FISCAL INCENTIVES TO SCALE UP ADOPTION OF ELECTRIC BUSES IN INDIAN CITIES

FINAL REPORT: VOLUME- I

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Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support renewable energy, energy efficiency and the adoption of sustainable transport solutions.

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LIST OF ABBREVIATIONS

AICTSL	:	Atal Indore City Transport Service Limited
AJL	:	Ahmedabad Janmarg Limited
AMC	:	Annual Maintenance Contract
ASTC	:	Assam State Transport Corporation
BEB	:	Battery Electric Bus
BEST	:	Brihanmumbai Electric Supply and Transport
BMTC	:	Bangalore Metropolitan Transport Corporation
CARB	:	California Air Resources Board
DHI	:	Department of Heavy Industries
EoI	:	Expression of Interest
EV	:	Electric Vehicles
FAME	:	Faster Adoption and Manufacturing of Electric (&Hybrid) Vehicles
FTA	:	Federal Transit Authority
GCC	:	Gross Cost Contract
IPT	:	Intermediate Public Transport
JCTSL	:	Jaipur City Transport Service Limited
JKSRTC	:	Jammu and Kashmir State Road Transport Corporation
JnNURM	:	Jawaharlal Nehru National Urban Renewal Mission
LCC	:	Life Cycle Cost
MCA	:	Model Concession Agreement
NEV	:	New Energy Vehicle
PHEB	:	Plug-In Hybrid Electric Bus
PTSO	:	Public Transport Service Obligation
RE	:	Renewable Energy
RfP	:	Request for Proposal
SLA	:	Service Level Agreement
SPV	:	Special Purpose Vehicles
SSEF	:	Shakti Sustainable Energy Foundation
STU	:	State Transport Undertakings
UITP	:	International Association of Public Transport
WBTCL	:	West Bengal Transport Corporation Limited

1 INTRODUCTION

1.1 BACKGROUND

The Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme launched in the 2015 kick-started the adoption of electric vehicles in India by providing financial incentives for Electric Vehicle (EV) purchase, charging infrastructure deployment and Research and Development (R&D) of electric vehicles. Coinciding with the end of phase I of FAME, Government of India (GoI) had announced the phase II of the scheme in April 2019, to accelerate India's transition from fossil fuel-based vehicles to zero emission vehicles. The FAME II scheme is rolled out with an overall outlay of INR 10,000 crores spread over three years i.e. between 2019-20 and 2021-22, to provide demand incentives for Electric Vehicles (EVs).

With an objective to maximise passenger-kms of travel electrified, the scheme prioritises electrification of public transport vehicles which cater to the majority of passenger demand in Indian cities. Approx. 35% of the total incentive amount i.e. INR 3,545 crores allocated towards electric bus (e-bus) incentives. A further allocation of INR 2,500 crores i.e. 25% of the fund is allocated to electric three-wheelers which provide Intermediate Public Transport (IPT) or paratransit services complementing public transport systems. With this increased emphasis on electrification of public transport (e-buses), it is important that we strategically plan for the subsidies and deployment efforts. This report is prepared towards creating enabling mechanism to scale up adoption of e-buses in Indian cities.

1.2 THE NEED TO INCENTIVISE ELECTRIFICATION OF BUSES

In the Indian context, incentivising electrification of public urban buses offers many benefits:

i) Buses are the primary form of public transport in India and they carry 20-40% of urban trips in many large cities. Electrifying buses will result in achieving the largest passenger-km of electrification possible

ii) Majority of urban buses in India are owned and operated by Government backed State Transport Undertakings (STUs) and Special Purpose Vehicles (SPVs). Therefore, targeted deployment at these venues can transform the entire urban bus sector. Previous government schemes like the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) have already demonstrated this

iii) The depot spaces available with bus operators offer adequate space for charging infrastructure thereby easing the implementation process

iv) City bus services have the highest vehicle utilisation among urban vehicles due to their daily operations of 200-250 km. Given the lower operational cost of EVs they offer the shortest payback period among all vehicles

Government of India (GoI) has initiated efforts in this direction as a part of Phase I of the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme. The scheme provided significant impetus towards promoting clean vehicle technologies in the public transport systems across Indian cities. Operators can now leverage the larger scale of procurement under FAME II to ensure efficient financing and procurement arrangements which yields in competitive prices. However, it is imperative that we create an enabling environment by preparing strategies/incentives/mechanisms to enable large scale adoption of e-buses through right design of subsidy scheme and procurement mechanisms at the State and City levels.

The e-bus subsidy component under FAME-I has been riddled with issues that have prevented the smooth roll-out of the scheme. Two significant reasons for these issues are:

- Design of the scheme: The design of the E-bus scheme did not consider the operational conditions of public transport agencies. This was responsible for issues such as a procurement bias that prevented PT agencies from leasing out the e-bus operations
- Inferior tender quality: Capacity limitations of public transport agencies and their lack of understanding of the e-bus operations has resulted in inferior tender documents.

Therefore, as we are planning and preparing for the FAME-II scheme it is important to ensure alignment of objectives between GoI and the recipient states and cities. The incentive mechanism needs to be appropriately utilised by public transport agencies to achieve robust implementation of the scheme.

1.3 PROJECT INTRODUCTION

International Association of Public Transport (UITP) with support from Shakti Sustainable Energy Foundation (SSEF) has undertaken the project on "Creating enabling mechanisms to scale up adoption of electric buses (e-buses) in Indian cities with the following objectives:

- To inform FAME-II guidelines to adequately address issues faced during FAME I
- To improve the capacity of bus agencies in procuring e-buses

The key activities taken up through the project include:

i. Review of international best practices on EV subsidy schemes

ii. Evaluate FAME I e-bus subsidy
iii. Inform FAME-II guidelines for e-bus subsidy
iv. Develop guidance material for PT agencies on contracting of E-buses
v. Dissemination of findings with central government agencies relate to FAME scheme and organize training programs for PT agencies to build their capacity on contracting, procurement, planning and operation of e-buses

Accordingly, this report compiles the first three activities of the project. The activities iv and v of the project are covered in Volume II report titled: "Procurement Mechanisms to Scale up Adoption of Electric Buses in Indian cities".

1.4 OUTLINE OF THE REPORT

The report discusses fiscal incentives to scale up adoption of electric buses and provides a review of the previous procurement practices in India. Chapter 1 provides a brief introduction to the project and its objectives. Chapter 2 is an overview of the electric bus funding in India through FAME-I. Chapter 3 is the global review of financial incentives for electric bus deployment. Chapter 4 focusses on the review of previous electric bus tenders called by various agencies followed by Chapter 5 concluding on a comparison of FAME-I learnings against FAME-II and a way forward.

2 ELECTRIC BUS FUNDING IN INDIA

2.1 BUS FUNDING PROVISIONS UNDER FAME-I

Phase I of the FAME scheme was anchored by the Department of Heavy Industries (DHI), Government of India. The scheme had a total outlay of INR 795 crores, which has been revised to INR 895 crores recently[1]. Out of this, DHI has initiated support to induct 390 electric buses with a funding support of up to INR 390 crores. The framework to deploy financial incentives is discussed below.

i) **Amount of subsidy**: The amount of subsidy decided to be per-bus and was provided in two levels, as a function of localisation of the product achieved by the manufacturer. Table 1 summarises the subsidy structure adopted by DHI.

Table 1 Subsidy design for electric buses under FAME I

Level	Percentage of localization	Subsidy
Level 1	Min 15%	60% of purchase cost or INR 85 Lakhs, whichever is lower
Level 2	Min 35%	60% of purchase cost or INR 100 Lakhs, whichever is lower

ii) **City selection process**: DHI invited Expressions of Interest (EOI) from all cities with a population of more than 1 million inhabitants and smaller cities which are State capitals. A screening process based on readiness of the city to induct electric buses was applied to finalise the 11 cities eligible for e-bus funding i.e. Delhi, Mumbai, Kolkata, Bangalore, Hyderabad, Ahmedabad, Jaipur, Indore, Lucknow, Jammu and Guwahati

iii) **Number and type of buses funded in cities**: A fixed number of buses were allocated to these cities i.e. 9 of the 11 cities were allocated 40 buses each while the hilly cities of Jammu and Guwahati were offered 15 buses each for subsidy. Delhi opted out of the scheme and their quota was allocated to Bangalore.

iv) **Business model for procuring electric buses**: Cities were allowed to choose the business model of their choice for procuring these buses. Consequently, five cities chose the Gross Cost Contract (GCC) model for procurement while five other preferred an outright purchase model.

[1] https://dhi.nic.in/writereaddata/UploadFile/FAME%20Notification(Final).pdf

a. In case of outright purchase, DHI provides 60 percent subsidy and the rest is provided by the cities

b. For cities opting for GCC model, 60% of the capital cost of the bus is covered over a period 3 years, in three instalments of 20% each in each fiscal

v) **Vehicle technology choice**: The configuration of the vehicle i.e. standard size (12m) or midi (9m), air conditioning, battery and range requirements etc. were decided by the cities according to their own requirements

Based on the bidding carried out across the country, Table 2 provides a summary of the cities selected, the number and type of buses identified after the tenders and their vendors. The next section of the report discusses on the international practices on electric bus funding.

Table 2 Summary of e-bus procurement under FAME I

City	Number of Buses	Bus-Type	Bus Agency	Procurement model	Shortlisted Bidder
Bangalore	60 AC	12m	Bengaluru Metropolitan Transport Corporation	Gross Cost Contract	Goldstone-BYD
	20 Non-AC	9m			
Mumbai	20 AC	12m	BEST Undertakings	Gross Cost Contract	Goldstone-BYD
	20 Non-AC	9m			
Hyderabad	40 AC	12m	Telangana State Road Transport Corporation	Gross Cost Contract	Goldstone-BYD
Ahmedabad	40 Non-AC	9m	Ahmedabad Janmarg Limited (AJL)	Gross Cost Contract	Ashok Leyland Limited
Jaipur	40 AC	9m	Jaipur City Transport Services Limited	Gross Cost Contract	Tata Motors Limited
Indore	40 AC	9m	Atal Indore City Transport Services Limited	Outright Purchase	Tata Motors Limited
Lucknow	40 AC	9m	Lucknow City Transport Services Limited	Outright Purchase	Tata Motors Limited
Kolkata	20 AC	9m	West Bengal Transport Corporation Limited	Outright Purchase	Tata Motors Limited
	20 AC	12m			
Jammu	15 AC	9m	Jammu and Kashmir State Road Corporation	Outright Purchase	Tata Motors Limited
Guwahati	15 AC	9m	Assam State Transport Corporation	Outright Purchase	Tata Motors Limited

3 GLOBAL REVIEW OF FINANCIAL INCENTIVES FOR ELECTRIC BUSES

In this section, we present a global review of incentives offered for electrification of bus fleets as an input to National and State level incentive designs in India. China, European Union (EU) and the United States of America (USA) have the most far-reaching incentives for electric buses. Hence their incentive structures and their evolution over the years are summarised in following sub-sections.

3.1 INCENTIVES FOR ELECTRIC BUSES IN CHINA

Electric buses in the People's Republic of China (PRC) have been promoted since 2009 as a part of their New Energy Vehicle (NEV) mandate along with support offered to hydrogen fuel cell technologies. The NEV mandate also covers private vehicles, taxis, Government vehicles and freight vehicles and is implemented through Government bodies at National, Provincial (State) and City levels in partnership with the Industry. The following are some of the key stakeholders of the mandate:

- National Development and Reform Commission
- Ministry of Finance
- Ministry of Industry and Information Technology
- Ministry of Transport
- National Government Offices Administration
- National Energy Administration
- City Governments and transport authorities
- Automobile manufacturers
- Battery manufacturers

3.1.1 PHASE-WISE DEVELOPMENT OF E-BUS SUBSIDIES IN CHINA

The subsidies for new energy buses have evolved in three phases since 2009.

i) **Phase I-2009-2012:** The first phase of the scheme known as "Ten Cities, Thousands of Vehicles" started in 2009 covered Battery Electric Buses (BEB), Plug-in Hybrid Electric Buses (PHEB), Hybrid buses, Trolley buses and Hydrogen fuel cell buses.[2] Subsidies were

[2] **Standard Vs Plug-in Hybrids:** Plug-in hybrid buses are very popular in the China due to the phase out of subsidies for standard hybrids. The main technical difference between plug-in hybrids and standard hybrids is that the former can

given directly to bus manufacturers which subtracted them from the final selling price to operators.

ii) **Phase II- 2003-2015:** The second phase of e-bus subsidies had two key improvements over the first phase:

a. The subsidies were discontinued for standard hybrid buses while it is continued for the other new-energy technologies
b. Since 2013, the central Government also funded charging infrastructure, the subsidy for which was transferred directly to pilot cities to develop the infrastructure

iii) **Phase III-2016-2020:** The third phase of the NEV subsidies which are currently in place begun in 2016, with an update to the scheme in 2017. Subsidies are given for battery electric buses, plug-in hybrid buses, ultrafast charging electric buses, and electric trolleybuses.

a. The government has gradually reduced subsidies on e-buses and will further reduce incentives in 2019–2020. After 2020, all subsidies on LCBs are likely to be phased out
b. Simultaneously, the Government introduced operational subsidies to transit operators and reduced the subsidies on Diesel since 2017
c. The updated incentive scheme since 2017 also distinguished subsidies by vehicle type and energy consumption.
d. The subsidy is based on 10–12 meter (m) bus as a standard vehicle. The subsidy level of pure electric buses of other lengths can be calculated relative to the 10–12 m bus based on the actual bus length and the energy consumption.
    i. A bus with a length of less than 6 m is given 0.2 times the subsidy of a standard vehicle
    ii. A bus between 6–8 m is given 0.5 times the subsidy
    iii. A bus between 8–10 m is given 0.8 times the subsidy
    iv. Double-deckers or longer buses are given 1.2 times the subsidy.

be charged directly at the grid. However, operators never charge their plug-in hybrids at the grid due to their small battery size and the operational complexity of charging them. Thus, bus operators use them in the same manner as standard hybrids. In this context, plug-in hybrids have the same environmental and financial impact as a standard hybrid, while costing 20% more without subsidy. Therefore, the purchase of plug-in hybrid buses is not generally recommended due to their incremental cost and their limited additional value compared with standard hybrids.

e. Pure electric drive range. A bus with a pure electric drive range of above 250 km receives 40%–50% more subsidies than a bus with an electric drive range between 100–150 km
f. Bus efficiency. The more efficient the bus in terms of energy consumption per net load (kWh/ton-km), the higher the subsidy level. The subsidy difference between the lowest defined efficiency category and the highest one is nearly a factor of 2
g. A distinction has also been made relative to the speed of charging, with higher subsidies given if batteries can be charged at a shorter time

The subsidies announced for vehicle length and energy consumption categories are presented in Table 3.

Table 3 Electric bus subsidies in China since January, 2017

Vehicle Type	Energy Consumption per Unit Carrying Mass E_{kg} in Wh/km.kg	Standard Vehicle (10-12m bus)					
		Electric Driving Range (constant velocity method, km)					
		6-19	20-49	50-99	100-149	150-249	>=250
Pure Electric Bus	E_{kg} < 0.25	20	26	30	35	42	50
	0.25≤ E_{kg} <0.35	20	24	28	32	38	48
	0.35≤ E_{kg} <0.5	18	22	24	28	34	42
	0.5≤ E_{kg} <0.6	16	18	20	25	30	36
	0.6≤ E_{kg} <0.7	12	14	16	20	24	30
Plug-in hybrid passenger bus		/	/	20	23	25	

/=not applicable; CNY= Chinese yuan, E_{kg}= energy consumption per kilogram, kg=kilogram, km=kilometre, m=meter

Example: 10-12m bus with electric drive range of 120 km and an E_{kg} of 0.4 receives a subsidy of CNY280,000; an electric bus with the same drive range and same E_{kg} but wth a size of 7. Would receive a subsidy of CNY 140,000

Source: ADB. 2018

3.1.2 IMPACT OF SUBSIDIES IN CHINA

The high subsidies combined with regulatory incentives led to a rapid uptake of electric buses in China. While the previous years witnessed significant annual growth, in 2017, sales of BEBs dropped by 20% due to reduced national, provincial, and local governments' subsidies for new energy buses and tightened regulations concerning subsidy disbursements. By the end of 2017, around 380,000 electric and plug-in hybrid buses were plying the streets of cities in China.

Multiple types of electric buses are available in China, including BEBs charged only overnight, BEBs charged overnight and fast charged during the day, opportunity charge electric buses charged at the end of routes or at stops along the route, BEBs operating with battery swapping technology at terminals and electric trolleybuses which can also operate without overhead wiring.

As of 2018, many cities in China have stopped purchasing conventional fossil fuel-powered buses. The current fleet is composed of around 40% New Energy buses, of which around half are pure electric buses. Most cities are targeting a 100% LCB fleet within the next 2–3 years and many have as their goal a pure electric fleet by 2021. The following figure presents the sales of electric buses in China and their share within the total bus fleet size.

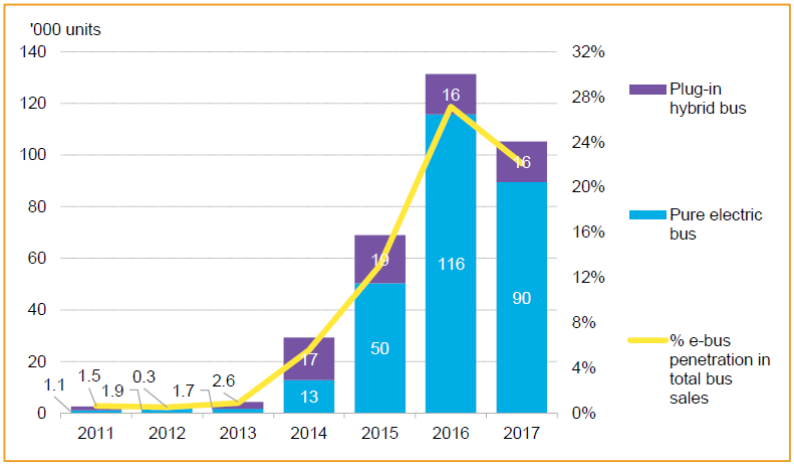

Figure 1 Electric bus sales in China

(Source: BNEF, 2018)[3]

3.1.3 IMPACT OF SUBSIDY STRUCTURE ON THE E-BUS FLEET CHARACTERISTICS

Bus fleets in typical cities in China are composed of around 60% standard 10–12 m buses and 40% units smaller than 10 m. Only few cities operate fleets of three-axle 14 m buses, including double-deckers and articulated 18 m units. Figure 2 presents the bus fleet type break of alternative vehicle technologies. Most of the hybrid buses are 10–12 m units. Majority of the trolley buses are also 12 m units, with some articulated 18 m buses. On the other hand, BEBs are dominated by small buses i.e. more than 60% of them less than 10m with only 40% being 10–12 m units, and 14 m double-decker units only in Beijing. BEBs are mostly used on shorter

[3] https://about.bnef.com/blog/electric-buses-cities-driving-towards-cleaner-air-lower-co2/

routes with less passenger demand compared with conventional buses. The se fleet characteristics can be explained by the following reasons:

i) Buses longer than 12 m receive only 20% higher subsidies than 10–12 m units while they cost approximately 2.5 times more

ii) The driving range criteria for subsidy has resulted in cities preferring BEBs over trolley buses, which have smaller battery size given their as they operate mostly with catenary cables which provide overhead charging

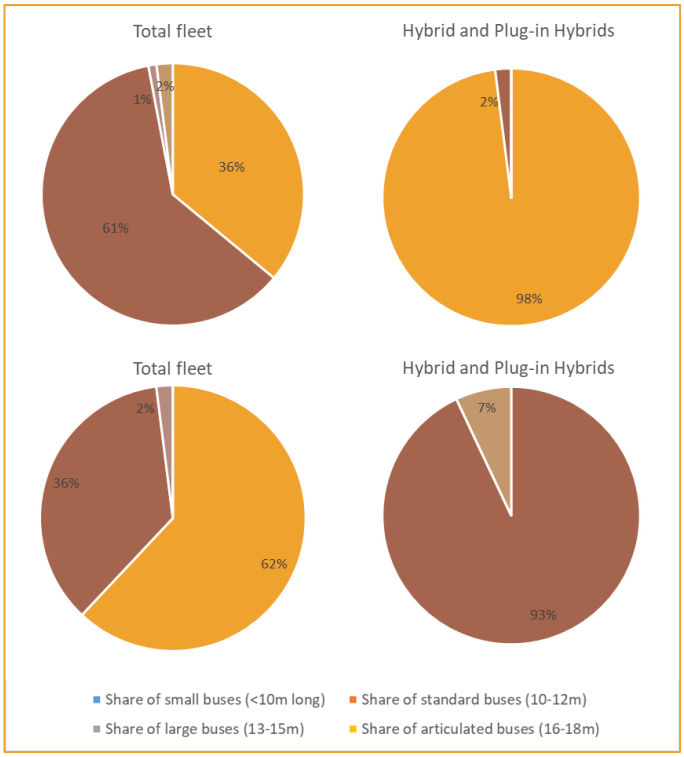

Figure 2 Bus size distribution of electric bus technologies in China

(Source: ADB, 2018)**Error! Bookmark not defined.**

3.1.4 ISSUES FACED WITH E-BUSES IN CHINA

Cities in China faced the following key issues during their transition to electric buses

i) **Battery performance uncertainty**: While manufacturers claim a driving range of 280 km with a battery pack of 250 kWh, the actual operational range was often only 200 km in year 1, with the performance dropping further during summer months. The battery performance dropped further to 130 km in year 8 during summer. The actual driving range and the claimed theoretical driving range can be a factor of

2 apart due to variance between manufacturer claim and real-world conditions like decreasing performance of batteries over time, air conditioning, heady loads, gradients etc. The smaller range will require more frequent recharging during the day, which requires the operator to deploy more fleet to meet the service requirements. The extra fleet and its supporting infrastructure will add to the cost of the operator

ii) The subsidies led to a large number of smaller (<10m) and standard size (10-12m) buses, in some cases even replacing the larger buses. Therefore, operators have to deploy more buses, more staff to manage the extra buses and redesign the network to have shorter routes. In summary the current subsidy structure led to the bus services moving towards lesser operational efficiency

iii) In many cities, the daily mileage of e-buses was observed to be half of the earlier system with conventional vehicles. This was partly due to the day-time recharge required for the bus. Further, it was also observed that the availability of subsidy led to cities purchasing more buses than required, thereby leading to the underutilisation of the fleet

3.1.5 SUMMARY OF E-BUS SUBSIDIES IN CHINA

Currently, subsidies in China are related to the length of the bus, electric driving range, bus efficiency, and bus technology used (e.g., whether it is opportunity charged or fast charged). The current policy is not technology- and size-neutral, but favours smaller buses with moderate to large battery sizes. This resulted in suboptimal technology and bus choice by bus operators. Also, high up-front subsidies potentially led to a too large fleet and an underutilization of units. A more effective incentive scheme would be related to passenger per kilometre performance by electric buses as technology-, size-, and system-neutral, and incentivizing the use of electric buses in an adequate and cost-effective manner.

3.2 ELECTRIC BUS SUBSIDIES IN THE EUROPEAN UNION (EU)

The electric bus phenomenon in Europe is a more recent development compared to the Chinese context. The first set of trails were conducted in 2014 as a part of the Zero Emission Urban Bus (ZeEUS) initiative funded by the European Commission. Many cities started with pilot projects of 8-10 buses to test the suitability of alternative electric bus technologies for their context. After conducting adequate number of trails and developing confidence in the technologies, many cities are now scaling up their e-bus deployments. The funding for the initial deployment was secured through grants or loans provided at various levels of Governance i.e.

i. Grant or loan provided by European Union (EU) level funding instruments like Horizon 2020, Fuel cell joint undertaking, European regional development fund, CIVITAS etc.
ii. Grant or loan provided by the National Government of individual countries
iii. Grants from the city or local transportation authorities

Further, funding for e-buses in EU can be broadly classified under the following categories:

i. Technical assistance
ii. Research, Development and Innovation
iii. Procurement and Infrastructure
iv. Operations

The amount of funding available varies significantly across cities based on the nature and source of funds received. In this section we present the specifics of funding support provided to promote e-buses in Europe.

3.2.1 APPROACH FOR E-BUS PILOTS IN EUROPE

EU has adopted a systematic approach towards piloting electric buses. They have recognised up front that introduction of zero-emission bus systems requires a systemic adaptation into the local bus operations context, that is not limited to just procurement of the vehicles. The pilots also demonstrated how the entire ecosystem for electric vehicles has to be built. Accordingly, the following approach was adopted:

i. **Preparedness of the city**: Most European cities have a Public Transport Authority (PTA) which manages the Public Transport Service Contracts (PTSCs) with the operators. These PTAs initially conducted detailed feasibility studies, cost-benefit analyses, charging infrastructure planning in collaboration with the energy providers and prepared the tender documents for the electric buses.

ii. **Vehicle selection for the pilot**: Vehicles selected were plug-in hybrids, battery full electric or battery trolley bus i.e. an important part of their operation was led in full electric propulsion. Further demonstration used market ready vehicles and not prototype vehicles.

iii. **Number of vehicles for the pilot**: The number of vehicles were selected for the demonstration in such a way that they were enough to perform a meaningful and statistically valid evaluation of the real impact of the solution on the operations

iv. **Operating conditions:** Different geographical, climatic, environmental and operational conditions were represented in the demonstrations

v. **Capacity building of facilities and staff**: The operation, depots, repair and maintenance facilities as well as the training of staff were conducted for the operation of zero-emission buses

3.2.2 E-BUS PILOT DEMONSTRATION PROJECTS AND KEY FINDINGS

The ZeEUS initiative selected 10 cities out of the 45 interested cities for the e-bus -Barcelona, Bonn, Cagliari, London, Muenster, Paris, Plzen, Eindhoven, Stockholm and Warsaw. The demonstrations are accompanied by local and horizontal evaluations, with the goal to provide decision makers with the necessary tools to evaluate the economic, environmental, operational and societal feasibility of electric urban bus systems. The ZeEUS project provided decision makers with the tools to determine 'if' the electric buses are needed for the city, 'how' and 'when' to introduce electric bus systems into the core urban network.

The 10 pilot initiatives demonstrated the applicability of electric buses in various contexts. Preliminary findings of the demonstrations indicated the five challenges to the introduction and scale up of electric buses:

- Cost of procurement, charging infrastructure, maintenance, system change etc.
- Operational changes like lower reliability and flexibility as compared to diesel buses
- A changed approach to tenders and contracts that take into consideration risk sharing between public transport operators and authorities as well as the differences in tendering
- Lack of interoperability especially for fast-/ opportunity charging
- Energy provision depending on the quality of the network as well as costs for electricity

3.2.3 NATIONAL LEVEL INITIATIVES TO SCALE UP E-BUS PILOTS FOR FLEET-LEVEL IMPLEMENTATION ACROSS EUROPEAN UNION (EU)

Building on the success of the pilot demonstration projects, various European countries have initiated funding instruments to promote electrification in bus fleets as a part of their energy and environmental performance improvement targets. This included National level initiatives and in some cases City level initiatives as well.

Table 4 presents an overview of the various National level funding instruments and their category of funding across the EU. Majority of the initiatives were structured as grants and not as loans, primarily because generating loans would require an accurate estimation of the risks involved in the project. Because of the lack of adequate understanding of the e-bus sector most of the initiatives were structured as grants. Most countries focussed on funding procurement and infrastructure development towards supporting the upfront deployment of the fleets. However, the focus on funding the gaps in operational viability has been limited.

Table 4 National level incentives for e-buses across EU

Country	Description of funding instrument	Grant / Loan	Category of funding			
			Technical assistance	Research, Development, Innovation	Procurement& infrastructure	Operations
Germany	National Hydrogen and Fuel Cell Technology Innovation Programme Phase II	Grant		X	X	
	National Climate Protection Initiative: Renewably Mobile	Grant			X	
	Funding Directive on Electro mobility	Grant	X		X	
	Model Regions for Electric Mobility	Grant		X	X	
	Electro mobility showcase	Grant		X		
Italy	Funding program for the regions' efforts to improve air quality through the modernization of the fleet for the local public transport	Grant			X	

Poland	Additional National funds for EU projects to fund viability gap in the Contracts, subject to agreement between National and Local Government on the developmental goals of the project	Loan			X	
	New scheme being launched to incentivise procurement and manufacturing. It'll be a combination of EU and National funds				X	
Spain	MOVELE and MOVEA- National funding instruments for Electric vehicles	Grant			X	
Sweden	National level support and industry partnership for Research & Development	Grant		X	X	
	Direct purchase incentives to be available for cities. Cities issue public service contracts for e-buses and claim support from the Government	Grant			X	
United Kingdom	Various National level funding incentivising different components of electrification i.e. fleet, charging infrastructure etc.	Grant	X		X	X

While e-bus initiatives picked up pace across countries, United Kingdom (UK) and Germany were the countries with the largest National level funding made available for e-buses. The following is a brief summary of their schemes:

UNITED KINGDOM (UK)

United Kingdom launched its 'Low Emission Bus Scheme' in 2015 with a budget outlay of £30 million to be spent between 2015 and 2020. This scheme replaces the earlier scheme known as the 'Green Bus Fund' established in 2009 which, in its four rounds from 2009 to 2013, financed

more than 1,200 buses. 89% of these buses were hybrids, 7% biogas and 4% pure electric vehicles. 60% of the buses were double-decker buses while the remaining 40% were single-decker buses.

The key feature of these funds is that they operate as challenge funds i.e. a competitive financing facility where the projects requiring the least financing for a given solution are incentivised. A maximum of 90% of the cost difference between a zero-emission and a conventional bus was paid through the scheme. Additionally, operators are paid an extra incentive of 6 pence per km of low-emission buses.

GERMANY

Government of Germany has launched a scheme with a budget of € 70 million to be spent between 2018 and 2021. The scheme 80% of the additional cost of investments by the operators if they acquire five or more all-electric buses. The funding covers the following items

i) Incremental cost of electric and plug-in hybrid buses over conventional vehicles

ii) Development cost of charging infrastructure

iii) Training and development of new service centres

iv) The buses need to be operated with electricity from renewable sources

CITY LEVEL INITIATIVES

In addition to the National level incentives detailed above, some cities had to generate additional finances to keep the e-buses operational. As explained above, even though the capital investments are made through National level funds, e-buses required additional investments from cities due to the upkeep of additional facilities and staff required for the new technology. These costs are currently being borne by the local Public Transport Authorities. Many of them have expressed the need for funding for operational subsidies to make scaling up of e-buses a success.

3.2.4 IMPACT OF E-BUS SUBSIDIES IN EUROPE

As a result of the above-mentioned initiatives, Europe currently has about 2,000 electric buses across various technologies. United Kingdom, with 17% of the total European fleet, has the largest fleet followed by the Netherlands with 14%, Poland, France, Germany and Italy with

around 8% each. Belgium, the Czech Republic, Sweden, Ukraine and Spain have shares of 3-6%. Figure 3 and **Error! Reference source not found.** present the technology choices of electric buses deployed across Europe and their vehicle types. Battery Electric buses dominate the market followed by trolley buses and plug-in hybrids. Majority of the buses inducted are in the 12-13m category which is in contrast to the Chinese case where majority of the battery electric buses were less than 10m long.

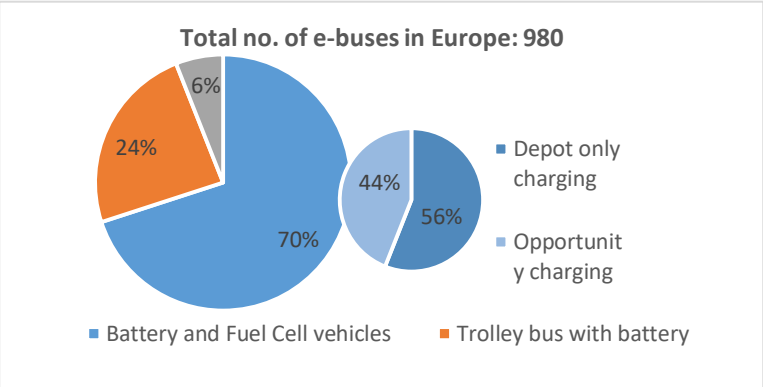

Figure 3 Electric bus technologies in Europe, 2017

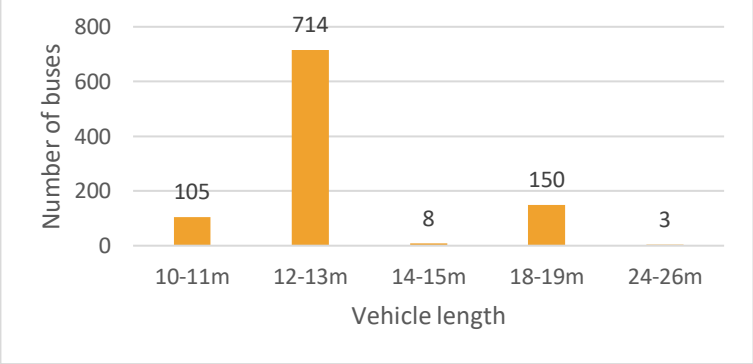

Figure 4 Vehicle length distribution of electric buses in Europe (Source: ZeEUS, 2017)

3.2.5 NEXT STEPS FOR E-BUS DEPLOYMENT IN EUROPE

In order to scale up the success of pilots and accelerate deployment of electric buses, the European Commission launched the 'European Clean Bus Deployment Initiative' in 2017, with a Declaration of Intent on promoting large-scale uptake of clean, alternatively fuelled buses. The Declaration is the first part of a three-step process of the 'Clean Bus Deployment Initiative' which includes the following items:

i) Step 1: Declaration of the endorsement of the signing cities, industry players, and sector associations, among them UITP, to accelerate the roll-out of clean buses.

ii) Step 2: Creation of a Deployment Platform that brings together public authorities, transport operators, manufacturers and financing organisations to exchange knowledge and issue recommendations on guiding the process now under development.

iii) Step 3: Creation of an Expert Group, of which UITP is member, bringing together stakeholders from the demand and supply sides to consolidate expertise on the technological, financial and organisational issues needed to accelerate the deployment of clean buses across Europe.

In addition to the above initiative, EU member states including France, The Netherlands, Germany, Italy, the UK and Poland have set up, or are setting up, national legal frameworks to promote vehicles with reduced environmental impact and energy consumption. Local initiatives, including the establishment of low- and ultra-low-emission zones, are also encouraging deployment of electric buses in cities.

3.3 E-BUS INITIATIVES IN THE UNITED STATES OF AMERICA (USA)

USA has about 300 electric buses across the country which is much smaller compared to China and the EU. However, in 2017a $284 million grant program was started by the Federal Transit Authority (FTA) for the purchase of clean diesel buses as well as zero-emission buses, with a federal share of costs of up to 90%. The FTA requires that all capital procurements meet FTA's "Buy America" requirements, which demands that all manufactured products be produced in the United States.

Additionally, the State of California, through the California Air Resources Board (CARB) has set a phase-wise target of achieving a 100% zero-emission transit system in the state by 2040. The incentives will be offered to large bus fleets (more than 100 buses) from June 2020, while smaller fleets will be eligible for subsidy from 2023. The summary of the subsidy offered to various vehicles is given in Table 5. CARB has approved financing plan of up to 50% of the e-bus cost for vehicles of Gross vehicle Weight (GVW) of more than 14000lbs (6350 kg) and length more than 7 m, but doesn't include trolley buses. Smaller buses are eligible for subsidy subject to conditions like high annual mileage of 320,000 passenger mileage per year for larger fleet operators and 180,000 passenger miles per year for smaller transit agencies. The scheme also has bonus incentives for additional features like induction of fuel cell vehicles and utilisation of Renewable Energy (RE) for charging needs.

Table 5 Subsidy plan for transit agencies in California

Bus length and Bus Type	Base Vehicle Incentive		
	1 to 100 vehicles[1]		> 100 vehicles
	Outside DAC	Within DAC	
20 ft - 24 ft	$80,000	$90,000	$35,000
25 ft - 29 ft	$90,000	$100,000	$40,000
30 ft - 39 ft	$120,000	$135,000	$55,000
40 ft - 59 ft	$150,000	$165,000	$70,000
≥ 40 ft. Double decker Bus	$175,000	$190,000	$82,250
≥ 60 ft. Zero-Emission Battery-Electric Articulating Transit Bus	$175,000	$190,000	$82,250
≥ 40 ft. Hydrogen Fuel Cell Electric Bus	$300,000	$315,000	$142,500

[1]The first three vouchers received by a fleet for transit buses, inclusive of previous funding years, are eligible for the $10,000/vehicle in additional funding amounts

(Source: CARB, 2018)

3.4 KEY FINDINGS ACROSS REGIONS

In summary, it can be concluded that the motivation and approach for incentivising electrification varied across countries. While emission and noise reductions are a priority for all countries, China and Poland also have industrial promotion as an additional but key priority. The incentives also varied in the area of focus. While majority of the incentives across regions focus on the end user subsidy i.e. subsidising the vehicle cost. However, the incentives in EU also have a significant allocation for Research, Development and Innovation which offers longer-term benefits to the sector.

The global review of financial and regulatory incentives for electric buses highlights the need for a combination of incentives for EVs and disincentives for the conventional vehicles to accelerate their deployment. In addition to the direct incentives described above, many countries have introduced indirect subsidies for accelerating EVs like subsidies for battery manufacturing, providing land at low costs to incentivise EV manufacturing etc. some of which are explained in the following section.

3.4.1 NON-FISCAL/ REGULATORY INCENTIVES TO PROMOTE ELECTRIC BUSES

In addition to the direct financial incentives for electric buses, these countries have also initiated non-fiscal incentives for electrification as summarised below:

CHINA-NEW ENERGY VEHICLE MANDATE

China's New Energy Vehicle (NEV) mandate includes several non-fiscal incentives to promote electrification, some of which are listed here:

i) **Industrial policies** that promote NEVs including the establishment of regulations and standards for electric vehicles, specifically for batteries. Special importance was given to a battery recycling policy in order to minimise the environmental impact of used batteries. These regulations allow for a standardization of products and ensure quality, thereby also giving the customer confidence and promoting the establishment of sustainable modes of production and products.

ii) **Tax preferences** for NEVs including fee waivers, purchase tax exemption, consumption tax exemption and reduced or no tax rates on key vehicle components.

iii) Targeting resources for **research and development** to projects related to NEVs

iv) **Infrastructure support policies** including grid construction and transformation

v) Establishment of **charging infrastructure** for NEVs.

REGULATORY INTERVENTIONS TO PROMOTE ELECTRIC BUSES IN EU

The EU is currently exploring the amendment of several regulations which can accelerate the deployment of electric buses in cities:

Alternative Fuels Infrastructure DIRECTIVE 2014/94/EU mandates common charging standards for all member states of the EU. This allows for a rapid scale up and minimising the number of charging points required to be put up by the member states. The directive specifically states that publicly accessible recharging points for electric vehicles should be installed, in particular, at public transport stations, such as port passenger terminals, airports or railway stations. It also mentions explicitly that the national plans should include measures that can promote the deployment of alternative fuels infrastructure in public transport services. These measures support the creation of public charging infrastructure required for the bus services

The European legal framework for the procurement of clean vehicles: Directive 2009/33/EC which mandates taking environmental performance into consideration while evaluating bids

for bus operations in cities. While this regulation doesn't explicitly state the need to prioritise electric buses, the possibility of such a regulation is being explored.

Promoting EVs through EU regulation 1370/2007 The regulation governs the Public Transport Service Obligations (PTSO) and Public Transport Service Contract (PTSC) framework, which mandates the public transport authority to provide the viability gap funding for operations on loss making services. Given the higher cost of e-buses compared to conventional vehicles, they need higher subsidies compared to conventional vehicles. Including e-bus financing within this framework is being explored to make their operations more viable for the operators

Regulation (EU) NO. 651/2014: Aid for electric buses through environment protection funds is also being explored

Next section of the report provides a critical review of the tenders called under FAME-I subsidy mechanism in comparison with the UITP tender structure document.

4 BENCHMARKING FAME-I TENDERS AGAINST UITP RECOMMENDATIONS

The experience of electric bus procurement carried out during FAME I provides a valuable learning experience for the upcoming e-bus procurements across the country. Towards this, the current chapter presents a detailed review of the results from FAME I tenders, an overview of the 'UITP Tender Structure 2018'-the global guideline published by UITP on bus tendering and a summary of how the FAME I tender compare with UITP recommendations.

4.1 REVIEW OF TENDERS FOR ELECTRIC BUSES UNDER FAME I

Table 2 in Chapter 2 presented the summary of the cities selected, the number and type of buses identified after the tenders and the shortlisted bidders. Six cities opted for a Gross Cost Contract (GCC) tender i.e. where operators are contracted according to Service Level Agreements (SLAs) and are paid on a per-km basis. In such a contract, the operator just has to specify the outcome of the service and not the detailed technology specifications. Given the lack of experience of operating e-buses, even cities with established bus operations like Bengaluru, Mumbai and Hyderabad have opted for this business model. Others have opted to take up the technology risk and have preferred the outright purchase model.

The bid prices for the selected bidders in each city are presented in Figure 5 and Figure 6 for cities with Gross Cost Contracts (GCC) and outright purchases respectively. The prices shown here are after factoring in the subsidy from FAME I. For e.g. Indore's bid price of INR 8.5 million after subsidy would mean a bus cost of 18.5 million. The outright purchase bids showed similarity in quotes while there appears to be significant variation in bid prices received for GCC. However, a closer analysis of the tender documents revealed the key reasons behind this variation. The minimum assured km of payment committed to the operators varied significantly between cities. Similarly, the tenure of the contract and its extension has also varied between cities. Figure 7 presents the variability in these tender conditions across cities opting for GCC. Cities with higher assured km of payment and longer contract tenure received the lowest per-km bids, given the higher revenue expected from these cities.

The following are some of the other reasons for the variation in bids across cities:

i) Subsidy being the same for 9m and 12 m buses
ii) Requirement of low-floor Vs high-fleet buses
iii) Brake specifications i.e. disk or drum breaks
iv) Type of suspension i.e. air suspension Vs hydraulic suspension

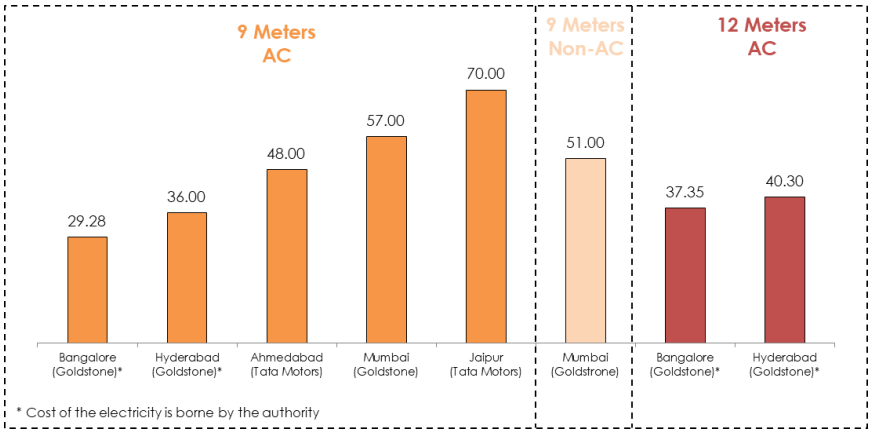

Figure 5 Bid Price for Gross Cost Contracts (GCC) in different Cities (INR per km)

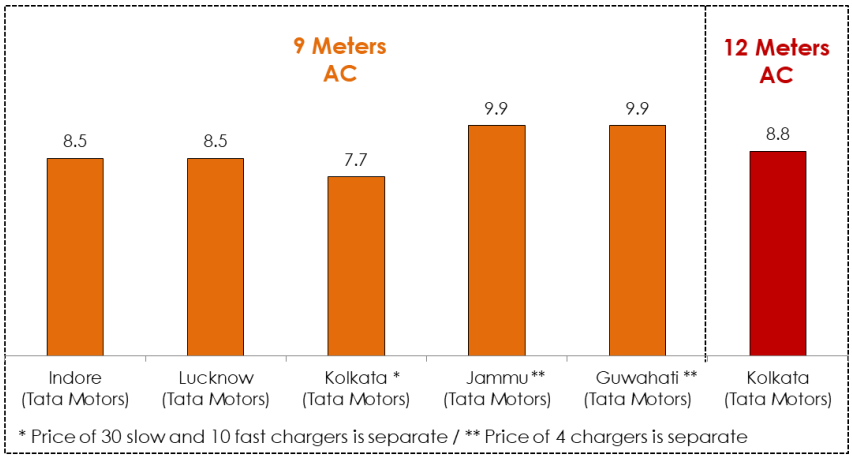

Figure 6 Bid Price for outright purchase in different Cities (INR million per bus)

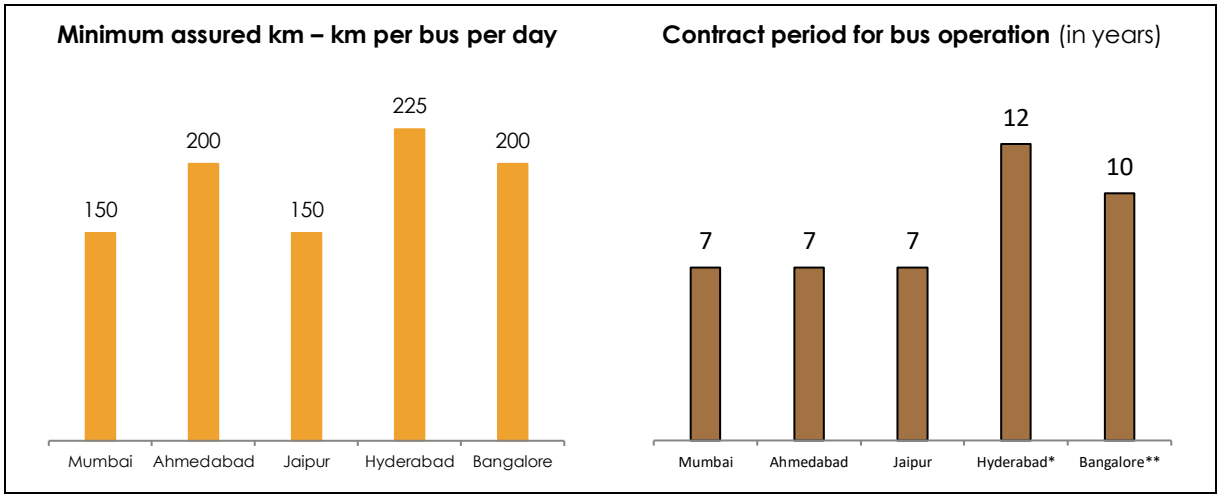

Figure 7 Key variables resulting in variable quotes for GCC contracts

* Hyderabad – Initial contract will be for 6 years and can be extended to 6 more years.

** Bangalore – Initial contract will be for 7 years and can be extended to 3 more years.

4.2 BENCHMARKING OF BIDS AND TECHNICAL SPECIFICATIONS

Given the variance in bid values and bus specifications received across cities, DHI constituted a committee to develop recommendations on benchmark technical specification and prices for various models of e- Buses. Table 6 presents the benchmark bus prices and the eligible incentive amount for 9m and 12m buses. The DHI also sought acceptance of cities who had tendered under GCC model to agree for joint ownership of buses between the operator and contracting authority.

Table 6 Benchmark prices of e-bus incentives sanctioned by DHI

Type of bus	Benchmarking price	Eligible incentive
12 MTR	INR 169.9 Lakh	INR 100 LAKH
9 MTR	INR 122.9 Lakh	INR 73.78 LAKH

4.3 CURRENT STATUS OF FAME I TENDERS

Despite the rigorous tendering exercise, the FAME scheme rollout has been hampered in many states due to a variety of reasons. Most of the cities opting for private operations under GCC have faced difficulties. Analysis of each city is presented in Table 7Table 11 . These reasons haven't been analysed in detail but the shift of business model from outright purchase to GCC has led to this difference.

Table 7 Current status of FAME I tenders

City, state	Mode of contract	Number of buses	Status
Bangalore, Karnataka	GCC	80	Tender cancelled.
Mumbai, Maharashtra	GCC	20 AC 20 Non-AC	Tender cancelled and under court proceedings
Hyderabad, Telangana	GCC	40 AC (Standard)	Contract awarded, operational now
Ahmedabad, Gujarat	GCC	40 AC (Midi)	Tender cancelled and re awarded without FAME subsidy
Jaipur, Rajasthan	GCC	40 AC (Midi)	Tender cancelled
Indore, Madhya Pradesh	Outright purchase	40 AC (Midi)	

Lucknow, Uttar Pradesh	Outright purchase	40 AC (Midi)	Awarded. Buses supplied
Kolkata, West Bengal	Outright purchase	20 AC (Midi) 20 AC (Standard)	
Jammu, J&K	Outright purchase	15 AC (Midi)	
Guwahati, Assam	Outright purchase	15 AC (Midi)	

4.4 POST FAME I ELECTRIC BUS PROCUREMENT INITIATIVES

Encouraged by the low cost of bids received during FAME I, many cities are now planning to induct electric buses in their fleet operations independent of subsidy availability. A few recent electric bus RFPs floated across India are listed in Table 8. Cities with larger sized procurements are preferring GCC model while the smaller quantity procurements prefer outright purchase.

Table 8 Recent electric bus tenders across India

No	STU	E-BUS TYPE	QTY	CONTRACT TYPE
1	Delhi Integrated Multimodal Transit System (DIMTS)	12m AC Low-Floor	375	GCC
2	BEST	Mini AC bus	200	GCC
3	Delhi Metro Rail Corporation (DMRC)	Mini AC buses feeder service	400	GCC
4	HRTC (Himachal Road Transport Corporation)	Midi bus	50	OUTRIGHT PURCHASE
5	KSRTC	Midi bus	10	GCC
6	Uttar Pradesh *(Agra, Allahabad, Ghaziabad, Kanpur, Lucknow & Gorakhpur and Varanasi)*	Midi bus	520	GCC
7	PMPML (Pune)	12 m buses	125	GCC
8	AJIL (Ahmedabad)	Midi bus	300	GCC
9	SURAT MUNICIPAL CORPORATION	Midi bus	50	GCC
10	NAGPUR MUNCIPAL CORPORATION	Midi bus	5	Outright purchase
11	GSRTC	Midi /normal	(30+25)55	GCC
12	RAJKOT MUNCIPAL CORPORATION	Midi	50	GCC

13	VADODARA SMART CITY	Midi	4	Outright Purchase
14	NASHIK MUNCIPAL CORPORATION	12 m buses	150	GCC

4.5 OVERVIEW OF UITP TENDER STRUCTURE DOCUMENT

The UITP tender structure document is a recommendation based on long experience and good practice in the business. It incorporates industry best practices for ecosystem players including manufacturers, STU's, operators etc. It was originally developed in 2009 and has been revised twice subsequently. The latest version, released in 2018, incorporates the needs for e-bus tendering and was found to be the most relevant benchmark for the current exercise. The document covers full life cycle of tendering from prequalification to Modal Concession Agreement (MCA). The objectives of the UITP tender structure are to:

- Improve efficiency of tender process
- Harmonise technical specifications to bring in economies of scale

The comparison with UITP tender structure is intended to provide a broad toolkit which helps Indian companies in carefully evaluating the major points which are essential to frame the tenders according to their requirement. More specifically it helps agencies in the following aspects

- Deciding the right mode of procurement (GCC v/s Outright purchase)
- Arriving at Life cycle cost of vehicles
- Framing appropriate evaluation criteria
- Detailing requirement for after sales, maintenance and training needs
- Finalizing the right MCA

4.5.1 KEY FEATURES OF UITP TENDER STRUCTURE DOCUMENT

UITP recommends bus procurement tenders to incorporate the following sixteen features:

1. Main Characteristic (summary) of tender
2. Purchase and contact persons
3. Procedure
    a. Two Stage tender
    b. Single Stage tender
4. Tender timetable
5. Legal requirement and standards

6. List of company related documents
7. Tender evaluation criteria
8. Life cycle cost
9. Financial conditions
    a. Payment timetable
    b. Financial Guarantees
    c. Penalties
10. Vehicle warranty
11. Vehicle availability / Unavailability
12. Acceptance procedure
13. Functional specifications
14. Technical Specifications
15. After Sales
16. Training

The current document compares 15 out of the 16 parameters of the toolkit grouped into four categories. The contact person parameters have been excluded considering they are irrelevant for the current report. The Life Cycle Cost (LCC) analysis hasn't been carried out by any of the cities and hence we aren't comparing them here.

4.6 COMPARISON OF FAME I TENDERS WITH UITP TENDER STRUCTURE

4.6.1 MAIN CHARACTERISTICS OF TENDER

The business model of procurement, vehicle warranty, vehicle availability across all FAME 1 tenders are compared in Table 9. As explained above, the FAME 1 tenders were structured on two models of procurement as follows:

- Gross Cost Contract (GCC) Model – 5 Cities
- Outright Purchase -5 Cities

The GCC tenders haven't mentioned warranty details since the operators were responsible for the vehicles. At the same time, operators were also responsible for setting up and maintaining the charging infrastructure for the entire contract period. The outright purchase tenders were observed to have the following shortcomings:

- Although the life of bus is for more than 10 years the warranty sought was only for 5 years maximum
- The warranty has been sought only for buses and not for charging infrastructure

- There is no mention of vehicle availability or fleet availability
- Payment and performance guarantee linked only to delivery and not to operations and maintenance
- The Life Cycle Costing (LCC) of the vehicles wasn't considered while comparing alternative vehicle and charging infrastructure technologies

The drawback with the GCC model were:

1. None of the cities developed financial mechanisms to ensure consistent payment to operators beyond the FAME Incentive. This has been a key gap area even in diesel and CNG bus GCC contracts across the country and is likely to hamper the operations of e-buses in the long run
2. Once contract award is executed the gap funding or FAME incentive has to be passed on to operator. In the event of termination or non-performance of the operator there shall be provisions in the contract to securitize the incentive amount. However, since the ownership of the e-buses vests with the operator throughout the contract period, securitizing the FAME incentive amount was one of the challenges faced by cities.

Table 9 Comparison of procurement modalities and vehicle specifications under FAME I

No	Agency/city	Qty	Type of contract	Supply timeline	No of years of	Vehicle warranty	Vehicle availability
1	BMTC (Bangalore)	80	Gross Cost Model	6 Months	7+3	--	100%
2	BEST (Mumbai)	80	Gross Cost Model	6 Months	7	--	100%
3	TSRTC (Hyderabad)	40	Gross Cost Model	6 Months	6+6	--	100%
4	AJIL (Ahmedabad)	40	Gross Cost Model	6 Months	7	--	100%
5	JCTSL (Jaipur)	40	Gross Cost Model	6 Months	7	--	100%
6	AICTSL (Indore)	40	Outright Purchase	3 Months	Outright Purchase	5 years or 6,00,000 km	Not Mentioned
7	LSTCL (Lucknow)	40	Outright Purchase	20 – 3 Months 20 – 6 months	Outright Purchase	3 years or 2,10,000 km	Not Mentioned

8	WBTCL (Kolkata)	40	Outright Purchase	20 – 3 Months 20 – 4.5 months	Outright Purchase	5 years	Not Mentioned
9	JKSRTC (Jammu)	15	Gross Cost Model	5 Months	5+5	--	100%
10	ASTC (Guwhati)	15	Outright Purchase	3 Months	Outright Purchase	5 years	Not Mentioned

*In Gross Cost Model since the operator maintains all the vehicles at his own cost there is no mention of vehicle warranty in tender.

4.6.2 BIDDER QUALIFICATION CRITERIA

Review of the tender procedure, tender evaluation criteria and the proposed timetable across all the tenders presented in Table 10 provides the following insights:

- The legal requirement of the Bidders had been clearly spelt out in all the tenders
- All the FAME 1 tenders were open bidding and was on single stage tender. There was no prequalification carried out to evaluate the buses/ solution being offered.
- As the cities under FAME 1 were shortlisted in mid of January 2018 and DHI had insisted that all the tenders were to be finalized before February 2018, the tender timetable provided by most of the cities was with a shorter time frame. As such, there would have not been enough time for the bidders to do a realistic assessment.
- The tender evaluation criteria in most of the cases where not multi criteria analysis
    - No environmental criteria had been considered while evaluating the tenders
    - No evaluation criteria had been proposed for assessing the charging infrastructure requirement such as space requirement for setting up the charging infrastructure, power required to charge the buses simultaneously etc.
    - In most of the gross cost model, more emphasis was provided to OEM rather than bus operations experience.
    - In outright purchase tenders, experience for manufacturing electric bus was not sought. Even global experience of e-bus manufacturing was not sought and no criteria for homologation was mentioned.
    - In all the tenders, the delivery period, passenger comfort was made uniform at the time of bidding hence creating a level playing field for all the bus manufacturers

Table 10 Comparison of bidder qualification requirements

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
1	BMTC	• Registered company under the Companies Act 1958/2015 *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Consortium Agreement • OEM Authorization Letter • Experience certificate Letter	• Allowed -3 (OEM/operator needs to be part of the consortium)	• Manufactured and supplied 25 e-buses or • Manufactured and supplied 500 CNG/diesel buses in last 5 years • Support letter from e-bus technology partner with 25 e-bus experience • ARAI certificate for proposed e-bus	• Operating Experience – Minimum 100 buses for 2 years	• Bidder himself or Through OEM or valid sub-contract Experience of setting up a 11 KV electrical installation	200 cr	50 cr
	BEST	• Registered company under the Companies Act 1958/2015 or Proprietorship Firm	• Allowed -3 (OEM needs to be part of the consortium)	• One project reference of minimum operation of 50 buses in single order Or	• Nil	• Nil	20 Cr	Positive Net worth in all three

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
2		*List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Consortium Agreement • OEM Authorization Letter • Experience certificate Letter		• Two project reference of minimum operation of 35 buses in each in India or abroad *(No specific experience of EV bus operations)*				preceding years
3	TSRTC	• Individual, Partnership firm, Company *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Consortium Agreement • OEM Authorization Letter • Experience certificate Letter	• No limit on the number of consortium members (OEM needs to be part of the consortium)	Manufacturing capacity of 10 numbers of electric buses/month	• Nil	• Bidder himself or Through OEM or valid sub-contract Experience of setting up a 11 KV electrical installation	20	10

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
4	AJL	• Individual, Partnership firm, Company *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Consortium Agreement • OEM Authorization Letter • Experience certificate	• Allowed -2 (OEM needs to be part of the consortium)	• Manufactured and delivered 1000 electric/diesel/CNG buses in last 5 years	• Ownership and/or Operation experience or • Combined ownership and operation experience of atleast 100 buses in India for atleast 1 year in last three years	• Nil	-	100 (OEM) + 5 (Operator)

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
5	JSTCL	• Company, Partnership firm and registered proprietary firm. Any foreign firms constituted under respective foreign law not registered in India are not allowed to participate in the Bidding as single bidder or consortium member *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Consortium Agreement • OEM Authorization Letter Experience certificate Letter	• Not mentioned	• Manufactured and delivered atleast 1000 electric/CNG/diesel buses over last 5 financial years	• and/or Operation experience or • Combined ownership and operation experience of atleast 100 buses in India for atleast 1 year in last three years	• Nil	-	100 (OEM) 5 (Operator)

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
6	AICTSL	• Registered company under the Companies Act 1958/2015 *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Experience certificate Letter	• Allowed -3 (OEM/Operator needs to be part of the consortium)	• A registered bus manufacturer based in India (with minimum 35% localization) • Warranty for 5 years of 6,00,000 kms for battery and motor • Certificates from STUs or municipal corporation on battery, motor and complete bus performance • Trial certificate on the product	NIL	• Bidder himself Or through OEM Or valid sub-contract - Experience of setting up a 11 KV electrical installation 11 KV substation	150 LEAD=50	100 Lead =30
7	LCTSL	• Registered company under the Companies Act 1958/2015	• Allowed	• OEM engaged in manufacturing and supply of e-buses	• NIL	• NIL	75	Positive

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
		List of Documents: • Certificate of Incorporation • Audited Balance Sheet • Experience certificate Letter		•				
8	WBTCL	• Registered company under the Companies Act 1958/2015 *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Experience certificate Letter	• Not Allowed	• Experience in manufacturing global standard buses	• NIL	• NIL	70	-
9	JKSRTC	• individual, Partnership firm, Company, Consortium /Joint Venture *List of Documents:*	• Not Allowed	• Manufacturing capacity of 10 e-buses/month	• NIL	• NIL	10	10

No.	Agency	Type/List of company related documents	No of Consortium members	Technical Experience			Financial Capability	
				Manufacturer	Operator	Charging Infrastructure	Average Turnover (In INR Crores)	Net worth (In INR Crores)
		• Certificate of Incorporation • Audited Balance Sheet • Experience certificate Letter						
10	ASTC	• Registered company under the Companies Act 1958/2015 *List of Documents:* • Certificate of Incorporation • Audited Balance Sheet • Experience certificate Letter	• Not Allowed	• A registered bus manufacturer in India	• NIL	• NIL	75 150 (Consortium)	50 100 (Consortium)

4.6.3 FUNCTIONAL AND TECHNICAL SPECIFICATIONS

The tenders under FAME-1, had covered all the desired functional and technical specifications in detail. This ensured level playing field across all bidders.

All the tenders followed the specifications prescribed under Urban Bus Specification (UBS) II. There were limited technical specifications pertaining to electric buses. As GCC model was solution agnostic and outcome based, such minimum technical specifications on electric bus and charging infrastructure were found acceptable. However, even outright purchase tenders haven't included electric bus and charging infra specifications.

The outright purchase model clearly spelt out the battery requirement whereas all the GCC model RFPs allowed the bidder to bring their own technology. No specifications provided with respect to charging infrastructure.

Table 11 Comparison of vehicle specifications across cities

Sr. No.	City, State	Type of Bus	AC / Non- AC	Floor Height	Seating Capacity	Charging Infrastructure	
						Range	Charging
1	Bangalore, Karnataka	Midi	Non- AC	650/900	31	--	-
		Standard	AC	400	42		
2	Mumbai, Maharashtra	Midi	AC	650/900	26-31		
		Midi	Non- AC	650/900	26-31		
3	Hyderabad, Telangana	Midi	AC	650/900	-		
		Standard	AC	400-900	-		
4	Ahmedabad,	Midi	AC	900	29		
5	Jaipur, Rajasthan	Midi	AC	650	29		
6	Indore, Madhya	Midi	AC	900	31	180 km with	2 Fast chargers on
7	Lucknow, Uttar	Midi	AC	900	29	170 to 200	-
8	Kolkata, West Bengal	Midi	AC	400-900	26	Minimum 150 km per	30 slow charging and 10 fast charging facilities
		Standard	AC	400-900	31		

9	Jammu, J&K	Midi	AC	650-900			
10	Guwahati, Assam	Midi	AC	900	34	>180 km per charge	2 Fast chargers on the route

4.6.4 PAYMENT TIMETABLE, FINANCIAL GUARANTEES AND PENALTIES

The payment schedule, financial guarantees and penalties of FAME tenders are compared in Table 12. The following are some of the key observations:

- The payment for all the GCC contracts was according to the travel distance (km) the bus has operated in a month. The FAME Incentive amount was to be paid upfront to the operator as and when the incentive amount is released by the DHI to the cities. Further, as the ownership of the buses vest with the operators, the incentive amount has been securitized through a bank guarantee of an equivalent amount
- In case of outright purchase, most of the tenders have preferred a milestone-based payment viz. upon supply, upon final acceptance and upon 6 months trial run
- The penalties in case of outright purchase RFPs, only liquidated damages have been proposed for late supplies and no other penalties have been proposed as the tenders are just procurement of Buses. In case of GCC model, both liquidated damages for late supplies and penalties for non-performance have been proposed

Table 12 Comparison of financial terms of FAME I tenders

No.	City, State	Payment Timetable	Financial Guarantee	Penalties/SLAs
1	Bangalore BMTC GCC tender	• FAME incentive will be released to operator on a back to back basis • Monthly payment • 15 days after invoice submission for	• Two bank guarantees Towards an amount equivalent to FAME Incentive scheme Towards performance of bus (Rs.9 Lakh per bus till 3 months	• Penalty of 0.3 times the quoted rate/km for any delay in bus supplies, charging infrastructure • SLAs are: Non availability of bus/day Conduct of driver Non-performance of scheduled trips Adherence to schedule timing

No.	City, State	Payment Timetable	Financial Guarantee	Penalties/SLAs
		balance payment	after contract expiry)	- Plying along non-authorized routes
2	Mumbai, Maharashtra GCC contract	• Monthly payment • 8 days post invoice submission for actual km of bus operations	• Two bank guarantees Towards an amount equivalent to FAME Incentive Towards bus performance (Rs.50000 per bus till 96 months)	• Rs. 5000/day/bus for bus withdrawal • Rs. 1000/day for other violations (misbehaviour, passenger complaints, late reporting, traffic violations etc.)
3	Hyderabad, Telangana GCC	• FAME incentive amount will be released on a back to back basis from DHI • Monthly payment 7 days after invoice submission for balance amount	• Bank guarantee: Rs. 50 lakhs/bus on execution date	• Rs. 5000/bus/day on supply failure • Proposed SLAs: Non-availability of bus Conduct of driver Non-performance of scheduled trios Adherence to schedule timing Bus cleanliness Bus damages
4	Ahmedabad, Gujarat GCC	• Invoice submission at end of 10 days every month • 90% payment within 10 days • Balance 10% in 15 days of next month	• Bank guarantee of Rs.2.5 Lakhs per bus	• Rs 2500 per bus per day to maximum of Rs 2.5 Lakhs per bus- liquidated damages

No.	City, State	Payment Timetable	Financial Guarantee	Penalties/SLAs
5	Jaipur, Rajasthan GCC	• Invoice submission at end of 10 days every month 90% payment within 20 days of invoice • Balance 10% in 15 days of next month	• Bank guarantee of Rs 2.5 Lakhs per bus	• Rs 5000 per bus per day to maximum of Rs 5 Lakhs per bus
6	Indore, Madhya Pradesh Outright purchase	• 60% payment within 30 days of receipt of bill 40% payment against final acceptance	• Bank guarantee of 20% of contract value within 30 days of acceptance	• 0.25% of the total value of bus every week to a maximum of 5% of contract value for failure in delivery/ commissioning
7	Lucknow, Uttar Pradesh Outright purchase	• 80% payment within 30 days of receipt of invoice • 20% payment within 15 days against final acceptance certificate	• Demand draft/bank guarantee of Rs 50 Lakhs	• 0.5% total value of buses per week for delay upto 4 weeks of delay • 0.75% LD for delay with 4-8 week • 1% LD for delay beyond 8 weeks • Subject to maximum of 10% of contract value
8	Kolkata Outright purchase	• 40% of total cost of bus post delivery of bus • 30% of total cost of buses with final acceptance certificate	Bank guarantee of 10% of total value of contract within 15 days of receipt of purchase order	• 0.25% of total valie of buses per week for any delay (including charging facilities) • Subject to maximum of 10%

No.	City, State	Payment Timetable	Financial Guarantee	Penalties/SLAs
		• 30% of total cost after 6 months of performance monitoring		
9	Jammu, J&K	• 100% payment within 30 days from delivery of buses	• Bank gurantee of 5% of contract value with 20 days of purchase order •	• Rs 800 per bus per day for delay for the 1st 15 days • Rs 1600 per bus per day for delay beyond 15 days
10	Guwahati, Assam Outright purchase	• 60% of the total price of each consignment in 30 days • 40% of total price within 90 days against final acceptance certificate	• Performance security of 20% of contract value • Within 30 days of letter of acceptance	• 0.25% of the total value of buses as liquidated damages •

4.6.5 POST TENDER PROCESSES

All the FAME 1 tenders mandated prototype evaluation, ARAI certification and homologation prior to acceptance of the buses. The after sales support was covered in GCC contracts for the entire contract period owing to the fact that the operator is responsible for operation and maintenance of the buses with 100% fleet availability. However, in outright purchase tenders, cities have asked for 5 -7 years warranty.

None of the cities' financial evaluation arrived at the least cost (L1) bid based on Life Cycle Costing (LCC) as more importance is given either the bus cost or the cost/km of operating the buses, including the subsidy amount.

The clauses on training & capacity building are similar across cities. The tenders have provisions for training of drivers, conductors and mechanical staff of the cities but the modalities of its implementation aren't detailed. Further, as payment is not linked to training, enforceability of the same is also a question. Table 13 provides a comparative analysis of these parameters.

Table 13 Comparison of post tender activities

No	City, State	Acceptance procedure	After Sales Support & Fleet Availability	Training
1	Bangalore BMTC	• Delivery after inspection of chassis, structure • Cost of inspection to be borne by OEM / Operator	• 50% of the rate quoted by the bidder per km for the untravelled km (fleet availability)	• Periodic training sessions by operator • Drivers and technicians for undergo orientation / familiarization training program regarding bus operation and maintenance
2	Mumbai	• Prototype inspection at : - Structure assembly stage before final panelling in prototype - After completion and panelling of all buses.	• Rs. 5000 per bus per day for non-availability	• Training to BEST drives including certification
3	Hyderabad	• Supply shall commence only after the inspection and test	• 100% availability	• Periodic training to drivers and technicians

4	Ahmedabad	• A quality assurance program to ensure quality product at the stages of
		  • Design
		  • Planning
		  • Procurement
		  • Manufacturing
		  • Testing
		  • Commissioning &
		  • Servicing
		• Confirm to bus code052 and certificate
			• Assured availability factor of 94%
			• 10% of revenue lost to authority on low fleet availability
				• Training program at Ahmedabad for drivers and technicians
				• Periodic training sessions for drivers, staffs and all personnel

No	City, State	Acceptance procedure	After Sales Support & Fleet Availability	Training
5	Jaipur	• Inspect and testify buses before induction and also during maintenance periods	• 10% of the revenue lost by STU if 100% fleet is not available	• Bus operation and maintenance training to drivers and technicians • Operator to conduct periodic training sessions
6	Indore	• Type approval conformity of production from authorized agencies • Finite Element Analysis from CIRT or authorized agencies as per CMVR	• Self-declaration on adequate availability of spare parts and after sales services	• Orientation training at Indore for two days for drivers in batches of 20 • Orientation training at Indore for 3 days for technicians/supervisors/engineers

7	Lucknow	• A prototype bus for preliminary inspection at following stages:
		  • Bus chassis
		  • Bus body structure
		  • Bus body panelling
		  • Bus final inspection
		Inspection of all buses at all stages is necessary
			• Undertaking for a period of 10 years on services in India	• Orientation training at Lucknow for 7 days for 80 drivers
				• Orientation training at Lucknow for 10 days for technicians/supervisors/engineers

8	Kolkata	• Inspection certificate by STU • Final acceptance certificate after 15 days of final inspection •	• On-site maintenance and / or repairing under warranty for a period of 5 years	• Training to 3 drivers and 1 maintenance staff per bus including ITS •
9	Jammu J & K	• 3rd party inspection at the plant/body building	• AMC for 10 years	• NA

No	City, State	Acceptance procedure	After Sales Support & Fleet Availability	Training
		site at the structural stage (1st stage and at final stage) • The cost of which shall have to be borne by the vehicle manufacturer.		
10	Guwahati	• Type approval conformity of production from authorized agencies • Finite Element Analysis from CIRT or authorized agencies as per CMVR	• NA	• Orientation training at Guwahati for 7 days for 2.5 drivers per bus in batches of 20 • Orientation training at Guwahati for technicians/supervisors/engineers

5 KEY LEARNINGS AND WAY FORWARD FOR FAME-II

The key conclusion on the process and learnings of e-bus subsidies under FAME-I and international examples were shared with the members of the DHI's 'Committee for standardisation of electric bus specification'. Further, Department of Heavy Industries (DHI) has called for an expression of interest inviting proposals from state/UT governments, transport undertakings, municipal corporations or other public entities for deployment of a total of 5,595 electric buses in different cities on an operational cost model. The FAME-II subsidy mechanism has incorporated many suggestions and learnings highlighted in this report while some remain unaddressed. Table 14 provides the comparative summary of suggestions put forward to FAME II and the approach adopted by DHI to address them wherever applicable.

Table 14 Comparison of FAME-II guidelines with learnings derived from FAME-I review

Topic	Learning from FAME-I and international review	Proposal under FAME-II
Vehicle choice by cities	- All category of buses received same subsidy amount - Therefore, most cities opted for 9m buses over 12m buses during FAME I, despite both the vehicles receiving the same subsidy. - The key reason for this was to minimise the extra cost of the bus beyond the subsidy to be incurred by the cities. - Majority of the Indian manufacturers who meet the localisation requirements for funding only have 9m models.	- Demand incentive different for different bus lengths: ▪ 6-8 m, ▪ 8-10 m and ▪ 10-12 m, ▪ Maximum subsidy of Rs 55 Lakhs.
Need to calibrate subsidy according to service offered	- Subsidy amount designed as an incentive for local manufacturing - Subsidy not a function of service delivered by the bus - 9 m bus with high localization may receive higher subsidy than a 12 m bus, in spite of more passenger-kms	- Manufacturing facility in India is mandated - OEM has to satisfy the localization as notified by DHI time to time - Subsidy linked to length of bus and hence more subsidy for more passenger-kms

Business model selection	- Cities which normally prefer upfront purchase model preferred GCC under FAME I because of the uncertainness involved in the technology and operational characteristics - Some of the smaller cities like Indore, Lucknow, Jammu and Guwahati with relatively lesser experience of city bus operations have opted for the upfront purchase model. - Despite this, the current status of implementation of these services show that except Hyderabad, the rest of the cities which opted for the GCC model couldn't induct the buses as planned.	The FAME II subsidy is only for deployment of e-buses under GCC model.
Harmonising tender conditions for comparable bids	- The tenders varied significantly in their bidding criteria i.e. daily assured km of service, tenure of the contract, provision of electricity by authority, residual bus value at the end of contract etc. - The Lawrence Berkeley National Laboratory (LBNL) analysis to harmonise tender conditions across cities showed that the bids are in-fact similar across cities.	- Cities need to guarantee that each bus slot will run for at least 5 lakhs km during its contract period. - Cities are given the choice of selecting the daily assured kms, contract period etc. - This would help cities to select the best suitable solution for each city and subsidy amount is capped at 40% of the total capital cost.
Subsidy structure and amount:	- The upfront disclosure of subsidy amount during FAME I provided clarity to cities but may have also resulted in the bidders claiming the subsidy even in cases where the incremental cost of electric buses over conventional vehicles may not be as much.	- This subsidy amount is capped at 40% of the total capital cost. However, the exact subsidies will only be determined when the bidding process is

	- DHI has reviewed the bids across cities to arrive at the benchmark prices for electric buses and their subsidy amount across cities. - Alternatively, a reverse auction process where bidders are asked to request for the maximum subsidy required for their models may yield a lesser quotation from them	completed by the cities and states
Implementation timeline challenges:	- Nine of the ten cities, Ahmedabad being the exception, issued the Letter of Association (LOA) to the selected bidders before the end of March, 2019. However, even today, many of them are facing a wide range of challenges in operationalising the e-buses. - In some cities, the bidders were unable to deliver the fleet as per the originally agreed timelines. In other cases, the lack of adequate power infrastructure required for the buses is posing challenges	- STUs are given a tight timeline of 3 months to complete the procurement process and a period of 12 months to begin the operation of buses. - However, the charging infrastructure development and associated challenges are not discussed in FAME II
Inadequate timelines for tendering:	- Pre-qualification could not be adopted before tendering owing to shorter timelines (< 1 month) fixed by DHI to avail FAME I funding - This has put the bus agencies in huge risk of approving the proto type post award of tender.	- STUs are given a period of 3 months to complete the procurement process which they may use to have a pre-qualification meeting
Life Cycle Costing (LCC) of vehicles to ensure selection of	- Bids of e-buses received during FAME I indicate very aggressive pricing offered by bidders - Cities haven't done their Life Cycle Cost (LCC) evaluations during tendering and only selected the bidder with the least per-km cost - This raised serious concerns about the sustainability of the project i.e. if the bidders	Not addressed

appropriate bidders	can sustain operations for the entire contract period at that rate	
Limited manufacturing capacity in India:	- Given the lack of adequate e-bus manufacturing in India only two manufacturers were shortlisted across cities. - The lack of manufacturing capability has resulted in delayed deliver buses	- Given the much larger scale of procurements initiated under FAME II, the lack of manufacturing capacity is likely to persist even in FAME II
Lack of charging infrastructure standards during FAME I:	Government of India hasn't developed standards for charging infrastructure at the time of bids for FAME I leading to cities relying on manufacturers for specifications.	- The Ministry of Power (MoP) has issued charging standards framework which should help FAME II bidding
Data sharing protocols	- None of the cities have established data sharing protocols with the e-bus suppliers which could have help them learn from the current operations	- FAME II mandates STUs to develop an online platform for monitoring the performance of e-buses. However, further mechanism and type of data is yet to be discussed

In summary, FAME I has initiated the much-needed implementation of electric buses in India. However, there were many challenges faced by cities in the process of taking the electric bus program from the conceptual level to successful demonstration. FAME-II EoI has tried to address those challenges and is an upgraded version of FAME-I. However, there are other challenges like charging infrastructure strategies, data sharing protocols etc. as listed in the table above which need further detailing and are required to be addressed before beginning the deployment under FAME II.

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