

User Needs Assessment Report: e-Bus Deployment in Accra and Kumasi



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Abbreviations and acronyms

ADB	Agricultural Development Bank
AMA	Accra Metropolitan Assembly
CBD	Central Business District
CLG	Company Limited by Guarantee
DAE	Direct Access Entity
DVLA	Driver and Vehicle Licensing Authority
EPA	Environmental Protection Agency,
ICA	Infrastructure Consortium for Africa
ISTC	Intercity State Transport Company
GAMA	Greater Accra Metropolitan Area
GAPTE	Greater Accra Passenger Transport Executive
GCF	Green Climate Fund
GSA	Ghana Standard Authority
GPRTU	Ghana Private Road Transport Union
KMA	Kumasi Metropolitan Assembly
L.I	Legislative Instrument
MOT	Ministry of Transport
MLGRD	Ministry of Local Government and Rural Development
MMDA	Metropolitan, Municipal and District Assemblies
MMTL	Metro Mass Transit Limited
MTTD	Motor Transport and Traffic Department
OEM	Original Equipment Manufacturer
QBS	Quality Bus Services
SSNIT	Social Security and National Insurance Trust

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1 Transportation Landscape of Accra

1.1 Passenger Modal Share

According to a report produced by the Infrastructure Consortium for Africa (ICA, 2016), about 42% of all trips in Accra are undertaken through informal, paratransit minibus operations, locally referred to as trotros. Non-motorised modes, principally walking on foot, and bicycling to a lesser extent constitute 33% of all trips. The dominance of trotros as a means of mobility in Accra cannot be overemphasised. The Consultants have undertaken passenger volume surveys along four major Accra routes over a two-day period (i.e., 14-16th December 2020). The surveys were conducted on the Adenta-Tudu route along the N4 corridor and Amasaman-Tudu route along the N6 corridor. The rest are Tudu-Adenta route, along the Independence Avenue corridor, and Tudu-Amasaman route, along the Kojo Thompson road corridor. As illustrated in Figure 1, the majority of trip makers surveyed (70%) travel by trotros. Other passenger modes of transport, including cars, taxis, and buses jointly constitute 30% of trips observed in the city.

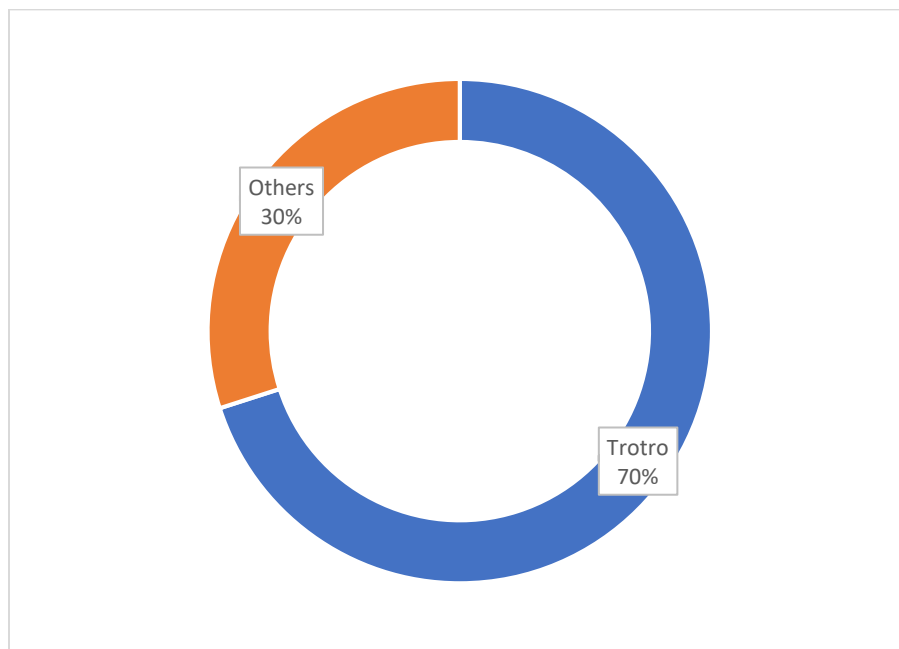


Figure 1: Observed passenger volume by motorised mode share in Accra

Depending on carrying capacities, trotros may be labelled as micro (10-15 passengers), mini (16-25 passengers) and midi (26-44 passengers), respectively.

Popular vehicle makes and models often used for trotro operations are the Mercedes-Benz 207, the Mercedes-Benz Sprinter, the Nissan Urvan, the Toyota Hiace, and the Ford Transit. These popular vehicle types may be found at the major public terminals all over Accra, as shown in Figure 2. Trotro operators have unionised into powerful owner and operator unions, with the Ghana Private Road Transport Union (GPRTU) being the largest.

Figure 2: Popular trotro vehicle types operating at selected termini:



1.2. Existing formal Bus Transport System in Accra

Presently, the Metro Mass Transit Limited (MMTL) and the Aayalolo Quality Bus Services (QBS) are the two leading intracity formal bus operating companies in Accra.

1.2.1. The Metro Mass Transit Limited (MMTL)

- *Brief introduction and background*

In March 2003, the Metro Mass Transit (MMT) Limited was formed under the Ghana Companies Code (1963) Act 179. The government of Ghana owns 45% shares of the company while the remainder is held by private entities, including the Agricultural Development Bank (16.6%), the Social Security and National Insurance Trust (16.6%) and the National Investment Bank (9.3%). The rest are Ghana Oil Company (7.5%), State Insurance Company (5.8%), Prudential Bank (1.6%) and In Treasury (2.5%).

- *Institutional structure*

The MMT limited is governed by a board of directors. However, the day-to-day activities of the company is run by management headed by the managing director. The company reports to the governing board which has representations from the Ministry of Transport and other relevant institutions.

- *Fleet landscape*

The MMT operates a variety of makes and models of buses for the various service types. This is presented in Table 1. In Figure 3, a VDL NEOPLAN bus is seen loading passengers at the main MMTL terminal at Tudu, in Accra's Central Business District (CBD).

Table 1: Current operational fleet characteristics of the MMT Limited

Bus Type (length)	Quantity of buses	Quantity of buses (Operational as of June 2018)	Total Passenger Capacity (Seating; Standing)
HUANGHAI COACHES	2	1	83 (43;40)
HUANGHAI CITY 1	116	77	150 (39;111)
HUANGHAI CITY 2	84	60	-
ANKAI/DRAGON	3	3	-
VDL NEOPLAN CITY 1	48	10	99 (33;66)
VDL NEOPLAN CITY 2	144	54	88(47;41)
VDL NEOPLAN COMM1	28	8	62(62;0)
VDL NEOPLAN COMM2	132	54	6362(63;0)
VDL JONCHEERE COMM 1	178	71	62(62;0)
VDL JONCHEERE CITY 1	149	62	88 (45;43)
TATA MARCOPOLO	45	16	70 (60;10)
ASHOK LEYLAND	87	23	77 (57; 10)
TATA COMMUTER 1	11	3	69 (59; 10)
TOTAL	1027	442	

Source: MMTL website <https://metromasstransit.com.gh/bus-route-operation-types/> Accessed on 11/09/2021 & Personal Communication



Figure 3: Passengers boarding a VDL NEOPLAN bus at the Tudu Terminal

- *Fare structure*

The MMTL charges relatively low fares and the fares are normally graduated for its intra-city bus operations. This means that even though a flat fare may be attached to the routes, passengers only pay the equivalent of the travel distance. The flat fares per route are as follows: Tudu-Amasaman (GHS¹ 3.00); Tudu-Tema (GHS 5.00), and Tudu-Adenta (GHS 5.00). The rest are Adenta-Circle (GHS 4.00), Tudu-Kasoa (GHS 4.00); Tudu-Ashaiman (GHS 4.50) and Tudu-Teshie/Nungua (GHS 5.00).

1.2.2. Aayalolo Quality Bus Service (QBS)

- *Brief introduction and background*

On 4th April 2014, the Greater Accra Passenger Transport Executive (GAPTE) was incorporated as a Company Limited by Guarantee (CLG) to operate a bus rapid transit system, which was later renamed a Quality Bus System (QBS). This is due in part to the inability to secure an exclusive busway for the vehicles on the Tudu-Amasaman corridor. In October 2016, the QBS started formal bus operations in Accra. GAPTE was established to manage the cross-jurisdictional problems through a unified route of operation. Under their regulatory function, they report to Ministry of Local Government and Rural Development (MLGRD), and supervision is under the Ministry of Transport, particularly with respect to the operation of terminals and bus procurement.

- *Institutional structure*

The Aayalolo is governed by a 17-member board whose membership is derived from all 12 local administrative assemblies in Accra and the Senya Awutu East in the Central Region of Ghana. A Chief Executive Officer who is in-charge of the Greater Accra Passenger Transport Executive (GAPTE), superintends the company's day-to-day activities. The MLGRD plays a supervisory role using the LI 1961.

¹ 1 GHS = 0.16 USD (24/11/2021)

- *Fleet landscape*

A total of 275 Scania Marcopolo Viale BRT buses have been imported for the exclusive use of the QBS. Presently, most buses are parked at the main depot at the Achimota terminal, as seen in Figure 4.



Figure 4: SCANIA buses at Achimota bus terminal

- *Fare structure*

The Aayalolo uses a zonal fare charge system. There are four zones per which charges are made. Along the Tudu-Amasaman corridor, the zones include Amasaman-Ofankor (Zone 1), Ofankor-Achimota (Zone 2), Achimota-Circle (Zone 3) and Circle-Tudu (Zone 4). These zones are illustrated in Figure 5. Since 1st April 2018, the fare is GHS 1.30 to travel within a zone and GHS 1.80 to travel within 2 zones. A commuter pays GHS 2.20 and GHS 2.50 respectively for travels within 3 and 4 zones.

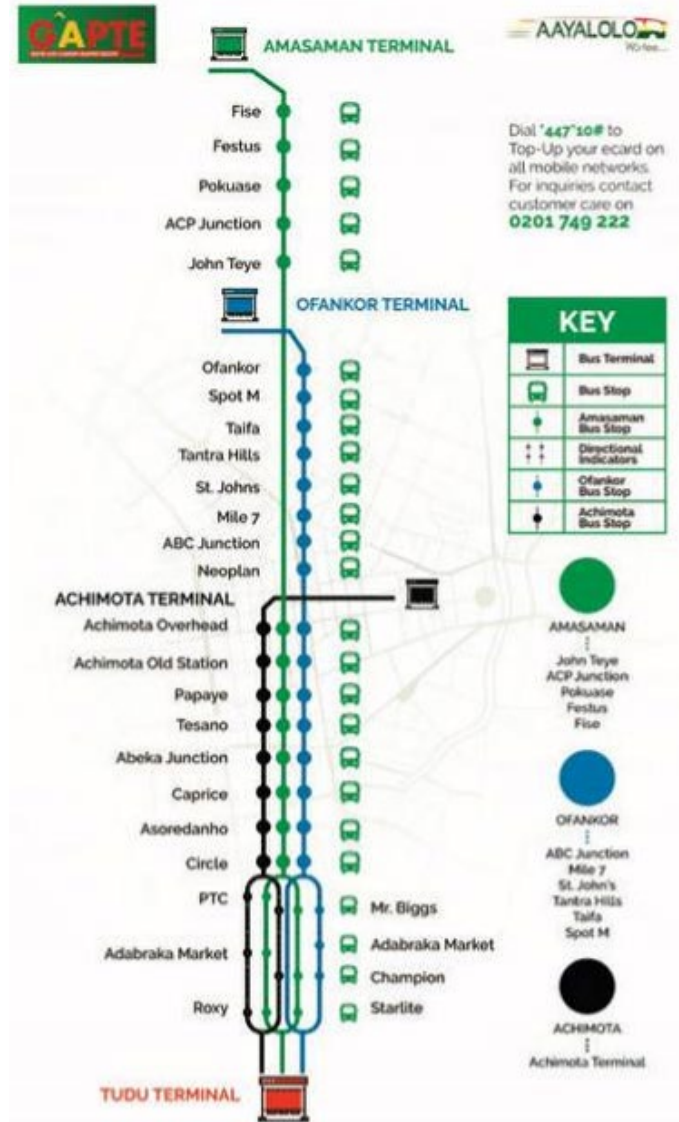


Figure 5: The operational zones of Aayalolo bus service on the Tudu-Amasaman corridor

Source: Aayalolo Newsletter (2017)

1.2.3. Operational Landscape and Facilities for Intracity Bus operations in Accra

- *Routes for intra-city bus operations*

The two formal bus companies operate on the busy routes originating from the city centre, and heading in different directions of the city. As seen in Figure 6, these routes include the Guggisberg Avenue, the Tudu-Kasoa route, along the Winneba/Graphic Road, and the Tudu-Amasaman route, along the Nsawam Road, just to name a few.



Figure 6: High-capacity routes and facilities along which the MMTL and QBS buses operate in Accra.

It is noteworthy that the MMTL has a relatively more extensive system of routes and stops in Accra. As seen in Table 2, prior to 2020, MMTL buses were seen on almost all the important routes in Accra. About 50% of MMTL's operations along these busy routes involve high-frequency bus services, on average every 10-minute interval, leading into or out of the central business district of Accra. The service does not extend beyond a radius of more than 40km from the cities. The MMTL also runs the Inter City bus services normally over long distances, about 140 kms in one direction, and Inter Urban/Rural Urban service strategically links most transportation-deprived rural areas to the bigger towns. However, operational challenges and the COVID-19 pandemic seem to have negatively impacted the active operations of the company.

Starting from November 2016, the Aayalolo began a pilot high-quality bus service (Type B) on the 20.65 km Tudu-Amasaman route, along the Accra-Nsawam Road, with 28 buses. By October 17th 2017, the company had increased its fleet size to 58 buses indicating that the service was enjoying massive patronage by commuters. Subsequently, the Tudu-Adenta and Tudu-Kasoa corridors were earmarked for an extension of the service. Unfortunately, since June 2019, ridership has dipped significantly to the extent that the Aayalolo has been running limited morning (5:30-8:30 am) and evening (2:30-7:00 pm) services. Similar to the MMTL, the QBS is reeling under the effects of COVID-19, and prevailing operational challenges.

Table 2: Operational visibility of MMTL and QBS in Accra

Major Routes in Accra	Trip distance	Pre-Covid era (2016-2020)		Post-2020	
		MMTL	QBS	MMTL	QBS
Tudu-Amasaman	21.9 km	12	60	1	30
Tudu-Tema/Ashaiman/Teshie-Nungua	38.3 km	45	5	6	14
CBD-Ministries Circulation	1.3 km	2	-	-	-
Tudu-Adenta	22.7 km	24	3	2	10
Adenta-Circle	23.5 km	4	-	-	-
Tudu-Kasoa	28.6 km	8	8	2	15

Source: Personal communication with MMTL and GAPTE, 2021; Trip distances based on Google map estimates

1.2.4. Key Depots and Terminals for intra-city bus operations

The Main Depot serving MMTL buses is located at Kaneshie, specifically along the Nii Teiko Din Street in Accra (see Figure 6, labelled as “Kaneshie depot”). The 10-acre facility currently holds close to 250 buses, most of which are broken down vehicles. Other facilities available include a bus maintenance workshop, a warehouse, a bus parking depot, a fuel depot, a bus washing bay and several administrative offices.

The government of Ghana has commissioned an ultramodern bus loading terminal and depot at Tudu to serve the operational needs of both MMTL and Aayalolo buses. In Figure 6, the location of this facility is labelled as “Tudu depot”. This facility has a commercial block with 14 offices, a restaurant and a banking hall. Furthermore, it has parking space for seventy-eight (78) buses and a drop-off space for thirty-two (32) passengers. Figure 7 shows the frontage of the ultra-modern terminal/depot facility at Tudu.



Figure 7: An ultra-modern bus terminal/depot at Tudu

Another bus terminal/depot, which the government also owns has been put up at Adenta, in Accra. In Figure 6, the location of this facility is labelled as “Adenta depot”. The facility comprises a bus terminal building, 18 offices, restaurant, bank, supermarket building, a 10-seater washroom, a passenger park-and-ride and bus parking covering an area of about 6.0 acres.

The main terminal and holding area can accommodate 60 buses and additional 50 vehicles for park-and-ride at a time. Presently, only Aayalolo buses operate from this depot/terminal. Given that the facility is the bona fide property of the Ministry of Transport, the MMTL can also use it should the need arise. The MMTL also has a terminal that serves as boarding terminals and minor workshops located at Tema Community 5 (along the Accra-Tema route). The QBS has adopted the Achimota loading terminal as its main depot. Labelled as “Achimota depot” in Figure 6, this public transport facility was opened in 2009 and has a parking space for 800 vehicles, mostly trotros. In addition, there is a police post, clinic, four 20-unit toilet facilities and 10 canteen rooms. In addition, the terminal boasts of an electronic destination board, waiting sheds for commuters, offices for local drivers and close circuit television cameras to promote and enhance the security and safety of users. The MMTL does not operate any bus activities from the Achimota terminal/depot. The QBS has two other termini located at Ofankor and Amasaman, along the Accra-Nsawam route, as shown in Figure 8.



Figure 8: A map of Accra showing locations of QBS facilities (Source: ICA, 2016)

1.3. Accra-Kumasi Intercity Services

The leading publicly-owned bus company which ply the Accra-Kumasi route is the Intercity State Transport Company (ISTC). The MMTL has a minimal presence on this route. However, private bus companies, including VIP, VVIP, and OA compete for passengers on this route.

1.3.1. Inter City STC Coaches Limited

- *Brief introduction and background*

The roots and origin of intercity STC (ISTC) began in 1909 as a Government Transport Department to cater central government's needs. In 1965, it was made a body corporate by Legislative Instrument (L.I) number 414 of 9th March 1965 to run commercial passenger services and was then called the State Transport Corporation (STC). STC was later incorporated in June 1995 as a Limited Liability Company under Ghana's Companies Act, 1962, (Act 179) in the name, State Transport Company Limited. Over the years, the company has gone through changes as it was taken by private company VANEF after it had acquired majority shares. It is now known as the Intercity STC Coaches Limited since October 2003.

Presently Intercity STC is owned by Social Security and National Insurance Trust (SSNIT), which has majority shares of 80% after taking over from VANEF and the Government of Ghana which owns the minority share of 20%.

- *Institutional structure*

A board of directors governs ISTC Limited. However, the company's day-to-day activities is run by management headed by the managing director, with three deputy managing directors in charge of finance and administration, operations and technical and engineering services. The board reports to the Ministry of Transport and other relevant shareholders.

- *Operational landscape and routes*

ISTC operates inter-city transport services, package/parcel/courier services, engineering consultancy services and bus hiring services using their high-capacity buses to all 16 regions of Ghana. Specifically, the operational schedules for the Accra-Kumasi journey are presented in Table 3.

In Table 4, the passenger volumes on the route over a three-year period have been presented. The table indicates that the ISTC has become very popular on the Accra-Kumasi route, and more passengers are using the service for the intercity journey.

Table 3: ISTC Accra and Kumasi itinerary, 2021

Accra-Kumasi			Kumasi-Accra		
Service	Days	Departure Time	Service	Days	Departure Time
1st	Mon-Sat	6:30am	1st	Mon-Sat	6:30am
2nd	Mon-Sat	8:30am	2nd	Mon-Sat	8:30am
3rd	Mon-Sun	9:30am	3rd	Mon-Sat	9:30am
4th	Mon-Sun	10:30am	4th	Mon-Sun	11:30am
5th	Mon-Sun	11:30am	5th	Mon-Sun	12:30pm
6th	Mon-Sun	12:30pm	6th	Mon-Sun	1:30pm
7th	Mon-Sun	1:30pm	7th	Mon-Sat	2:30pm
8th	Mon-Sun	2:30pm	8th	Mon-Sat	3:30pm
9th	Mon-Sun	3:30pm	9th	Mon-Sat	4:30pm
10th	Mon-Sun	4:30pm	10th	Mon-Sat	6:00pm
11th	Mon-Sun	5:30pm			

Source: ISTC, 2021

Table 4: ISTC Passenger volumes on the Accra-Kumasi route

Direction	2019	2020	2021 (Jan-Oct)
Accra-Kumasi	199,404	170,294	226,234
Kumasi-Accra	178,216	134,035	188,142

Source: Personal Communication with ISTC, 2021

- *Fare structure*

The ISTC charges a flat rate of GHS 45 per passenger for all trips between Accra and Kumasi. This appears to be cheaper than privately-owned bus services that also serve the route.

- *Fleet landscape*

The ISTC operates a variety of makes and models of buses and luxury coaches for the various service types. This is presented in Table 5. Figure 9 shows the Scania Marcopolo Viaggio bus and a Toyota Hiace minibus which serve the Accra-Kumasi route.

Table 5: Operational fleet characteristics of the ISTC Limited in 2021

Bus Type (length)	Quantity of buses	Total Passenger Capacity (Seating)	Air-Conditioned?
GrandBird	40	49	YES
Scania Marcopolo Paradiso	40	44	YES
Scania Marcopolo Viaggio	10	52	YES
Toyota Hiace	12	14	YES
AMPS mini buses	10	14	YES
MPlaza	10	-	YES
Nordic	7	-	YES

Source: Personal communication with ISTC, 2021



Figure 9: Sampled ISTC buses plying the Accra-Kumasi route

- *Key Depots and Terminals for the Accra-Kumasi Intercity Service*

The main Accra ISTC depot is located at its head office at No. 1 Ajuma Crescent, opposite the Awudome Cemetery, Kaneshie. In Figure 10, the location is labelled as “ISTC Main Depot, Circle”. The 10.43-acre plot of land can hold 120 buses. In addition, the facility has a guesthouse, a training school, a mosque and a space for parking and ride. Also, the depot has a canteen/restaurant, a station for the Ghana National Fire Service, a Driver and Vehicle Licensing Authority (DVLA) inspection site, a fuel station, a clinic, a passenger lounge and an engineering workshop that can hold close to 50 buses.

Buses departing for the journey to Kumasi usually take off from the 0.8-acre “ISTC Terminal, Odawna”. This terminal can hold 8 buses at a time. It can boast of a passenger lounge, a washroom and an Office Depot. From here, the buses may pick up passengers waiting at the “BRT/ISTC Terminal, Achimota”. This facility has a bus holding capacity of 2 buses, a washroom and a passenger lounge.

ISTC drivers and passengers take a mandatory short rest of about 10 minutes at the Linda Dor Highway Rest stop for the Accra-Kumasi-bound journey. In Kumasi, the ISTC has four main terminals/depots. Their geographic locations, and available facilities are illustrated in Table 6.

Table 6: ISTC facilities in Accra and Kumasi

Depot/Terminal Location	Land size (acres)	Bus holding capacity	Key Facilities
Oforikrom Depot, Kumasi	22.37	100 buses	<ul style="list-style-type: none"> • Valuation office • Mosque • Warehouse • Engineering workshop • Fuel station • Training school
Asafo Terminal, Kumasi	1	6	<ul style="list-style-type: none"> • Washroom • Passenger lounge • Cal Bank banking hall
Adum Terminal, Kumasi	1.69	5	<ul style="list-style-type: none"> • Restaurant • Passenger lounge • Petty trader stores
Kumasi Goil (Labour), Kumasi	-	5	<ul style="list-style-type: none"> • Fuel station • Washroom

Source: Personal Communication, 2021

The driving crew and passengers returning to Accra from Kumasi take a short rest of about 10 minutes at the Joffel Catering Services. Passengers may alight at the “BRT/ISTC Terminal, Amasaman” or the “BRT/ISTC Terminal/Depot, Achimota” in Accra.

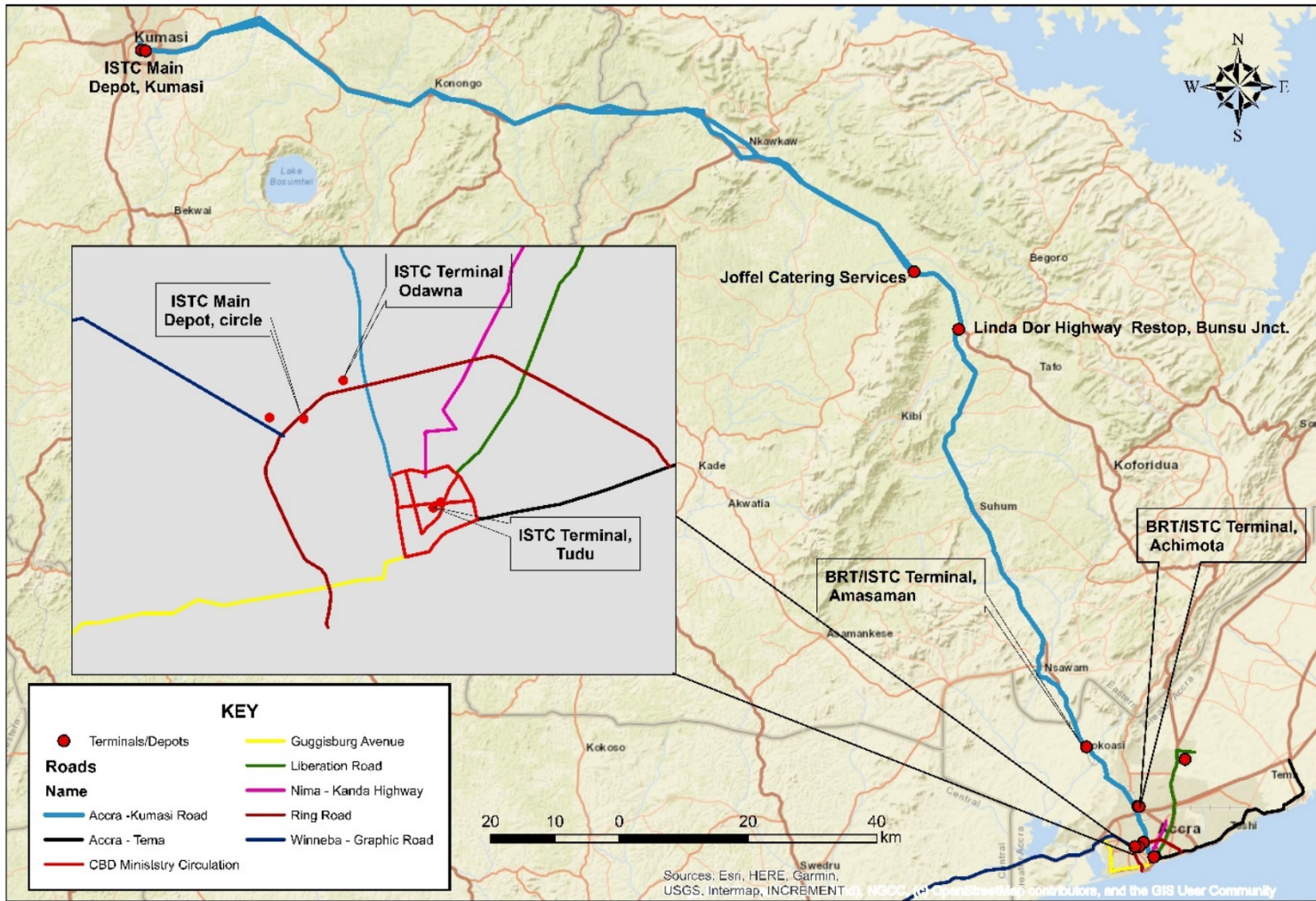


Figure 10: A map of the Accra-Kumasi route showing ISTC facilities



Figure 11: A pictorial view of ISTC main depot at Circle, Accra

2 Stakeholders Assessment for e-Bus Deployment

2.1 Stakeholders Mapping and Consultation Analyses

The acceptance of e-Buses in Ghana will be dependent on several real and perceived user needs. This user needs assessment began with an extensive desk review of policy documents, organisational reports and data, and relevant literature to identify key issues and offer fresh insights into the financial, technical, and operational measures critical for e-Bus adoption in Accra and Kumasi. In addition, we reflected on and incorporated some key insights from the e-Mobility policy framework. Lessons learned from the reviews, and draft policy informed the stakeholder consultations, analysis and contextualisation of the user need assessment. This report will provide useful input for determining the priority areas for the business model and technical feasibility analysis and policy measures to facilitate the adoption of e-Buses in Ghana.

The second step comprised consultations with institutions and organisations relevant to user needs assessment. This process employed a qualitative methodology to collect data on the institutional overview and business model, existing fleet inventory and support mechanisms, and stakeholders' opinions about e-Bus adoption in Accra and Kumasi. Attempts were made to contact the stakeholders who were categorised under: (a) national/city policy actors and regulators; (b) end users or public transport operators of e-Buses, and (c) donors. Zoom interviews were held with available stakeholders and experts. Overall, five expert interviews were conducted to represent a cross-section of the categorised stakeholders (Appendix 1). They included: city authority (Accra Metropolitan Assembly), department of transport (Kumasi Metropolitan Assembly), and three public transport operators; Metro Mass Transit Limited (MMTL), Greater Accra Passenger Transport Executive (GAPTE), and the Intercity State Transport Company (ISTC). Each interview lasted between 30 and 50 minutes. The framework used for engaging key stakeholders in e-Bus implementation in Accra and Kumasi is illustrated in Figure 12.

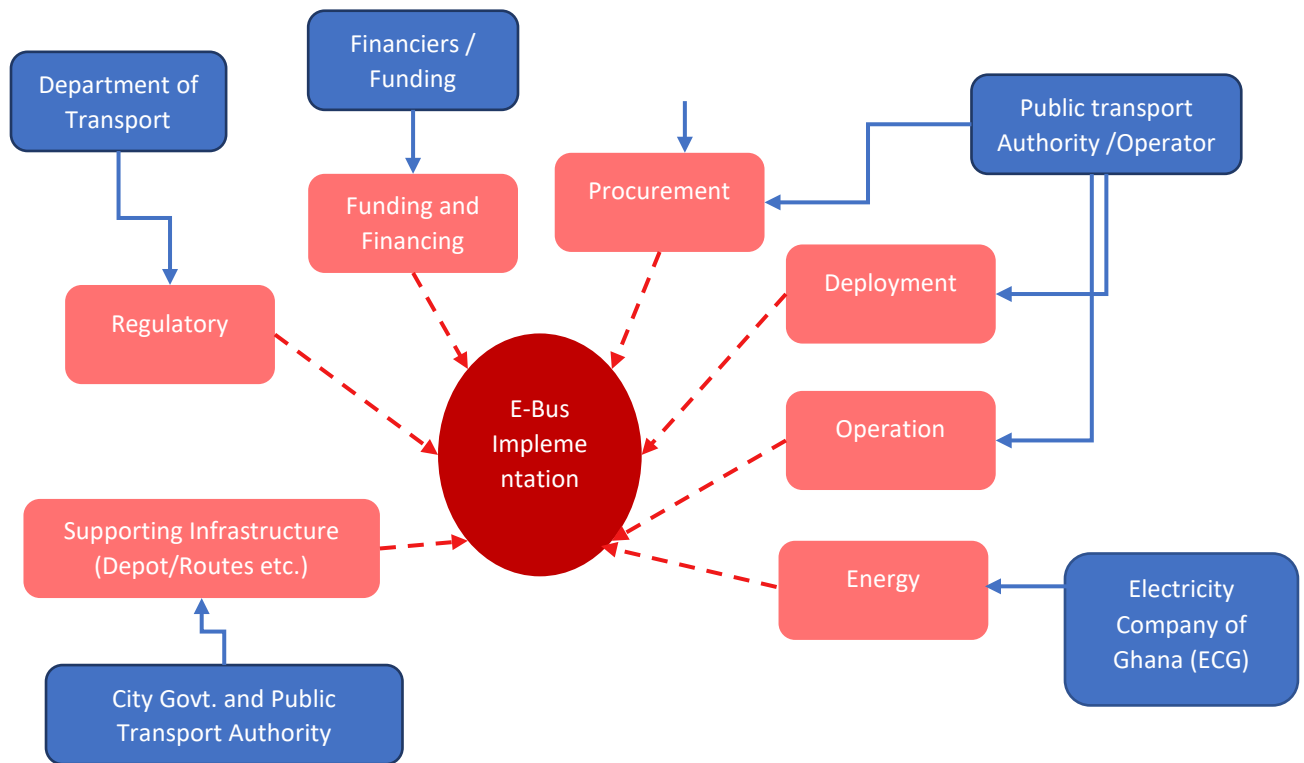


Figure 12: Framework for engaging key stakeholders in e-Bus implementation

The analysis of our engagements with these stakeholders has been organised into the sections below.

2.2 Central Government Agencies

The qualitative views of experts and stakeholders were sought regarding plans by the Ghanaian government to promote the use of electric vehicles for the country. The results are illustrated in Figure 13. At the national level, the policy actors, regulators and end-users who were consulted

for the e-Mobility Policy Framework report indicated their overwhelming support for the introduction of e-Buses to promote public passenger transport in Ghana. These stakeholders included: Ministries of Transport, Roads and Highway, Finance, Energy, Local Government and Rural Development, Trade and Industry, and the Energy Commission, Environmental Protection Agency (EPA), Ghana Standard Authority (GSA), and Driver and Vehicle Licensing Authority (DVLA). The end users included: OEMs, transport operators (i.e., MMTL, GAPTE, ISTC and VIP) and private individuals. The experts emphasised that EVs adoption will serve the nation well in terms of helping overcome dependence on fossilised fuels (23.4%) and improve the environment (22.1%). A sizeable number of respondents (18.2%) indicated that EVs are cost-effective to run (Figure 14). Other reasons for the endorsement included: savings on fuel and maintenance costs, improving efficient (scheduled) bus transport system and saving Ghana from becoming a dumping ground for ICEVs.



Figure 13: Key themes for supporting EVs adoption in Ghana

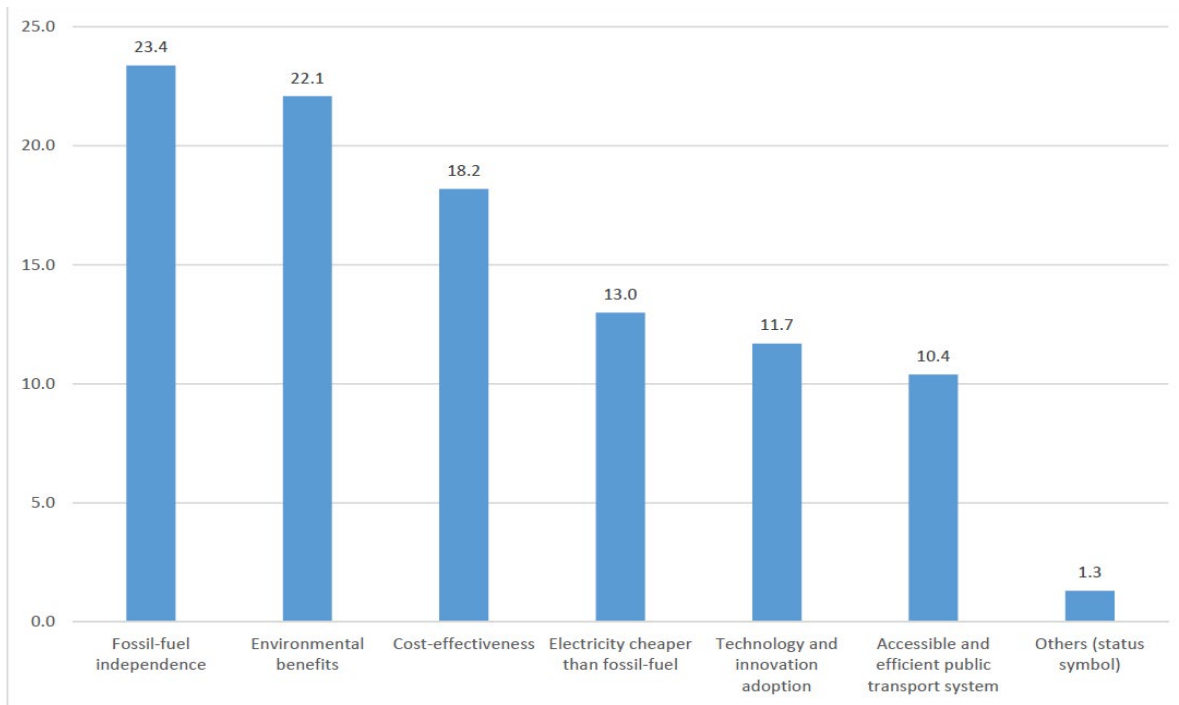


Figure 14: Key themes for supporting EVs adoption in Ghana (in percent terms)

The stakeholders unanimously highlighted the fact that because global trends are shifting in the direction of EVs, it is a worthy cause that Ghana is putting in place the necessary policy and operational framework to avoid being left out in this global drive and becoming a dumping ground for used ICEVs. On the issue of capital cost, they intimated that though the initial purchasing cost is high, the total cost of ownership in the long term will be beneficial in terms of savings on fuel and maintenance costs. Thus, the operational cost is relatively cheaper and sustainable than fossil-fueled buses.

However, all the stakeholders also emphasised the need for government to facilitate the provision of the necessary infrastructure, support systems and incentives, including charging stations, reliable power supply and subsidies. Through the provision of the needed enabling environment, government will engender private sector participation and support for e-Bus adoption and deployment. In particular, the transport operators will invest and venture into e-Bus operations when the required charging support system has been developed to enable them to enjoy economies of scale. The stakeholders suggested that charging points for intercity buses should be strategically located along key corridors preferably leveraging existing terminals and/or depots to minimise cost of infrastructure development.

The bus terminals and depots should have charging stations whereby buses will be charged when they retire. For intracity buses, stakeholders have proposed that existing filling stations can be retooled and used as charging centres, especially the stations with sufficient space to allow for the parking of the e-Buses. The charging stations are expected to have backup power to address any potential power fluctuations. In addition to retooling filling stations, new charging points should be developed at parking lots with retractable cables along the sides of the road whereby people can plug in to charge while they go to work or shop, visit the market and go about their daily activities. The charging stations and points should be easily accessible and equitably distributed across the city.

Stakeholders mentioned the range and battery capacity of buses as a major concern that needs to be addressed to allay fears of becoming stranded as a result of battery run-down. They expect battery cost to be compensated over time by the relatively longer battery life compared to conventional battery for ICEVs. For intercity journeys during booster charging at rest stops, passengers should be given something to wait for. For example, restaurants, stores/shops and amusement parks could be developed to engage passengers while they wait.

The development of transport operators' human capacity and resource needs to support the operations and maintenance of e-Buses was also highlighted by stakeholders. They expect workshops, garages and training centres (to train and certify technicians, artisans, etc. to be provided and standard servicing parts made available in the Ghanaian market to develop and support the e-bus ecosystem. The Ministry of Energy and the Energy Commission have previously provided similar interventions and training programs on solar. The Energy Commission noted that the current electricity rate for charging is far cheaper than diesel and petrol. They are currently working on charging standards and regulations, including considering a common tariff for EV charging. The Ghana Standards Authority also emphasised the need to develop standards for charging stations, charging equipment, service parts etc.

From the perspective of the Ministry of Finance, fuelling buses for public transport has been a considerable government expenditure. Hence as part of its revenue mobilisation through innovative financing efforts, the Ministry is extensively discussing the issue of a carbon tax with development partners and seeking investment partnerships in renewables (e.g., solar) and reliable power generation and distribution.

They acknowledge that even though EVs' introduction would lead to loss of revenue from fuel taxes, the transition from brown economy to green economy may not deprive Ghana's economy entirely. There is the need to explore innovative ways of transitioning and non-monetary benefits, including savings on health expenditure, the balance of payment (foreign exchange to import crude), etc. The Ministry is proposing a solar roof top battery charging system with spare batteries for recharge while e-Buses are running.

The stakeholders called on the government to provide tax incentives and subsidies. At the same time, the banks and financial institutions make affordable and easily accessible financing schemes and credit facilities to support e-Buses. For instance, a vehicle purchase scheme and bank's interest rate and repayment plan should be attractive. In addition, the government is expected to introduce attractive interventions to attract private sector investment and OEMs to manufacture e-Buses as is being done with cars under the automotive development policy. There is a need for closer grassroots engagement, especially with the transport unions (e.g. GPRTU, GRTCC, etc.) to avoid any resistance that would hinder the deployment and operations of e-Buses in Ghana.

2.3. City Government Agencies

2.3.1. Department of Transport, Kumasi Metropolitan Assembly

The Department of Transport of the Kumasi Metropolitan Assembly (KMA) works as an advisory body to the city government. In terms of organisational structure, the Department is headed by the Head of Transport, supported by directors in charge of planning, operations, enforcement, and administration. The Head reports to the Metropolitan Coordinating Director who is accountable to the Mayor of KMA. The Department of Transport is involved in the issuing operating permits to transport operators within their jurisdiction, typically a 10km radius. Within the KMA area, there are a lot of trotros and shuttle buses. The high occupancy buses ply the Kumasi to Accra corridor and other busy corridors that link regional capitals to other towns. Thus, the bus operators are expected to obtain an operating permit issued by the Department of Transport in collaboration with the KMA, particularly for terminals and lorry stations in the central Kumasi area such as Asafo, Adum, Oforikrom etc. The metropolitan, municipal and district assemblies (MMDAs) control the routes within their jurisdiction.

Due to the cross-jurisdictional nature of their operations, the MMTL and ISTC bus operators negotiate with the MMDAs in receiving permits and acquiring terminal spaces; hence do not require operating permits from the KMA.

The Department of Transport welcomes the introduction of e-Buses in Kumasi as the initiative will promote public transport in the city. The Department anticipates that e-Buses are modern high-occupancy buses that will improve efficient (scheduled) public transport and reduce congestion and carbon emissions in the city. They expect the supporting systems and enabling environment to be put in place by the government to make the bus operations efficient and sustainable to address rising informality in the transport system. The Department will support the implementation of e-Buses through regulatory, enforcement and compliance requirements, especially in their issuance of permits and supervision of terminals. They are willing to provide every support that will promote the performance of e-Buses.

2.3.2. Accra Metropolitan Assembly

The Accra Metropolitan Assembly (AMA) is the city authority for Accra, which currently comprises three sub metros due to the recent fragmentations and ceding of some municipalities from the AMA. However, given that transport issues cut across multiple metropolitan, municipal and district assemblies, the AMA cannot plan for its jurisdiction alone. For example, within the Greater Accra Metropolitan Area (GAMA), the route from Amasaman to Tudu (CBD) will traverse several sub-metros. Hence, the Greater Accra Passenger Transport Executive (GAPTE) is an organisation mandated to regulate the cross-jurisdictional routes.

AMA has direct jurisdiction over terminals in the central business district (CBD). The assembly issues permit that covers license, insurance, etc. and they also regulate overaged vehicles and vehicle road-worthiness. The conditions for being issued a permit include ensuring an operator does not extend to other routes outside the jurisdiction of the permits. AMA only registers and supervises bus operations that fall within its sub-metros.

This includes the CBD corridors such as Accra-Kumasi, Accra-Takoradi, Accra-Cape Coast, and Accra-Tamale. For intracity transport operations, the busiest routes include Lapaz, Circle, Kaneshie, Tema Station, etc.

In terms of city transport development, the Assembly plans to identify workplace and satellite business districts to improve transport services, thereby resulting in efficiency and productivity. There are efforts geared toward strengthening the coordination of the cross-jurisdictional routes to ease permit issuance and limit cross-boundary route disputes and concerns. In addition, there are plans for e-ride services. AMA will be collaborating with the digital taxi operators (e.g., Uber, Bolt, Yango etc.) to identify strategies that will promote efficiency in operations and service delivery in the city. These plans have implications for efficient bus operation in the city.

Due to the cross-jurisdictional routes, the AMA intimates that implementing e-bus in Accra will require stronger institutional coordination spearheaded by GAPTE to ensure that the operational requirements are met to enable transport operators to provide efficient e-bus services. Regarding options and locations for establishing charging infrastructure for e-Buses, the city authority leverage the current filling stations to be used as charging facilities to support intracity operations and bus depots and terminals for intercity operations. They anticipate that through public-private partnerships, arrangements will be put in place to develop charging equipment and infrastructure.

2.4. Bus Operators

2.4.1. The Metro Mass Transit Limited (MMTL)

Metro Mass Transit Limited (MMTL) is a transport company that runs both intracity and intercity operations. They obtain a permit through consultations with all the relevant MMDAs who have jurisdiction over the routes they operate. In addition to terminals built and owned by MMTL, they also rent some privately-owned terminals where they usually pay annual fees.

In terms of procurement, MMT buses are procured by the government with duty waivers under a subsidised fare regime. The government, through the Ministry of Transport, procures the buses and lends them to MMTL to operate.

A special account has been created into which MMTL, until recently, makes payments to cover the bus purchase cost. However, due to operational challenges, MMTL has been unable to redeem the payments and requested that government write off the loan or treat it as a grant. The government is yet to respond to their request. Meanwhile, MMTL uses their generated revenues to maintain the buses and meet other operational costs regularly. However, there are different

arrangements for charging fares and deciding revenue share for buses procured through a private partnership where duty cost and additional clearing charges have to be paid. In such a scenario, any direct purchases from OEMs will have to undergo the necessary approvals pertaining to Ghana's public procurement arrangements. In such instances, MMTL compares the cost implications of charging lower fares.

MMTL currently has 190 buses in operation in Ghana. Plans are far advanced to receive 400 additional buses from the government beginning in 2022. They expect to receive about 50 e-Buses from the Ministry of Transport as their share of the government's intended e-Bus project to support intracity and intercity transport services. During the Covid-19 lockdown, the government spent GHC 27 million on MMTL to support their operations and ensure the passengers on the buses adhered to the safety protocols. MMTL is negotiating with the government about the subsidised fare structure to make the company competitive and viable. Their vehicles purchased from OEMs come with parts and maintenance kits and operational servicing support for one year.

The operations of MMTL are categorised into three:

- (i) Intracity – Below 40km;
- (ii) Interurban – 41-150km (e.g. Kumasi-Obuasi, Accra-Winneba etc); and
- (iii) Intercity – Above 150km.

Their major intracity arterial routes in Accra include Ashaiman, Tema, Madina, Adenta, Circle, Nsawam, Kasoa, Pokuase, and Amasaman. The intercity routes include Accra-Kumasi, Accra-Takoradi, Accra-Tamale/Bolgatanga/Wa, Accra-Aflao/Ho. MMTL plans to run campus shuttle for public university campuses out of the buses they expect from the government in 2022.

MMTL spends a high share (35%) of its operating cost on fuel for intercity operations, while they spend around 55% on fuel for intracity operations due to traffic congestion in the city. The e-Buses are expected to be the game-changer for the company's fortunes given that they will reduce fuel expenditure and maintenance costs. Regarding charging infrastructure, MMTL has 17 depots interspersed across the country, which they expect to be leveraged for providing charging facilities for e-Buses. In Accra, they have terminals at Adenta and Tudu where buses can charge overnight when they retire or during the day before loading passengers.

For the e-Bus operations, the company expects a business model whereby government procures the buses and MMTL provides the services at reasonable transport fares. A fund will be set up that will contribute to paying off the initial capital outlay and increasing the number of buses in phases, and generating income to make the model self-sustaining within a minimum of three years.

Due to the current arrangement with the government, MMTL expects the Ministry of Transport to handle issues pertaining to procurement and potential OEM that will supply the e-Buses. They, however, expect higher battery capacity buses particularly for intercity operations. For intercity operations, they target terminals on selected busy corridors that can provide space for installing charging facilities beyond 150km routes.

Overall, MMTL supports the e-Bus project for its fuel-saving potentials and efficient public transport opportunities as it provides scheduled bus service. Due to the high initial capital outlay government is expected to lead in the procurement of the e-Buses, charging stations and provision of reliable power.

2.4.2. Aayalolo Quality Bus Service (QBS)

GAPTE is a company established to regulate the Aayalolo bus service in Accra and manage the cross-jurisdictional problems through a unified operation route. The company currently has 245 buses for intracity operations. Their major arterial routes include Ashaiman, Tema, Adenta, Dodowa, Amasaman and Kasoa. The buses are deployed based on demand, and as part of their mandate, GAPTE is expected to work with the MMDAs and MLGRD to develop feeders that will supply buses to the main city centers.

They are concerned that the size of Aayalolo buses does not make it possible to work in certain feeder concessions. Hence, GAPTE ensures that every concession is developed based on a fit-for-purpose operational model. For example, a feeder concession on the Madina-Adenta route from Ritz junction to Zongo junction should be designed to fit and benefit that particular concession. In addition, consideration is given to passenger demand, vehicle occupancy etc., to determine the right number of buses and trips, bus sizes, and the appropriate revenue share arrangement.

The Aayalolo buses are imported by the government with duty waivers. Government has a lending arrangement with GAPTE. Per the arrangement, GAPTE is expected to contribute a share of their revenue to a dedicated account to pay off the capital cost, after which GAPTE becomes the owner

of the buses. Vehicle OEMs that supply buses to the company usually provide mechanical support, drivers training, and technical support for fleet management and e-ticketing system. As a regulator, GAPTE receives a certain per cent of the revenue share from the Aayalolo operators. The remaining is used to cover costs including fleet renewal, repayment of lending cost, maintenance, and other operating costs.

GAPTE considers the e-Bus project a great initiative and an innovative way to address transport challenges in major cities as the e-Buses will drastically reduce fuel expenditure. Fuel cost for running Aayalolo buses accounts for 75% of operating cost. They expect the government to subsidise charging cost, which will reduce operating cost and promote e-Bus adoption and deployment. The business model for the e-buses will depend on several factors, hence GAPTE is envisaging a mix of different operational models. Government should procure the e-buses under a lending regime and open up the market to allow for private participation whereby individuals come together to acquire the fleet of vehicles and create concessions on particular routes. GAPTE can enter into a lending agreement with the private operators. Based on services provided on a given concession, which the electronic ticketing system will control, the revenue share will be determined and their costs of operation and maintenance will be covered. They propose that government should, in the long term, consider acquiring the existing fleet of old vehicles and retrofitting them into the e-bus model in such a manner that the informal sector is not left behind.

Since GAPTE's mandate is to provide bus rapid transport in GAMA, the infrastructure that supports the BRT system is designed and managed by GAPTE together with the Ministry of Roads and Highway. For intracity operations, they expect the charging infrastructure to be developed robustly so that the buses can run without interruptions in their schedules. To improve operational hours, they are concerned about high battery capacity buses. Given that almost all the assemblies have terminals except a few, GAPTE proposes that the Aayalolo terminals and bus depots be developed as EV charging facilities. The Achimota terminal provides ultra-modern facilities and services that can be leveraged to deploy e-Buses. Subsidising charging costs and creating the enabling environment will attract the private sector to venture into e-Bus operations.

All the current corridors plied by the Aayalolo service have potentials for the deployment of e-Buses. GAPTE expects to design more concessions for private operators to come on board, given the high demand. According to the company, in terms of prioritised corridors, currently, Ashaiman

is the most patronised and profitable route. The Adenta corridor provides more road space for BRT operations. In contrast, the Amasaman corridor currently has an intelligent traffic system that allows the traffic light to give priority to Aayalolo buses. The CBD-Kasoa route also has one of the highest passenger demands.

GAPTE has concluded arrangements for contraflow design and is currently waiting for the board to roll it out in 2022. This is being done in close collaboration with a unit at the Motor Transport and Traffic Department (MTTD) of the Ghana Police Service to provide visibility and enforce bus operations on the dedicated lanes and contraflow system to be piloted on the CBD-Adenta route. They intend to deploy roadblocks and dispatch to lead the buses on the selected Adenta-CBD route.

2.4.3. Inter City STC Coaches Limited

Intercity State Transport Corporation (ISTC) is a transport company with national and international operations in Burkina Faso, Benin, Togo and Ivory Coast. The operations in West Africa contributed about 45% of revenue share until the COVID-19 pandemic, which occasioned the closure of land borders. This has affected the revenue generation of ISTC, and the company is negotiating with the government to resume its international operations in light of the border closure.

ISTC plans to expand and develop new national terminal operations due to the continuous border closure. They have recently added 8 new terminals, all strategically located where there is passenger demand. Currently, the Circle (Accra) and Asafo (Kumasi) terminals contribute about 35% of monthly revenue. New terminals have been opened at Labour and Abrepo in Kumasi and Kasoa in Accra. The Amasaman and Madina terminals are yet to start operations. Since the transport terminals are run by the MMDAs and GPRTU, ISTC works closely with the assemblies particularly in issuing permit and terminal allocation. Such close collaboration secured the Pokuase (Accra) and Asafo (close to VIP - Kumasi) terminals. Depending on who owns the lorry parks, ISTC makes the necessary arrangements, including monthly rents/leases.

Currently, the ISTC has 180 high occupancy coaches as a nominal fleet, out of which 153 are in operation across the country. In addition, they have 170 minibuses through partnerships with private operators, out of which ISTC owns six minibuses. These minibuses operate on corridors

including Aflao, Ho, Obuasi etc. On the Accra-Kumasi corridor, the ISTC has a minimum of 80 bus trips operating during off-peak days and a maximum of 100 bus trips during peak days.

Recently through a private lending arrangement with Agricultural Development Bank (ADB), ISTC procured 100 buses from Daewoo company in Ghana to enhance its operations, especially in the new terminals with high passenger demand. Per the arrangement, a two-year warranty was given, and the supplier is expected to provide staff training. In a previous supply arrangement with Scania buses, in addition to staff training and supply of service parts, the supplier provided some service vans and pick-ups. In terms of industry-standard requirements, towing trucks are expected to be provided as well.

Buses procured by the government are duty-free and the government ensures that the bus fares are affordable. Government has a lending arrangement with ISTC where they are expected to contribute a share of their revenue to a special account to defray the capital cost. The buses become the property of ISTC once they complete the repayment arrangement. The fare structure is usually set based on the operating cost. ISTC is engaging with the government to secure GHC 50 million to procure buses due to revenue loss from border closure due to COVID-19. They are expecting to receive around 100 buses to start within 2022. Private sourcing arrangements are also ongoing with some banks and OEMs.

Private operators of high occupancy buses that have entered into partnerships with ISTC pay 15% to ISTC as revenue share. For the operators of the minibuses, ISTC receives 10%. The existing revenue share arrangement is not profiting enough, but according to the company, it is to make the service available to passengers. For the ADB buses, the fare model used was renegotiated because of the revenue shortfall due to the land border closure. The company projects a revenue amount of GHC 147 million in 2022 for the 153 buses currently in operation. Through the Allianz partnership with the private operators, ISTC is estimated to receive GHC3.2 million while other shares, primarily from the minibuses, will account for GHC 17 million.

Regarding the e-Buses, ISTC expects a business model whereby the government procures the buses for them to operate under the current lending regime. The high passenger demand corridors will be given to Accra-Kumasi, Accra Tamale/Bolgatanga, and Accra-Takoradi. Since charging is a key issue, they are concerned that the required infrastructure will be put in place to support intercity journeys, leveraging the existing terminals, depots and rest stops. For example, for the

northern corridor, such as Accra Tamale/Bolgatanga, a charging facility could be installed at Kintampo. The company expects a stopping time of 30 mins to be sufficient for passengers to refresh themselves while the e-buses get charged. This suggestion is against the backdrop that the current 15 mins are not enough given that drivers always have to call and rush passengers to get on board. The stopping time at the rest stop will be part of the departure formalities. Since some terminals (e.g. Madina and Cape Coast) share the same compound with GOIL filling stations, ISTC anticipates that charging facilities can be quickly developed. They intend to commercialise the charging points to maximise profit.

ISTC supports the government e-bus project as a laudable initiative. Fuel cost is the biggest expenditure item, making up about 40% of operational cost, followed by the cost of spare parts and maintenance. They expect that the initial high purchase cost will be compensated for overtime by the low operation and maintenance costs. Since the government is spearheading the procurement process, they do not anticipate any significant challenges. They intend to deploy the e-buses on routes with high passenger demand and facilities supporting charging infrastructure. ISTC is concerned that the charging infrastructure and systems should be accessible, affordable and equitably deployed with backup power plants.

They anticipate that provision will be made for high-capacity batteries, spare batteries, quick chargers, recovery trucks, staff training and retooled workshops to support the deployment and operation of the e-Buses.

2.5. Financers and Donors

2.5.1. Ecobank

Ecobank Ghana Limited is currently the only Direct Access Entity to the Green Climate Fund (GCF) in Ghana. It works closely with the National Designated Authority to develop entity work programme, project concept notes, full funding proposals, and requests to bolster institutional and project development capacities. Ecobank Ghana received accreditation from the GCF in 2019. Ecobank Ghana's accreditation is for the medium level category. Hence they can finance and be part of projects to the tune of US\$250 million. Ecobank Ghana has an environmental, social risk category B that enables them to fund projects which have environmental impacts for which mitigation measures would be put in place. As a direct access entity, Ecobank Ghana qualifies to submit and execute GCF projects in Ghana. The bank deems the project prioritisation approval,

which is the first document the GCF requires before submitting a proposal, as a major limitation. It usually takes long for the NDA and Ministry of Finance to give such approvals.

The GCF investment criteria include:

- Impact
- Paradigm shift
- Sustainable development
- Recipient needs
- Gender
- Country ownership and political buy-in
- Efficiency and effectiveness
- Co-financing

The compliance measures and processes required to access GCF funding are enshrined in the GCF investment criteria document. The bank emphasized the need to consider environmental benefits such as the project lifetime impact, emission reduction and savings, reference to the direct and indirect benefits, etc. A gender action plan should be developed according to GCF's gender policy. The proposal must be financially viable such that the project is self-sustaining to guarantee its sustainability.

Per the investment criteria the project should be contributing to an adaptation or a mitigation project. This should be aligned to the Nationally Determined Contributions (NDCs), national policies, Paris Agreement among others. Hence for funders to have confidence in the project the business model should have both business and environment components. Thus particular emphasis should be placed on carbon savings and livelihoods. For example, how many buses will run on fossil fuel (diesel) and electricity, energy sources (renewables), dedicated lanes to promote an efficient bus rapid transit, how many jobs will be created or disputed, alternative livelihood strategies to minimize impact, differential gender impact and needs, etc. Also, they expect that the project should have less risk and is financially viable and can pay for itself within stipulated timelines.

Ecobank Ghana further noted that the grievance redress mechanism (GRM) is another key impact component of GCF projects. The GRM is a set of arrangements that enable local communities, employees, transport operators and other affected stakeholders to raise grievances with the investor

and seek redress when they perceive a negative impact arising from the investor's activities. Also, an environmental impact assessment will be required in this regard.

In terms of ongoing sustainable projects, Ecobank Ghana collaborates with African Development Bank (AfDB) on the Affirmative Finance Action For Women in Agriculture (AFAWA). Funding has been made available for the AFAWA led by AfDB with Ecobank Ghana being the implementing agency. The bank is also executing an accelerated solar project: the solar rooftop for households, irrigation cooperatives for micro, small and medium enterprises. They are currently going through the approval process for the accelerated solar action project. The Energy Commission were engaged as consultants who provided technical inputs for the project. The e-Bus project will be one of the maiden GCF projects that Ecobank Ghana is directly involved in.

The bank highlighted that although they can be involved in projects amounting to 250 million per their accreditation category, GCF will normally not fund the full amount of USD250 million. This will have to be complemented with co-financing. They advised that the MoT initiate discussions with other entities which are also interested in bringing funds to support the project. When funding agreement has been secured with GCF and the project's financial viability has been guaranteed, Ecobank can come in to invest some funds as co-financing for the project. They will follow their risk acceptance criteria for funding projects, including how viable the project is, the operating (business, technical) models of the transport operators, what do their revenues look like, the trade-offs, emission gains, timelines etc. These will constitute the mainstream risk analysis in line with the sustainability indicators of the bank. They indicated their previous engagement with Metro Mass Transit Limited (MMTL) through a government procured bus scheme.

Ecobank Ghana also mentioned that policy and regulation are essential considerations. They were concerned about whether the e-Mobility policy will undergo the necessary parliament processes for approval, and whether there will be a Legislative Instrument (L.I.) to guide its implementation? These concerns will have to be addressed before GCF will endorse the project for funding. Moreover, these concerns should be factored into the timelines as the process can be long. They noted that it has already taken them three years to finalise the first phase of one of their projects. They advised that every meeting and consultation with partners and stakeholders related to this project must be recorded and documented throughout the feasibility study phase. This is a requirement from GCF.

They further advised that we find similar projects elsewhere which can be localized to situate our project properly. They referred us to the GCF investment criteria, and programming manual that gives information as to how the project should be structured to meet the criteria.

3 First Level Concept Note

Based on the above user needs assessment and preliminary analysis of the current urban passenger transport landscape a first-level concept note is made. Its objective is to give a visualisation of the end-outcome from the project and firm key decisions in overall solution **sizing, structuring and financing**. The note, as shown in Table 6, will be updated in next phases of the project.

Table 6: First level concept notes on e-bus deployment in Ghana

<p>Funding (for infra for first e-Bus deployment) (Assumed)</p>	<ul style="list-style-type: none"> Assuming 15 million USD (~30 e-Buses with chargers and infra – assuming imports and taxes) If higher funding can be available, then larger floor sizes can be procured.
<p>e-Bus Type and fleet size (Assumed)</p>	<ul style="list-style-type: none"> For both operations e-buses can be from same OEM but due to operational differences the type, model and battery capacity of the e-bus can be different Following specifications are first level estimations, in next phase based on analysis specifications will get revised <p>For Intracity: 24 no. of e-Buses; standard 12m length; Air Conditioning²; Low floor³; ~250kWh battery</p> <p>For Intercity: 6 no. of e-Buses; standard 12m length; Air Conditioning; High floor coaches; ~350kWh battery</p>
<p>e-Bus Operator (Proposed)</p>	<ul style="list-style-type: none"> Based on the current understanding following operators are proposed for e-bus operations <p>For Intracity:</p> <ul style="list-style-type: none"> MMTL – A limited liability company (LLC) with 45% equity stake from Govt. of Ghana; in operations since 2003 (across Ghana); Own a 10 Acre depot in Accra (potential depot for electrification); Apart from main depot it has presence over other 2 depots in Adenta and CBD; Operates from key CBD terminal along with other terminals in Accra; backed by Ministry of Transport; Does intracity and intercity operations both at/from Accra. Given Govt. holding, it can host e-Bus asset. <p>For Intercity:</p> <ul style="list-style-type: none"> ISTC – A public bus transport company with 20% stake of Govt. of Ghana; In operations since 1909; Provides services on both national and international level; ISTC have one depot in Accra spread over 10.4 acre of land and one depot in Kumasi spread over 20 acres of land; ISTC runs 80

² Air condition (AC) for e-Buses can consume 20% battery energy capacity. Accra temperatures ranges between 21-31 degree Celsius. This can allow easier AC management and lighter load on the battery.

³ Low floor e-Buses typically comes heavier (by ~20%), causing higher energy consumption and lower mileage (kms in one full charge). It can be evaluated if Ghana needs Low floor e-Buses. OEMs compensate this by lowering payload capacity for low floor e-Buses.

	buses daily during off-peak days to 100 buses during peak days on Accra-Kumasi route; Comparatively low fares than private operators on the route																												
Depot selection	<ul style="list-style-type: none"> The list of potential depots and terminal for e-bus operations in Accra and Kumasi is given below. The final depot will be decided based upon consultation with stakeholders considering dead mileage of e-bus for final routes, space requirement for charging infrastructure and maintenance repair work. <p>Accra</p> <ul style="list-style-type: none"> Single depot with 1-2 terminals connected to the key routes is preferred for first e-Bus implementation for both intracity and intercity operations. Given current suggestion of two different operators for intercity and intracity following are the potential depots and terminals are proposed <table border="1" data-bbox="709 678 1837 1421"> <thead> <tr> <th data-bbox="709 678 758 824"></th> <th data-bbox="758 678 1010 824">Depot/Terminal</th> <th data-bbox="1010 678 1199 824">Ownership</th> <th data-bbox="1199 678 1388 824">Land Area & Bus Parking Capacity</th> <th data-bbox="1388 678 1837 824">Key Facilities</th> </tr> </thead> <tbody> <tr> <td data-bbox="709 824 758 1019">1</td> <td data-bbox="758 824 1010 1019">Kaneshie Depot</td> <td data-bbox="1010 824 1199 1019">MRTL</td> <td data-bbox="1199 824 1388 1019">10 Acre 250 Buses</td> <td data-bbox="1388 824 1837 1019"> <ul style="list-style-type: none"> Bus maintenance workshop A warehouse Fuel depot Bus washing bay Administrative office </td> </tr> <tr> <td data-bbox="709 1019 758 1138">2</td> <td data-bbox="758 1019 1010 1138">Tudu depot</td> <td data-bbox="1010 1019 1199 1138">MoT, Government of Ghana</td> <td data-bbox="1199 1019 1388 1138">Acreage unknown 78 buses</td> <td data-bbox="1388 1019 1837 1138"> <ul style="list-style-type: none"> 14 offices Drop off space for 32 passengers </td> </tr> <tr> <td data-bbox="709 1138 758 1292">3</td> <td data-bbox="758 1138 1010 1292">Adenta Depot</td> <td data-bbox="1010 1138 1199 1292">MoT, Government of Ghana</td> <td data-bbox="1199 1138 1388 1292">6 Acre 60 buses</td> <td data-bbox="1388 1138 1837 1292"> <ul style="list-style-type: none"> 18 administrative offices Restaurant & Supermarket Dedicated parking for 50 park-and ride vehicles </td> </tr> <tr> <td data-bbox="709 1292 758 1421">4</td> <td data-bbox="758 1292 1010 1421">ISTC Main Depot, Circle, Accra</td> <td data-bbox="1010 1292 1199 1421">ISTC</td> <td data-bbox="1199 1292 1388 1421">10.43 Acre 120 buses</td> <td data-bbox="1388 1292 1837 1421"> <ul style="list-style-type: none"> Guesthouse Training school Space for park and ride </td> </tr> </tbody> </table>					Depot/Terminal	Ownership	Land Area & Bus Parking Capacity	Key Facilities	1	Kaneshie Depot	MRTL	10 Acre 250 Buses	<ul style="list-style-type: none"> Bus maintenance workshop A warehouse Fuel depot Bus washing bay Administrative office 	2	Tudu depot	MoT, Government of Ghana	Acreage unknown 78 buses	<ul style="list-style-type: none"> 14 offices Drop off space for 32 passengers 	3	Adenta Depot	MoT, Government of Ghana	6 Acre 60 buses	<ul style="list-style-type: none"> 18 administrative offices Restaurant & Supermarket Dedicated parking for 50 park-and ride vehicles 	4	ISTC Main Depot, Circle, Accra	ISTC	10.43 Acre 120 buses	<ul style="list-style-type: none"> Guesthouse Training school Space for park and ride
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1	Kaneshie Depot	MRTL	10 Acre 250 Buses	<ul style="list-style-type: none"> Bus maintenance workshop A warehouse Fuel depot Bus washing bay Administrative office 																									
2	Tudu depot	MoT, Government of Ghana	Acreage unknown 78 buses	<ul style="list-style-type: none"> 14 offices Drop off space for 32 passengers 																									
3	Adenta Depot	MoT, Government of Ghana	6 Acre 60 buses	<ul style="list-style-type: none"> 18 administrative offices Restaurant & Supermarket Dedicated parking for 50 park-and ride vehicles 																									
4	ISTC Main Depot, Circle, Accra	ISTC	10.43 Acre 120 buses	<ul style="list-style-type: none"> Guesthouse Training school Space for park and ride 																									

	<table border="1" data-bbox="709 191 1843 321"> <tr> <td data-bbox="709 191 1010 321">(1.5 km away from #1 MMTL main depot)</td> <td data-bbox="1010 191 1199 321"></td> <td data-bbox="1199 191 1388 321"></td> <td data-bbox="1388 191 1843 321"> <ul style="list-style-type: none"> • Fuel Station • Passenger Lounge • Engineering workshop </td> </tr> </table> <p data-bbox="657 472 768 500">Kumasi</p> <ul style="list-style-type: none"> • One depot/terminal will be selected for intercity e-bus operation which will be having necessary charging infrastructure required for e-buses <table border="1" data-bbox="709 618 1812 1094"> <thead> <tr> <th data-bbox="709 618 768 764"></th> <th data-bbox="768 618 1010 764">Depot/Terminal</th> <th data-bbox="1010 618 1192 764">Ownership</th> <th data-bbox="1192 618 1394 764">Land Area & Bus Parking capacity</th> <th data-bbox="1394 618 1812 764">Key Facilities</th> </tr> </thead> <tbody> <tr> <td data-bbox="709 764 768 1000">1</td> <td data-bbox="768 764 1010 1000">Oforikrom Depot, Kumasi</td> <td data-bbox="1010 764 1192 1000">ISTC</td> <td data-bbox="1192 764 1394 1000">22.37 Acre 100 buses</td> <td data-bbox="1394 764 1812 1000"> <ul style="list-style-type: none"> • Valuation office • Mosque • Warehouse • Engineering workshop • Fuel station • Training school </td> </tr> <tr> <td data-bbox="709 1000 768 1094">2</td> <td data-bbox="768 1000 1010 1094">Asafo Terminal, Kumasi</td> <td data-bbox="1010 1000 1192 1094">ISTC</td> <td data-bbox="1192 1000 1394 1094">1 Acre 6 Buses</td> <td data-bbox="1394 1000 1812 1094"> <ul style="list-style-type: none"> • Washroom • Passenger lounge </td> </tr> </tbody> </table>	(1.5 km away from #1 MMTL main depot)			<ul style="list-style-type: none"> • Fuel Station • Passenger Lounge • Engineering workshop 		Depot/Terminal	Ownership	Land Area & Bus Parking capacity	Key Facilities	1	Oforikrom Depot, Kumasi	ISTC	22.37 Acre 100 buses	<ul style="list-style-type: none"> • Valuation office • Mosque • Warehouse • Engineering workshop • Fuel station • Training school 	2	Asafo Terminal, Kumasi	ISTC	1 Acre 6 Buses	<ul style="list-style-type: none"> • Washroom • Passenger lounge
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<p data-bbox="216 1102 436 1130">Routes selection</p>	<ul style="list-style-type: none"> • Potential 2-3 intracity routes and 1 intercity route • All routes will be connected to the depot/terminal • Finalisation of routes based on detailed survey, energy estimation for e-Bus and stakeholder consultations (part of detailed technical analysis) 																			

	Route	One way route length (km)	No of buses running per day (Pre-covid)												
	Intracity- MMTL														
	R1 CBD – Kasoa (via Kaneshie)	28	8												
	R2 CBD – Amasaman	21	12												
	R3 CBD – Adenta	21	24												
	Intercity - ISTC														
	I1 Accra - Kumasi	250	80												
Chargers Type and Charging strategy	<ul style="list-style-type: none"> • Fast DC chargers; plug-in type or down-pantograph (to be evaluated in detailed technical analysis, keeping in view future technology evolution and interoperability of chargers for heavy commercial vehicles) • Overnight Depot charging for intracity routes (and if required en-route Terminal charging, depending on routes detailed study) • Intercity e-Bus (250 kms one direction) will most likely need interim charging and two-end points charging (one at Depot in Accra, and other at Kumasi) 														
Operational Model	<ul style="list-style-type: none"> • Scheduled e-Bus operations (both intracity and intercity) • Scheduled charging at Depot/ Terminals to align with e-Bus passenger schedules 														
Business Model	<p>Existing business models for ICE buses:</p> <table border="1"> <thead> <tr> <th></th> <th>MMTL</th> <th>ISTC</th> </tr> </thead> <tbody> <tr> <td>Government of Ghana procures the buses and give to operators on lease</td> <td>YES</td> <td>YES</td> </tr> <tr> <td>Operator procures the buses through private partnership</td> <td>YES</td> <td>YES</td> </tr> <tr> <td>3rd party operating their buses under company franchise</td> <td>NO</td> <td>YES</td> </tr> </tbody> </table>				MMTL	ISTC	Government of Ghana procures the buses and give to operators on lease	YES	YES	Operator procures the buses through private partnership	YES	YES	3rd party operating their buses under company franchise	NO	YES
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Proposed business models for e-Buses

- TBD with below options; to be developed in discussion with stakeholders
- Similar business model will be preferred for both intracity and intercity operations

	e-Buses investment	e-Buses ownership	e-Buses operations	e-Buses maintenance	Chargers' O&M	Ticketing
Model-1 (Conventional)	Donor agency + GoG support	MMTL /ISTC	MMTL /ISTC	MMTL /ISTC	MMTL /ISTC	MMTL /ISTC
Model-2 (GCC)	e-Bus OEM + GoG support	e-Bus OEM	MMTL /ISTC	e-Bus OEM	e-Bus OEM	MMTL /ISTC
Model-3 (Hybrid)	Financing/ Leasing co. + GoG support	Financing/ Leasing co.	MMTL /ISTC	e-Bus OEM (contract from Leasing co.)	e-Bus OEM (contract from Leasing co.)	MMTL (paying to Leasing co.)

References

Infrastructure Consortium for Africa (ICA) (2016). Diagnostic Study and Project Development/Investment Pipeline for Urban Transport in Sub-Saharan Africa: Project Investment Proposals Report Accra (Ghana) Draft

Appendix 1: Stakeholders engaged for the user needs assessment

	Institution/Organisation	Designation
1	Kumasi Metropolitan Assembly (KMA)	Head of Transport
2	Accra Metropolitan Assembly (AMA)	Head of Transport
3	Metro Mass Transit Limited (MMTL)	Head, Corporate Planning
4	Greater Accra Passenger Transport Executive (GAPTE)	Operations Manager
5	Intercity State Transport Company (ISTC)	Deputy Managing Director Operations