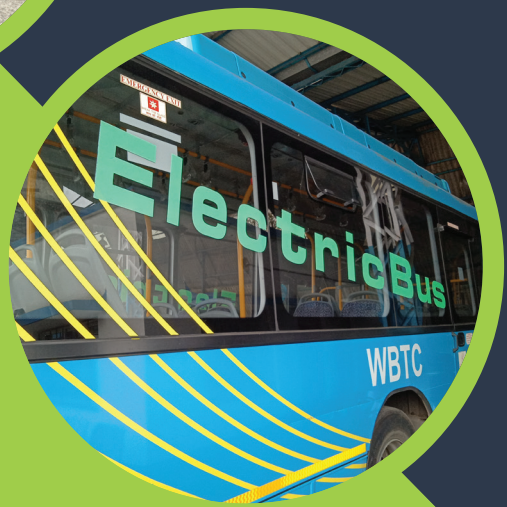
SUCCESSFUL OPERATION OF ELECTRIC BUS FLEET

"A Case Study of Kolkata"



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Reflections

"We are committed to provide a smart, clean, and eco-friendly transport system in the state and are committed to introduce vehicles that run on cleaner fuel, thereby reducing carbon footprint. 80 electric buses and 60 buses that run on CNG have been rolled out by the two state transport undertakings, viz. WBTC and SBSTC respectively. We are committed to introduce more number of eco-friendly buses throughout the state in a phased manner.It is my conviction that this step will significantly reduce particulate matter (PM) pollutants and will help citizens breathe cleaner air."

*– **Shri Suvendu Adhikari,** Hon'ble Minister-in-Charge for Department of Transport, Department of Water Resources Investigation and Development & Department of Irrigation and Waterways, Government of West Bengal*

"Electrification of public transport is an effective way to bring down air-pollution levels in cities and electric buses are one of the most potent solutions to initiate this transition to sustainable at-scale mobility. TERI is delighted on the launch of its case-study on the successful implementation and operation of the e-buses model in Kolkata. The support received from the West Bengal Transport Corporation (WBTC) as well as from Government of West Bengal for this study is deeply appreciated."

*– **Dr. Ajay Mathur,** Director General, TERI*

"Kolkata is one the biggest metropolitan cities of Asia. The transportation network is diverse and running from centuries. Kolkata has been a pioneer in electric mobility and we would like to increase this for better environment. I would like to thank IEA and TERI to include Kolkata as the only city from India and showcase its successful operation of electric city buses in the flagship report, Global EV Outlook (GEVO) 2020."

*– **Shri Prabhat Kumar Mishra** (IAS), Principal Secretary, Department of Transport, Government of West Bengal*

"Kolkata, the city of joy has been passionately running tramway, an electrical mode of transport in the streets of the city since more than a century. Just like the trams, the city has introduced electric vehicles with an aim to decarbonise the transport sector and pioneers nationally in the operations of electric buses for public transport. In the future WBTC would be increasing the number of electric buses in the streets of Kolkata and surrounding areas with an aim to reduce pollution, dependence on fossil fuels, and providing a safe and comfortable journey to the commuters. I would like to thank my WBTC team for taking our bus system to global-level through IEA's GEVO 2020."

*– **Shri Rajanvir Singh Kapur (IAS),** Managing Director, West Bengal Transport Corporation*

"Energy efficiency is about learning from each other and highlighting good examples of success that all can benefit from. I am pleased to thank The Energy and Resources Institute (TERI), the West Bengal Transport Corporation (WBTC) and the Government of West Bengal for their important work on the cross sectoral implementation, and commend their highlighting of the range of impacts of electric buses in Kolkata. Case study examples such as this showcase best practice and the multiple benefits of energy efficiency as well as enabling Kolkata to act as an inspiration for other cities globally."

*- **Dr. Brian Motherway,** Head of Energy Efficiency, International Energy Agency*

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Thanks, in this regard, go in particular to Shri Rajanvir Singh Kapur, IAS, Managing Director, WBTC who took great personal interest in supporting this study and facilitated access to the required resources.

Mr. Debabrata Guha, Senior Engineer, WBTC deserves a special mention for providing all the nececcsary datasets and information required for carrying out this study.

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Introduction

The city of Kolkata, the capital of the state of West Bengal in India, is governed by the Kolkata Municipal Corporation (KMC) which is responsible for governing the city area that comes under Kolkata Metropolitan Area (KMA) municipal limits. Kolkata is the third most populous metropolitan area in India which accommodates close to 4.5 million people in the metropolitan area while the sub-urban area has a population of around 15.7 million[1]. The population density of the city was 24,252/ km^2 as per census 2011. The city is situated between 22.57 degree-N latitude and 88.36 degree-E longitude on the Indian mainland, covering an area of 205 km^2 and lies on the Eastern banks of the Hooghly river which is a tributary of the Ganges. Kolkata is a prime commercial and business hub of Eastern India housing major industrial sectors like steel, heavy engineering, mining, cement, textile, and Information Technology (IT). The 'City of Joy' is strategically placed as per the Indian administrative boundary, also being the gateway to Northeast India as well as to many South Asian countries. Kolkata has a dense yet one of the most robust networks of public transportation – a combination of railways, rapid sub-urban Metrorail, trams, buses, 3-Wheelers, and ferries. There are 925 bus routes operating in KMA[2], out of which 38% are being operated by state transport undertakings (STUs) while the remaining routes are operated by private operators. Kolkata has a well-established inter-state road connectivity network with other parts of the country through National and State highways (NH-2, 6, 34 & 117).

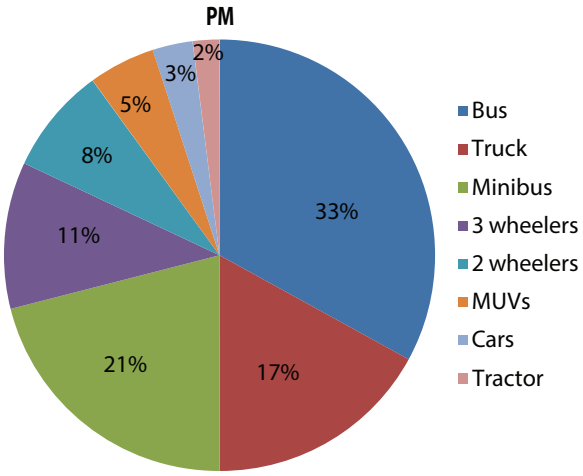


Figure 1: Emissions from various categories of vehicles

Kolkata has recorded the highest amount of particulate matter (PM) and NOx emissions per 0.1 million of vehicular population despite having lesser number of on-road vehicles as compared to other metropolitan cities in the country. This is primarily due to operation of fleets of older vehicles. Road transport in the city contributes to almost 4.6 tonnes of particulate matter per day. The contribution of different vehicle categories to total air pollution from the transport sector, shown in terms of PM emissions, is presented in figure 1[3]. The conventional diesel-based transport buses are observed to be the major contributors to air pollution (caused by PM, hydro carbons and gases like, CO_2, CO, SO_2& NO_X) with 33% contribution to particulate matter emissions. Besides this, the monthly average values of $PM_{2.5}$ and PM_{10}, calculated on the basis of 24 hour mean values, are found to be a bit higher than the specified limits (greater than 60 and 100 µg/m^3 respectively) particularly in the period from October to March[4]. However, SO_2 and NO_2 are perceived to be well within the prescribed limits (<80 µg/m^3)[4]. Additionally, the individual ontribution from transport, industrial and domestic sectors is found to be 50%, 48% and 2% respectively as per previous studies. Last year, the city's ambient air quality deteriorated during winter months and, for a few instances, it was found to be more polluted than New Delhi's air[5].

[1] https://www.census2011.co.in/census/city/215-kolkata.html

[2] http://www.indiasmartgrid.org/reports/Report_Implementation_Plan_for_Electrification_of_Public_Transport_in_Kolkata_1_November_2017.pdf

[3] http://www.indiaenvironmentportal.org.in/files/file/Report_Status_RoadTransport_SixCities.pdf

[4] http://www.wbpcb.gov.in/writereaddata/upload/contents/File-32.pdf

[5] https://timesofindia.indiatimes.com/city/kolkata/kolkata-air-turns-fouler-than-delhis/articleshow/71946814.cms

Kolkata has 80-85% shared mobility access (highest in India) wherein public transport options (comprising of buses, metro, and tram network) are being used in large numbers. The city has 1,553 number of conventional diesel-powered buses of various makes and models (details are given in Annexure-I), operating along 348 routes under West Bengal Transport Corporation (WBTC). These buses have passenger carrying capacity of 35-45 nos. each. A total of 134 number of routes (nearly 40%) are long distance routes while 60% of the routes have a trip length of less than 20 km. In-order to comply with the emission standards mandated by the Government of India, most of the conventional fleets (more than 1,500 in number) in the city follow Euro-III & IV emission standards, while very few of them (38 nos.) comply with the emission criteria set under Euro-II. The average fuel economy of these diesel-based vehicles is around 2-3 km/ litre.

Electric Buses Procurement and Operation: Technical Details

Figure2: Inauguration of e-buses by Hon'ble Chief Minister of West Bengal

Aiming to reduce vehicular air pollution, the Government of India (GoI) has taken various initiatives and electric mobility has been the prime focus. To support the implementation of the same, Phase-II of the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME-II) was launched in 2019 which focuses mainly on promoting low-emission electric vehicles including providing support tovehicle charging infrastructure. Consequently, under FAME-II initiative, an outlay of about INR 3,500 Crores (Approx. USD 0.46 Billion) has been earmarked for deployment of more than 7,000 electric buses (e-buses) across the country. The Government of West Bengal has already taken several policy measures to introduce electric mobility in the state[6], including a complete shift towards STU owned electric buses by 2030[7]. In the case of Kolkata, the Department of Transport, Government of West Bengal (GoWB), herein WBTC, has already introduced 80 electric buses under the Phase-I of the FAME scheme (FAME-Iinitiative), operating in and around the city starting with 20 buses since February 2019 to the recently procured lot of 10 buses, introduced in January 2020 (the inaugural ceremony's photograph is shown in figure 2). These electric buses have been distributed among the existing 10 depots (nine belonging to WBTC and one to South Bengal State Transport Corporation, a STU), located at different places within the city and one at the seaside town of Digha. All ten depots have one DC fast charger (DCFC) apiece. Eight depots have six DC slow chargers (DCSC) each (details are provided in Annexure-II); Nonapukur possesses 7 DCSCs, and Digha depot has one DC Slow charger installed. Out of the nine terminus points, six terminus points have one DC fast charger each, Tollygunge and Howrah stations have two DC fast chargers each, and Rajabazar has one DC slow charger installed. Figure 3 shows DC slow and fast chargers installed at the Kasba depot in Kolkata. As of now, 5% of the total conventional bus fleet has gone electric in the city. The e-buses are operational under 12 different routes with an average distance travelled per route equal to 20 km.

Figure 3: DC slow & fast chargers installed at Kasba bus depot in Kolkata

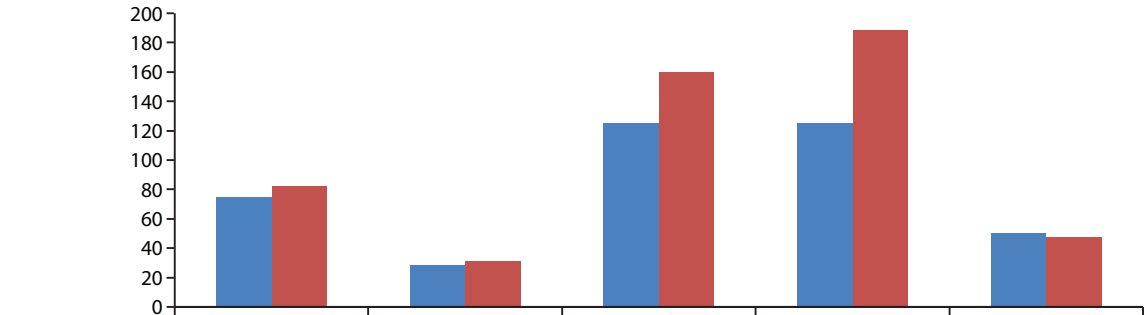
Figure 4: E-bus in Kolkata

[6] https://timesofindia.indiatimes.com/city/kolkata/french-agency-to-take-up-city-e-bus-as-case-study/articleshow/74465514.cms

[7] https://timesofindia.indiatimes.com/city/kolkata/west-bengal-sets-2030-deadline-for-e-vehicle-revolution/articleshow/71549170.cms

The electric buses are of two configurations based on bus length: 9 m and 12 m. All the buses have comfortable interiors with Air Conditioners (AC) provided for maximum passenger and driver comfort. One of the buses is photographed in figure 4. There are 40 numbers of 9 m AC buses that can carry 31 passengers while the 12 m long AC buses that can carry forty passengers are also forty in number. The 9 m long buses are having 125 kWh battery packs while the 12m variants have 188 kWh batteries. The driving range of the aforementioned fleet is 130 km and 160 km respectively in a fully charged condition for 9 m and 12 m long buses respectively. The capital costs of the 9 m and 12 m type e-buses are INR 74.9 lacs and INR 82.5 lacs respectively, whereas the battery replacement cost comes out to be INR 28 lacs for the 9 m buses and INR 31 lacs for the 12 m buses, excluding Goods and Services Taxes (GST). At present, the GST is 18% on EV batteries. The expected lifetime of batteries and electric buses are considered to be 10 years while 7 years warranty has been provided for battery packs. Figure 5 shows the cost break-up for each of the two bus configurations alongside the major characteristics of the main components. TCO stands for the Total Cost of Ownership for the bus.

fast chargers. Both depot charging and opportunity charging schemes are made use of for charging the buses. The fast chargers have a power rating of 120 kW and generally take 1.5-2 hours to fully charge the batteries (from 0 to 100% state of charge) of e-buses while the slow chargers, which are rated at 60 kW, take 3-5 hours to charge the same capacity. The chargers comply with the GB/T charging standard and the communication protocol followed in the standard transfers the essential parameters between charger and battery management system (BMS). The chargers (manufactured by Tellus Power based in China) are installed at both bus depots and terminus locations as mentioned in Annexure-II. The total development cost of charging infrastructure for 9 DCFCs (costing INR 14.86 lacs/charger) and 61 DCSCs (costing INR 9.02 lacs/charger) has been around INR 12 Crore (USD 120 million), including civil and electrical works. In-addition, the average per unit electricity cost to charge the e-buses comes out to be INR 11-12.39/kWh, whereas the monthly demand charges are INR 5 lacs. This monthly figure is split into INR 4.5 lacs for the West Bengal State Electricity Distribution Company Limited (WBSEDCL) and INR 50,000 for the Calcutta Electricity Supply Company



	Capital cost of e-buses in INR (Lacs)	Batery replacement cost in INR (Lacs)	Driving range in km	Battery size in kWh	TCO in INR/km
9 meter e-bus	74.9	28	125	125	50.21
12 meter e-bus	82.5	31	160	188	47.58

Figure 5: Cost break-up and component-wise characteristics of e-buses

Behind the successful running of 80 e-buses in the city is a smartly planned charging station placement and operation scheme. The WBTC leveraged the existing bus depots and terminus points for putting up charging infrastructure that includes both slow chargers and

(CESC) Limited – the two electricity distribution companies (DISCOMs) serving the city of Kolkata. The total electricity consumed in a month across all the depots is around 2,30,000 kWh and the cost for the same is INR 28.5 lacs including the energy charges

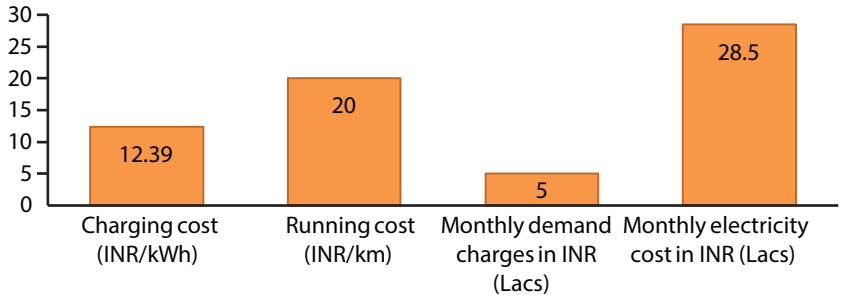


Figure 6: Monthly electricity consumption and cost associated with charging and operation

(INR 23.5 lacs) and demand charges as mentioned above. The aforesaid parameters along with their values have been shown in figure 6. Discussions are going on with both electricity distribution companies (CESC Limited and WBSEDCL) for reviewing the electricity tariff as well as demand charges which is expected to reduce the monthly electricity bill for WBTC.

After accounting for all the aforementioned costs associated with e-buses, the total cost of ownership (TCO) comes out to be INR 45-50/km while the TCO for diesel buses has been found out to be INR 37/km, considering the capital cost of INR 85 lacs for an AC diesel bus. However, the running cost of the e-buses comes out to be INR 22/km which is one-third of the same for a diesel busand due to falling price of batteries, these electric buses are expected to be commercially viable within the next 2-3 years in India. The major drivers behind the implementation of electric buses are the efforts towards reducing air pollution levels and cost-competitiveness of these buses over diesel buses. The end-to-end implementation timeline has been indicated below in figure 7 and it took almost 6-7 months since receiving the buses from the supplier to make the whole scheme operational.

Figure 7: Stage wise implementation timeline for on-road operation of e-buses

The Government of West Bengal (GoWB) has principally decided not to induct any new diesel buses in the city of Kolkata, and only CNG-based and electric buses are to be procured from now onwards. Further, the plan is to have an entire city fleet of 5,000 e-buses by 2030 which is expected to reduce the cumulative CO_2 emission by 7,82,560 tonnes, and in this view the government is ready with a plan of setting up 241 EV charging stations across the city under KMA[8]. These efforts by the city government received recent accolades internationally and consequently, Kolkata won the prestigious C40 Cities Bloomberg Philanthropies Award last year for its Low Carbon Commute Transition[9] as part of its ambitious climate change mitigation action plan. Besides this, under Phase-II of the FAME initiative, 150 e-buses were allocated for Kolkata and consequently, the tendering process has been completed for two lots of e-buses having 100 & 50 buses respectively. PMI-Foton, one of India's leading e-bus Original Equipment Manufacturers (OEMs) was awarded the contract for 50 e-buses in New Town Kolkata at a rate of INR 86/ km for 12 m AC bus under the Opex model. This is one of the financial models (suggested by Niti Aayog, a policy think tank under the GoI which is responsible for framing the EV policy in the country).The available price was on higher side for the other lot of 100 buses, and hence the proposal was not approved.

[8] https://timesofindia.indiatimes.com/city/kolkata/241-ev-charging-stations-in-city-suburbs-for-rs-125cr/articleshow/71283786.cms

[9] https://www.c40.org/press_releases/c40-awards-2019

Institutional Implementation

The nodal agency of the Government of West Bengal, herein WBTC, has played an instrumental role in the implementation of e-buses with funding support from the Government of India (60% of the funds for buses and 15% of cost of buses for chargers), and from the Government of West Bengal for balance cost of e-buses and chargers as well as the infrastructure cost, as depicted in figure 8. The manufacturer and supplier tried their best to provide the solution on time and thus the implementation could be completed with minimum delay from the scheduled time. Since diesel buses have been the major contributors to pollution levels in the city, therefore, e-buses are foreseen as a key element for reducing vehicular emission. Secondly, the lower operating cost of e-buses has also been one of the key drivers for e-buses adoption.

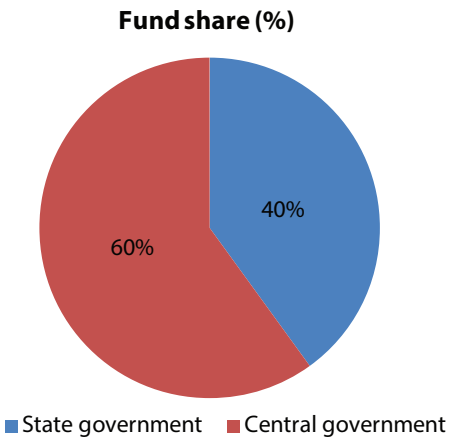


Figure 8: Funding share of central and state governments for E-bus program implementation in Kolkata

WBTC is the entity responsible for operating the public bus fleet in Kolkata. The transport entity formed partnerships with relevant organisations and infrastructure providers in the city and this exercise proved to be a good example of multi-stakeholder participation towards implementing clean mobility. The electricity infrastructure for the bus depots was provided by CESC Limited, a privately owned power distribution utility functioning in the area administered by KMC, and by WBSEDCL, owned by the Government of West Bengal. WBTC comes under the commercial category of electricity consumers based on the sanctioned load, and as per the state's electricity regulator, commercial category consumers can either opt for an optional tariff scheme of Time-of-Day (ToD) tariff or, the presently applicable tariff scheme (slab-wise commercial tariff as per West Bengal State Electricity Regulatory Commission order). Arrangements have been made for application of ToD tariff system in all locations which, according to WBTC, seems financially beneficial to them and it will be implemented soon. Moreover, both the distribution utilities/DISCOMs have extended their support to ensure that the e-buses charging infrastructure is allowed to provide electricity under the existing supply code with minimal investment from WBTC towards electrical network augmentation.

The e-buses have been manufactured by TATA Motors at their Dharwad plant, located in the state of Karnatakawhereas the battery packs (Li-Ion NMC) used in these e-buses have been supplied by Octillion Power Systems, a USA based company having manufacturing units in China. The chargers have been manufactured and supplied by Tellus Power, China.

The Capex model (outright purchase) was chosen to procure the e-buses under FAME-I since WBTC already owns an entire bus/ fleet infrastructure and possesses the required man-power and years of experience to operate transport services. Therefore, in consideration of these factors, WBTC preferred to utilize their existing assets and made a decision for outright purchase of the buses. Also, the cost of the e-buses was attractive under the FAME-I scheme. However, since it became compulsory to opt for the Opex model under FAME-II, the GoWB did not proceed with the procurement of the other lot of 100 e-buses under Phase-II of the FAME India program. The driving range and technical specifications of e-buses had been extended during tendering process in-order to encourage more OEMs (with their existing e-buses models) to participate in the tender for supply of e-buses.

Impacts and Challenges

The implementation of the electric buses program in Kolkata has had a great impact on all aspects related to public mobility. The reliability of electric bus operation has seen to be improved up to 98% despite several initial challenges. Moreover, overwhelming responses have been received from the e-bus riders (a survey was conducted through social networking) in terms of comfort and reliability in each trip. Furthermore, the cost of Li-Ion batteries has been reducing drastically over the last few years and it is expected to drop further in the next 2-3 years which will positively impact the viability of e-buses that use these batteries. Although, the impact on air pollution levels has not been as significant as anticipated since very few conventional vehicles have been replaced by e-buses (5% of total conventional fleet) till date, it is expected that annual CO_2 emissions will reduce by 3,094 tonnes, considering daily round trip of 100 kms per bus and an emission factor of 1.19 Kg CO_2 emissions/km per bus. The impact on the electricity distribution network is equally critical to review and the same have been minimal so far.

As mentioned above, it is also imperative to analyse the impact on utility load curve due to un-controlled charging of e-buses since these buses are being charged based on driving pattern irrespective of load demand, even though the buses are predominantly being charged during the night and in the afternoon period when the load demand is comparatively less. Though, there will be a surge in demand in case large numbers of conventional fleets are converted into electric, utilities may accordingly propose for a variable tariff based smart charging in-order to manage and ensure the smooth operation of their networks.

Since all the components associated with e-buses have been supplied or manufactured outside of the city, the impacts on local job creation have not been discussed, so far. However, future interventions in regulatory& policy framework are expected in-order to encourage large-scale local manufacturing and import of electric vehicles and associated components. With this view, GoWB has come up with a draft 'Electric Vehicle Policy 2020' wherein they have set-up an ambitious target to attract a combined investment of over INR 30,000 Crores (USD 3.95 billion) in policy implementation across the electric mobility eco-system with employment potential through locally created jobs. Additionally, the government is determined to convert 100% of the WBTC bus fleet into an e-bus fleet by 2030. In-addition, GoWB has also announced tax incentives and a subsidy scheme to set-up infrastructure and components related to electric vehicles such as chargers, batteries etc. within the state.

Conclusions

Although 80 e-buses have been accommodated into the existing depots and the capex was not so huge due to the utilization of the existing assets, setting up new charging infrastructure for additional e-buses remains a major challenge in terms of identifying the appropriate location along-side the number of chargers required in each station based on traffic density & travel pattern. In-addition, frequent tripping of chargers and grid-synchronizations issues were observed to be a major concern during initial phases (up to 4-5 months) however these issues were rectified through software re-configurations. Therefore, it becomes important to validate the operation of chargers during installation phase itself so that the aforementioned issues do not arise during the running phase. The driving range of the 9 m e-buses was also experienced to be lesser than expected (<150 km/ charge) and the range with and without passenger movement was found to be 100 and 130 km per charge respectively. Regular monitoring of bus charging and impact on the local distribution network is being followed. Accordingly, it is essential to monitor and analyse the power quality parameters originating due to e-bus chargers on a regular interval (WBTC has been performing this on a quarterly basis) in-order to ensure proper functioning of the electrical network. All these considerations have been acknowledged and WBTC has been proactively planning for implementing ideas on making the ecosystem more sustainable in all aspects. As an example, charging of buses from green energy supplied by solar power plants installed on rooftops of WBTC depots has been encouraged by WBTC and TERI has been entrusted to carry out the study and implementation activities.

Since, the price for a bus under the Opex model of FAME-II is a bit on the higher side, therefore, it could be considered as one of the potent challenges to transitioning towards cleaner and low carbon public transport systems. Furthermore, point to point charging facility/ infrastructure is required to better utilize the routes, though it was not possible for every case due to infrastructural constraints. Nine terminus points were set-up in-order to provide intermediate charging facility for the currently operating 80 electric buses (refer to Annexure-III). WBTC has also planned to use cleaner sources of energy (solar PV along-with battery storage) at its existing e-buses depots to charge the e-buses which is expected to result in lower electricity cost for charging e-buses. Besides this, further scope for benefits is foreseen if WBTC plans to opt for a ToD tariff or time-of-use (ToU) tariff scheme coupled with solar plus energy storage (as per TERI's analysis[10]).

[10] https://timesofindia.indiatimes.com/city/kolkata/solar-panels-on-depot-roofs-to-charge-e-buses/articleshow/74016804.cms

Annexures

Annexure-I: Conventional buses under WBTC

OEMs			CSTC	CTC	WBSTC	Total	KMPL		
							CSTS	CTC	WBSTC
Volvo	Volvo AC	BS-IV	63			63	1.53		
AL Jan bus AC	ALFBV8/1	BS-IV	169			169	1.65		
AL Jan bus AC	ALFBV8/2	BS-IV	277			277	1.92		
AI Lynx AC	Lynx	BS-IV	38			38	3		
Tata non-AC	1623	BS-IV	120			120	1.8		
Tata non-AC	1613	BS-IV	45	118	49	212	2.12	2.8	2.5
Eicher non-AC	10.9	BS-IV	20	15	4	39	3.61	4	3.89
SML/Mahindra	Cosmo	BS-IV	16	10		26	4	4.2	
Volvo AC	8400	BS-III			38	38			1.7
Volvo AC	9400	BS-IV		15		15		3.21	
Volvo AC	9100	BS-III		14		14		3.15	
Tata non-AC	1512	BS-III	33	171	50	254	2.22	3.04	2.84
Tata non-AC	712	BS-III	4			4	3.5		
Tata AC	712 ES	BS-III	10			10	2.52		
Tata	1618	BS-III		14		14		2.4	
AL non-AC	ALFBV1/188	BS-III	11			11	2.42		
AL non-AC	ALFBV2/51	BS-III	15			15	2.34		
AL non-AC	1/37	BS-III	15			15			
AL non-AC	2/48	BS-III		43	15	58		2.8	3.14
AL	4/85	BS-III		24	11	35			2.48
AL	4/86	BS-III			5	5			2.77
Tata AC	1624	BS-III			24	24			1.54
Eicher non-AC	20.15	BS-III		35		35		2.9	
Eicher non-AC	10.75	BS-III		20		20		4.4	
AL AC	4/88	BS-II			2	2			3.06
AL non-AC	4/88	BS-II		16	4	20		3.1	2.86
AL AC	TF1812	BS-IV			4	4			2.56
Tata AC	1510 T	BS-II		8	8	16		3.2	2.27
Total No. of Buses			836	503	214	1,553			
No. of Routes			150	163	35	348			

* AL – Ashok Leyland

Annexure-II: Details of E-bus Depot Charging Stations in Kolkata

Sr. No.	Depot	12 meter e-bus	9 meter e-bus	Sub-Total	Charging Units	DISCOM/ Tariff Category	Remarks
1	Belgharia	8	0	8	1-FC 6-SCs	CESC/ M(i)	Commercial (Urban), Rate M (i)*
2	Kasba	10	0	10	1-FC 6-SCs	CESC/ M(i)	-DO-
3	Nonapukur	0	7	7	1-FC 7-SCs	CESC/ M(i)	-DO-
4	Thakurpukur	4	4	8	1-FC 6-SCs	CESC/ M(i)	-DO-
5	Howrah	0	7	7	1-FC 6-SCs	CESC/ M(i)	-DO-
6	Salt Lake	9	0	9	1-FC 6-SCs	WBSEDCL/ Rate B-IDCT*	Commercial consumers (50 kVA and above but upto 125 kVA), Optional Tariff Scheme – I
7	Lake	0	8	8	1-FC 6-SCs	CESC/ M(i)	-DO-
8	Gariahat	0	9	9	1-FC 6-SCs	CESC/ M(i)	Applied for ToD, Optional Tariff Scheme – I (not Prepaid)
9	New Town	9	0	9	1-FC 6-SCs	WBSEDCL/ Rate B- IDCT	As per Sr. No. 6
10	Digha	0	5	5	1-FC 1-SC	WBSEDCL/ Rate B- IDCT	As per Sr. No. 6
Total No. of E-Buses		40	40	80	SC: Slow Charger FC: Fast Charger *as per WBERC's Tariff Orders		

Annexure-III: Details of Terminus Point E-bus Charging Stations in Kolkata

Sr. No.	Terminus Point	Charging Unit(s)	DISCOM
1	Santragachi	1-FC	WBSEDCL
2	Karunamoyee	1-FC	WBSEDCL
3	New Town Bus Stand	1-FC	WBSEDCL
4	Nabanna	1-FC	CESC
5	Howrah Station	2-FCs	CESC
6	Tollygunge	2-FCs	CESC
7	Rajabazar	1-SC	CESC
8	Garia	1-FC	CESC
9	Airport	1-FC	CESC

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We believe that resource efficiency and waste management are the keys to smart, sustainable and inclusive development. Our work across sectors is focused on

1. Promoting efficient use of resources
2. Increasing access and uptake of sustainable inputs and practices
3. Reducing the impact on environment and climate

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