 20% to 95% SoC for a 260 kW-h battery in under 70 minutes - in all weather conditions. The state may offer additional subsidies on purchase of charging equipment to CSP to achieve a maximum service charge of Rs. 2.0 per kW-h. The maximum capping of service charge and minimum guarantees are applicable for a 10-year period and shall be revised by the state government post that.

- State Government shall encourage setting up of battery recycling units through separate fiscal and non-fiscal incentives. It is expected that such infrastructure shall not only facilitate effective battery management and promotion of battery second life but shall also promise financial benefits to bus operators looking to replace their batteries. The fiscal and non-fiscal incentives should be targeted to offer bus operators a minimum of 40% cost of the current battery market value (cost of cells excluding casing) if the residual capacity of the battery is 80% or more at the time of buy back.
- State governments through the transport department should revise permit conditions and permit numbers specific to electric buses. These may come with revised or more attractive fare structure. These shall be referred to as e-bus permits. Additional e-bus permits shall be introduced and offered to private stage carriage operators for operations by electric buses. Existing standard permit holders shall be allowed to migrate to e-bus permits without any additional fees. In addition, these permit conditions shall be relaxed. e-bus permit fees shall be free of cost for the first four years. For the following years, permit fees shall not exceed 50% of the current/standard bus permit fees. The permit shall have an increased service operation time ceiling by 2 hours. This will account for additional charging time required for e-buses. e-bus permits shall be offered on both owned and leased buses, therefore permit holders can operate a self-owned or a leased bus on the allotted route. e-bus permits would not have any limits on the route length and thus more routes will be accessible to e-bus permit holders.

Bibliography

Gandhi, S., Gola, K., Ganguly, S., Goel, P., Suresh, R., Kochar, K., 2021. National Bus Resource Requirement - Roadmap for Overcoming the Gaps. New Delhi.