C40 CITIES

tumi E-Bus Mission

Development of the India Zero Emission Bus Market Investor's Guide

Prepared by

PMANIFOLD

Abbreviations

1	2W	Two-Wheeler
2	3W	Three-Wheeler
3	4W	Four-Wheeler
4	ACMA	Automotive Component Manufacturers Association
5	AIS	Automotive Industry Standards
6	AJL	Ahmedabad Janmarg Limited
7	AMC	Annual Maintenance Contract
8	AMTS	Ahmedabad Municipal Transport Service
9	ARAI	Automotive Research Association of India
10	BEB	Battery Electric Bus
11	BEE	Bureau of Energy Efficiency
12	BEST	Bombay Electric Supply & Transport
13	BIS	Bureau of Indian Standards
14	BMS	Battery Management System
15	BRPL	BSES Rajdhani Power Limited
16	BRTS	Bus Rapid Transit System
17	BS	Base Station
18	BSES	Bombay Suburban Electric Supply
19	BYPL	BSES Yamuna Power Limited
20	CAGR	Compound Annual Growth Rate
21	CAPEX	Capital Expenditure
22	CCS	Combined Charging System
23	CEA	Central Electricity Authority of India
24	CERC	Central Electricity Regulatory Commission
25	CESL	Convergence Energy Services Limited
26	CHAdeMO	CHArge de MOve - Japanese fast-charge
27	CMS	Central Management System
28	CMUBS	Chief Minister Urban Bus Scheme
29	CNA	Central Nodal Agency
30	CNG	Compressed Natural Gas
31	CO_2	Carbon Dioxide
32	CPCB	Central Pollution Control Board
33	CPO	Charge Point Operator
34	DC	Direct Current
35	DFI	Development Finance Institution
36	DHI	Department of Heavy Industry
37	DIMTS	Delhi Integrated Multi-Modal Transit System
38	DISCOM	Electricity Distribution Company
39	DMRC	Delhi Metro Rail Corporation
40	DST	Department of Science and Technology
41	DTC	Delhi Transport Corporation
42	EBITDA	Earning before interest, tax, depreciation, amortisation
43	EESL	Energy Efficiency Services Limited
44	ESP	Energy Service Provider
45	EV	Electric Vehicle
46	EVSE	Electric Vehicle Supply Equipment
47	FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
48	FDI	Foreign Direct Investment
49	FOR	Forum of Regulators
50	FY	Financial Year
51	GCC	Gross Cost Contract
52	GDP	Gross Domestic Product
53	GHG	Greenhouse Gas
54	GNCTD	Government of the National Capital Territory of Delhi
55	GoI	Government of India
56	Grand Challenge	Demand Aggregation Program mandated by GoI to be driven by CESL
57	GSECL	Gujarat State Electricity Corporation Ltd
58	GST	Goods and Services Tax
59	I&C	Instrumentation and Control
60	ICE	Internal Combustion Engine
61	ICT	Information and Communications Technology
62	INR	Indian Rupee
63	IREDA	Indian Renewable Energy Development Agency Limited
64	IRR	Internal Rate of Return
65	IT	Information Technology
66	ITS	Intelligent Transport System
67	JV	Joint Venture
68	LCA	Life Cycle Assessment
69	LCO	Lithium Cobalt Oxide
70	LCV	Light Commercial Vehicle
71	LFP	Lithium Iron Phosphate
72	LMO	Lithium Manganese Oxide
73	MCA	Model Concession Agreement
74	MCGM	Municipal Corporation Greater Mumbai
75	MeitY	Ministry of Electronics and Information Technology
76	MERC	Maharashtra Electricity Regulatory commission
77	MNRE	Ministry of New and Renewable Energy
78	MoC&I	Ministry of Commerce and Industry
79	MOD	Ministry of Defence
80	MoEF&CC	Ministry of Environment, Forest and Climate Change
81	MOF	Ministry of Finance
82	MoHIPE	Ministry of Heavy Industries and Public Enterprises
83	MoM	Ministry of Mines
84	MoP	Ministry of Power
85	MoP&NG	Ministry of Petroleum and Natural Gas
86	MoRTH	Ministry of Road Transport and Highways
87	MoSD&E	Ministry of Skill Development and Entrepreneurship
88	MoST	Ministry of Science and Technology
89	MSEDCL	Maharashtra State Electricity Distribution Company Limited
90	MSME	Ministry of Micro, Small and Medium Enterprises
91	MTC	Metropolitan Transport Corporation (Chennai)
92	NBEM	National Board for Electric Mobility
93	NCA	Lithium Nickel Cobalt Aluminum Oxide
94	NCAP	National Clean Air Program
95	NCC	Net Cost Contract
96	NCEM	National Council for Electric Mobility
97	NCR	National Capital Region
98	NDC	Nationally Determined Contribution
99	NEBP	National Electric Bus Program
100	NEMMP	National Electric Mobility Mission Plan
101	NGT	National Green Tribunal
102	NMC	Lithium Nickel Manganese Cobalt Oxide
103	NSP	National Service Provider
104	NTPC	National Thermal Power Corporation Limited
105	O&G	Oil And Gas
106	OEM	Original Equipment Manufacturer
107	OPEX	Operational Expenditure
108	OPM	Outright Purchase Model
109	PCI	Public Charging Infrastructure
110	PCMC	Pimpri-Chinchwad Municipal Corporation
111	PCS	Public Charging Station
112	PE	Private Equity
113	PHEV	Plug-in Hybrid Electric Vehicle
114	PISC	Project Implementation and Sanctioning Committee
115	PMC	Pune Municipal Corporation
116	PMP	Phased Manufacturing Programme
117	PMPML	Pune Mahanagar Parivahan Mahamandal Ltd
118	PPP	Public Private Partnership
119	PSCDCL	Pune Smart City Limited Corporation
120	PSU	Public Sector Undertaking
121	PT	Public Transport
122	PTA	Public Transport Authority
123	R&D	Research and Development
124	RBI	Reserve Bank of India
125	RTO	Regional Transport Office
126	SERC	State Electricity Regulatory Commission
127	SGST	State Goods and Services Tax
128	SIAM	Society of Indian Automobile Manufacturers
129	SIDCO	Small Industries Development Corporation Limited
130	SIPCOT	State Industries Promotion Corporation of Tamil Nadu
131	Sitilink	An Undertaking of Surat Municipal corporation under PPP model. It is an integrated bus rapid transit and public bus transport system for Surat.
132	SLA	Service Level Agreement
133	SMC	Surat Municipal Corporation
134	SMEV	Society of Manufacturers of Electric Vehicles
135	SNA	State Nodal Agency
136	SPCB	State Pollution Control Board
137	STU	State Transport Undertaking
138	Switch Delhi	The Government of NCT of Delhi launched the Switch Delhi campaign to inform, encourage and motivate the citizens of Delhi to switch from conventional vehicles to electric vehicles.
139	TATA POWER DDL	Tata Power Delhi Distribution Limited
140	TCO	Total Cost of Ownership
141	UT	Union Territory
142	VFA	Value of fixed assets
143	VGF	Viability Gap Funding
144	VKT	Vehicle Kilometers Travelled
145	ZE Bus	Zero Emission Bus
146	ZET	Zero Emission Transport
147	ZEV	Zero Emission Vehicle

Note: Currency Exchange rate – 1 USD = 79.92 INR *(Source: RBI)*

1

Background

Introduction

Need of the Guide

- India has a sizeable Zero Emission Bus (ZE-Buses) potential market. However, high import taxes, a complex regulatory system, and a lack of competition amongst technology providers constitute critical challenges to fleet-wide ZE-Bus deployments, mainly due to the lack of local production. For this ZE-Bus transition to happen, ZE-Bus industry leaders need to invest in India to produce locally, and although some are aware of this reality, few really understand the implications of investing in India.

Aim of the Guide

- Indian Zero Emission Bus Market Investor's Guide is developed as part of the TUMI project by pManifold, with guidance from TUMI teams at C40 Cities to fill existing knowledge gaps from investors and/or manufacturers and provide the essential information for the decision to invest in the ZE-Bus market in India. This report is focused on intra city ZE-Buses powered by electric batteries.
- This report is intended to serve international investors seeking to enter the Indian ZE-Bus market.

Who is this guide for?

- This investment guide is divided for two types of investors:
  1. Operators/Aggregators
  2. Charging infrastructure providers
- Besides investors, this is a document that is of interest of any players or entities working in the public transportation sector.

C40 CITIES

tumi E-Bus Mission

Prepared by PMANIFOLD

- C40 is a network of mayors of nearly 100 world-leading cities collaborating to deliver the urgent action needed right now to confront the climate crisis. C40's mission is to halve the emissions of its member cities within a decade, while improving equity, building resilience, and creating the conditions for everyone, everywhere to thrive.

- TUMI e-Bus Mission is a global implementation initiative with the objective of contribute significantly to the goal of creating sustainable urban transport systems. The TUMI E-Bus Mission supports 20 deep dive cities in their transition towards electric bus deployment. National and regional core groups help upscale these efforts to 100 mentee cities until the end of 2022. Until 2025, 500 cities will be inspired, and these actions will lead to the procurement of more than 100,000 e-Buses, resulting in a reduction of more than 15 megatons of CO_2 emissions.

Partners:

Funders:

German government

Die Bundesregierung

Facilitators:

BMZ

Federal Ministry for Economic Cooperation and Development

GIZ

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Prepared by MANIFOLD

Acknowledgement

C40 cities expresses its sincere gratitude to the following stakeholders for their generous grant in making ***Development of the India Zero Emission Bus Market Investor's Guide*** *in India* possible.

We would like to thank **WRI team** for sharing Market research information in e-Bus segment. We are grateful to the team for their support in providing the e-Bus data at the National level and City level data.

C40 cities expresses its sincere gratitude to **pManifold** for their pertinent inputs, data analysis, and support in coordinating with the stakeholders.

We also express our gratitude to **all stakeholders** listed here for sharing **technical knowledge** and giving their **time** for this larger cause.

Contact Person	Designation
Mr. Wilberforce Chege	TUMI e-Bus Mission Manager, C40
Ms. Lusanda Madikizela	Senior Programme Manager, e-Bus Mission, C40
Mr. Manoj Soni	Head - eMaaS (e-Mobility Business), Ashok Leyland Experience - Urban Mass Transport Expert, Electric Bus, EV, Electric Mobility, BRT operation, People Transport, Building Scalable and successful e-Mobility business, Global network, Annual Growth
Mr. Jayant Deshmukh	e-Bus City Operations Expert Experience - Public Transport Industry including training, Designing and implementing training programs in public bus transportation including for e-Bus Operators, City Bus Services under PPP model & monitoring the bus operations, Business plan for improvement in City bus services, Bus operation under Net cost model
Mr. Karthick Athmanathan	Business Head- Electric Vehicles & e-Mobility Solutions at Ashok Leyland Vice President, Product Development and Chief Engineer, Buses at Ashok Leyland Global Platform Director, Buses at Ashok Leyland
Mr. Rajesh S	Vice President – Sales & Marketing, Electric Vehicles & e-Mobility Solutions, Ashok Leyland (Retired)
Mr. Sanjay Bhatia	Business Consultant EV and Hydrogen mobility and ex- Tata Motors president
Mr. Manish Pandey	Manager, WRI - Urban and Electric Mobility
Mr. Ranjith Parvathapuram	Senior Manager – Electric Mobility, WRI Experience in Integrated Mobility, Public Transport, Capacity Building, Sustainable Development
Ms. Aparna Vijaykumar	Manager, WRI - Electric mobility, public transport and urban development
…	

**Detailed list of Stakeholders consulted will be further provided*

This Guide

1. The Indian Market	2. Bus manufacturing in India	3. Potential models for ZE-Bus deployment	4. How to invest in India?
A. Why investing in India?	A. Overview of bus production in India	A. Separation of asset ownership	A. For OEMs to set-up operations in India
B. Opportunities in the main 6 cities	B. Investment opportunities	B. Model applied per city	B. For capital investors

ZE-Bus Investor Guide – Executive Summary

Executive Summary

In view of India's recent pledge at COP26 Summit at Glasgow to achieve net-zero emissions by 2070, Indian cities have a unique opportunity to bypass the typical stages of incremental and marginal improvements to public transportation and fuel efficiency. India needs an immediate and ambitious plan to revamp its public transportation infrastructure. And looking at the trends so far, ***e-Buses are the future of public transportation in India.***

In support of this goal, India has implemented key national and state initiatives, including its flagship EV scheme, Faster Adoption and Manufacturing of Electric (**FAME**) Vehicles, which provides varied incentives although India needs more foreign direct investment to meet its goals. There is a major gap between the investment levels in e-Buses and batteries required to remain aligned with net-zero scenarios and existing investment levels. However, a **recent study by INVEST INDIA finds that investors are optimistic about India's e-Bus market and growth potential**.

India has a sizeable zero-emission bus (ZE-Buses) potential market. By ***2030, more than 50,000 Intracity e-Buses*** are expected to be deployed. ***Approximately 10,000 Mn USD Investments*** are expected for the intracity e-Bus electrification that includes cost of e-Buses and supporting charging infrastructure. However, high import taxes, a complex regulatory system, and a lack of competition amongst technology providers constitute critical challenges to fleet-wide ZE-Bus deployments, mainly due to the lack of local production. For this ZE-Bus transition to happen, ZE-Bus industry leaders need to invest in India to produce locally, and although some are aware of this reality, few really understand the implications of investing in India. Several cities in India have made commitments to ZE-Bus deployments in the next few years, showing that there is demand from the public sector, but there is still the need for more providers, manufacturers, and investors to accelerate the market and boost the necessary supply competitiveness to enable viable costs for the transition. The six cities - ***Ahmedabad, Chennai, Delhi, Mumbai, Pune & Surat*** account for approximately ***60% of the market by 2030***. Indian e-Bus market offers **4 distinct opportunities** where investment is already transpiring and will continue to rise in order to meet growing market demands. The interested stakeholders can enter the market as a/an ***Manufacturer, Operator/ Aggregator, Charging service provider and Financier.***

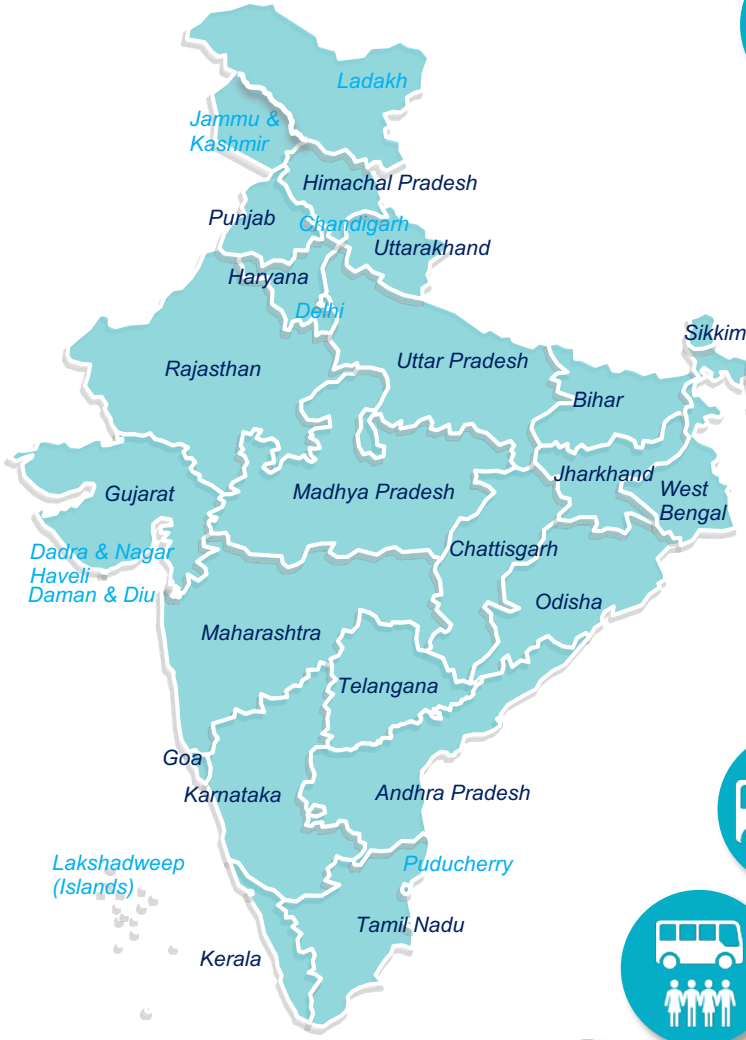
India is gearing up towards strong Electric Bus Ecosystem exhibiting strong niche of enabling entities required for the transition to e-Bus. (Entities - Government Entities, Industry Association, Advisory and R&D, OEM and EVSE Provider, Operators, Funding Institutions.)

3

ZE-Bus Landscape in India

This section aims to provide the overview of ZE-Bus Landscape in India detailing out the ZE-Bus Ecosystem, ZE-Bus Policy, Demand, and Supply Landscape and ZE-Bus Business models

Indian Bus Market: Need more buses



Population – 1.39 Bn

28 States & 8 UTs

5 Mn+ 7 Cities

1 Mn+ 48 Cities

Transport is State subject

~30% Urban mode share for PT

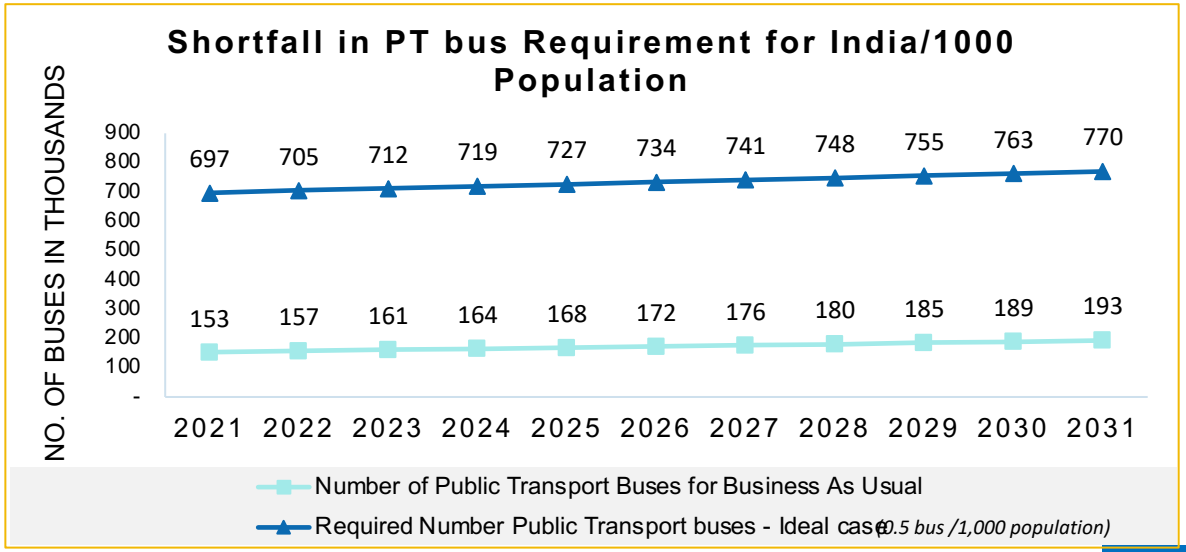
0.11 Buses/1,000 population

Total 28 State Transport Undertaking

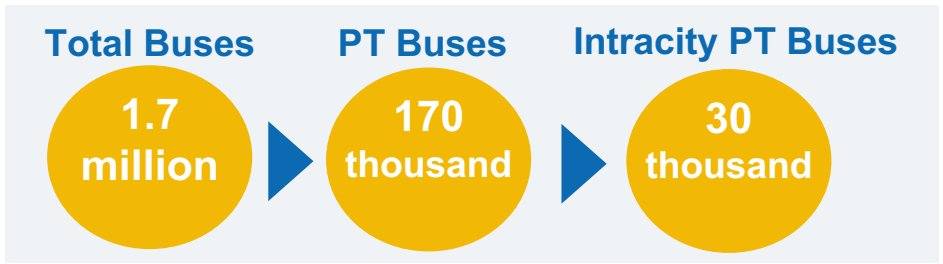
- India is estimated to have **1.53 Bn** Population by end of 2031
- As per Ministry of Housing and Urban Affairs (MoHUA) and Global benchmark of **0.5-1 Bus/ 1,000 population**; India has 170,000 PT Buses on-road.
- There is **4.2 X demand** for PT Buses with shortfall of 504,000 buses. Scope for electrification and this offers a market for e-Buses.
- India has less than **1.5** Bus per 1,000 people, whereas China has **6** buses per 1,000 people

Source: MORTH

Demand for buses in India



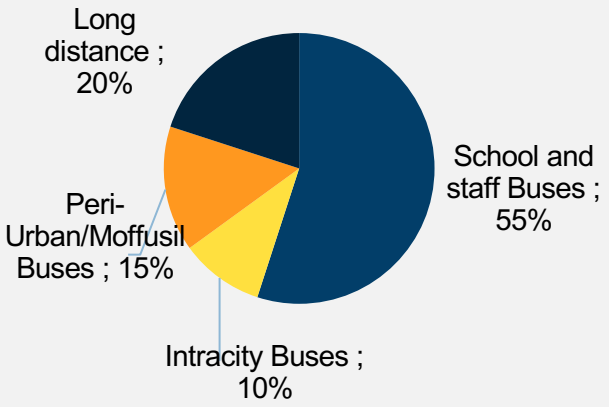
Indian Bus Market Segmentation



"**Public service vehicle**" means any motor vehicle used or adapted to be used for the carriage of passengers for hire or reward, and includes a maxicab, a motorcab, contract carriage, and stage carriage ;
"**Private service vehicle**" means a motor vehicle constructed or adapted to carry more than six persons excluding the driver and ordinarily used by or on behalf of the owner of such vehicle for the purpose of carrying persons for, or in connection with, his trade or business otherwise than for hire or reward but does not include a motor vehicle used for public purposes ;
Corresponding Law. - Section 2 (33, 35) corresponds to section 2 (25) of the Motor Vehicles Act, 1939.

Indian Bus Market segmentation

No. of Buses - Use Case wise

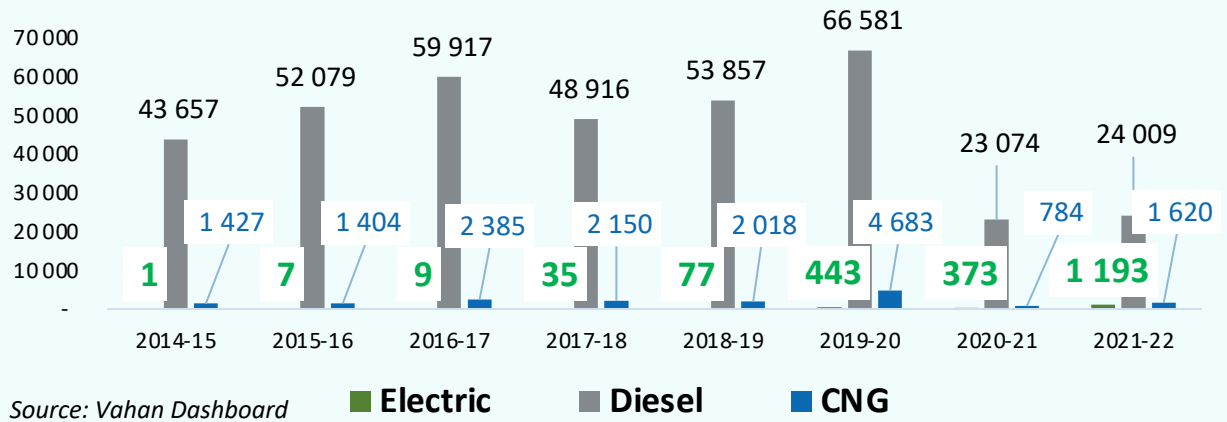


Source: Stakeholder consultation

Bus length – Use Case wise

- School and staff - 7m, 9m, 12m
- Peri-Urban/ Moffusil - 9m, 12m
- Long distance - 12m
- Intracity - 7m, 9m, 12m

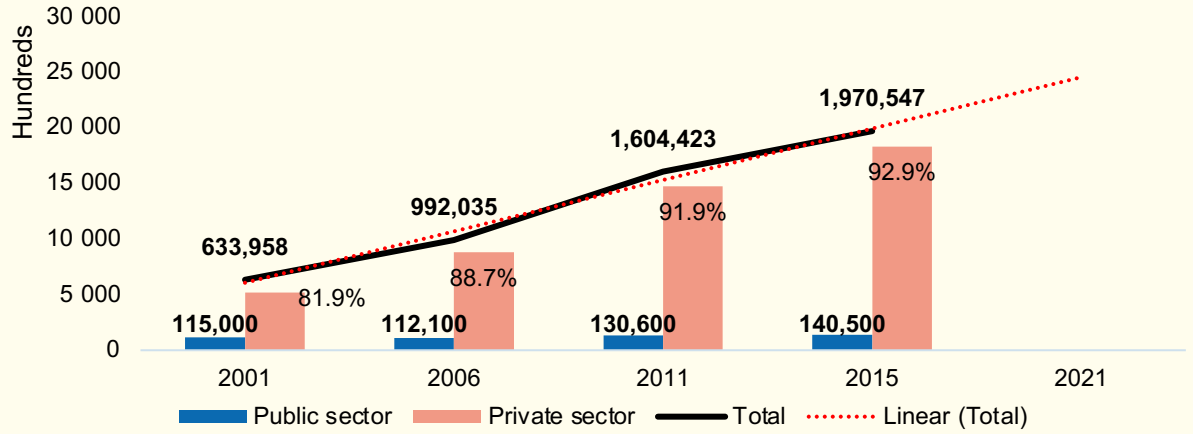
No . of Buses - Annual bus registrations by fuel type



Source: Vahan Dashboard

- In the FY 2022-23 (from March 2022 to till date), the no of **e-Buses registered are 599**.

No. of Buses - Public vs Private



Source: Ministry of Road Transport and Highways

Despite the decreasing total yearly bus registrations, the no of **e-Bus registrations** has been increased **3x times** in the last FY.

Currently, only the PTAs/STUs are involved in e-Bus deployment. **Private entities** also need to take a lead as they form a large **market** of **~90%** of the total buses.

Electric Buses in India

e-Buses: Growing Opportunity in India

India Target- Net zero carbon emissions by 2070

Alarming levels of air pollution – **14 out of 15 most polluted cities** of the world are in **India-** necessitated a switch to cleaner mobility

Mass passenger transport through e-Buses would help **reduce direct carbon emissions**

e-Buses are **capable to save energy**; save fossil Fuels and forex for fuel imports

Strong policy support, facilitation and **incentives outlay** to drive growth of e-Buses by government

Deployment of e-Buses can **generate jobs** across **Automobile industry** for manufacturing (vehicle and subsystems), **supply and innovation, planning, operations, monitoring and others**

Most of Bus based **PT Systems lacks financial capacity** and **require upfront investment**; on GCC basis outsourcing reduced deficits; e-Buses are **capable to reduce TCO of PT operations with ~30% lower* than Diesel buses.**

High domestic potential and growing **potential to export e-Buses** to Asian and other global market with growing manufacturing base and increased **localisation**

Rising **global adoption** enabling **Economies of Scale**, proliferation of duty-cycle-focused technologies enabling **technology maturity** and **price declines**

*Refer Grand Challenge- Slide

e-Buses in India: More than 60+ cities running e-Buses

ZE-Bus Landscape in India

A **e-Bus Ecosystem**

B ZE-Bus Policy Landscape

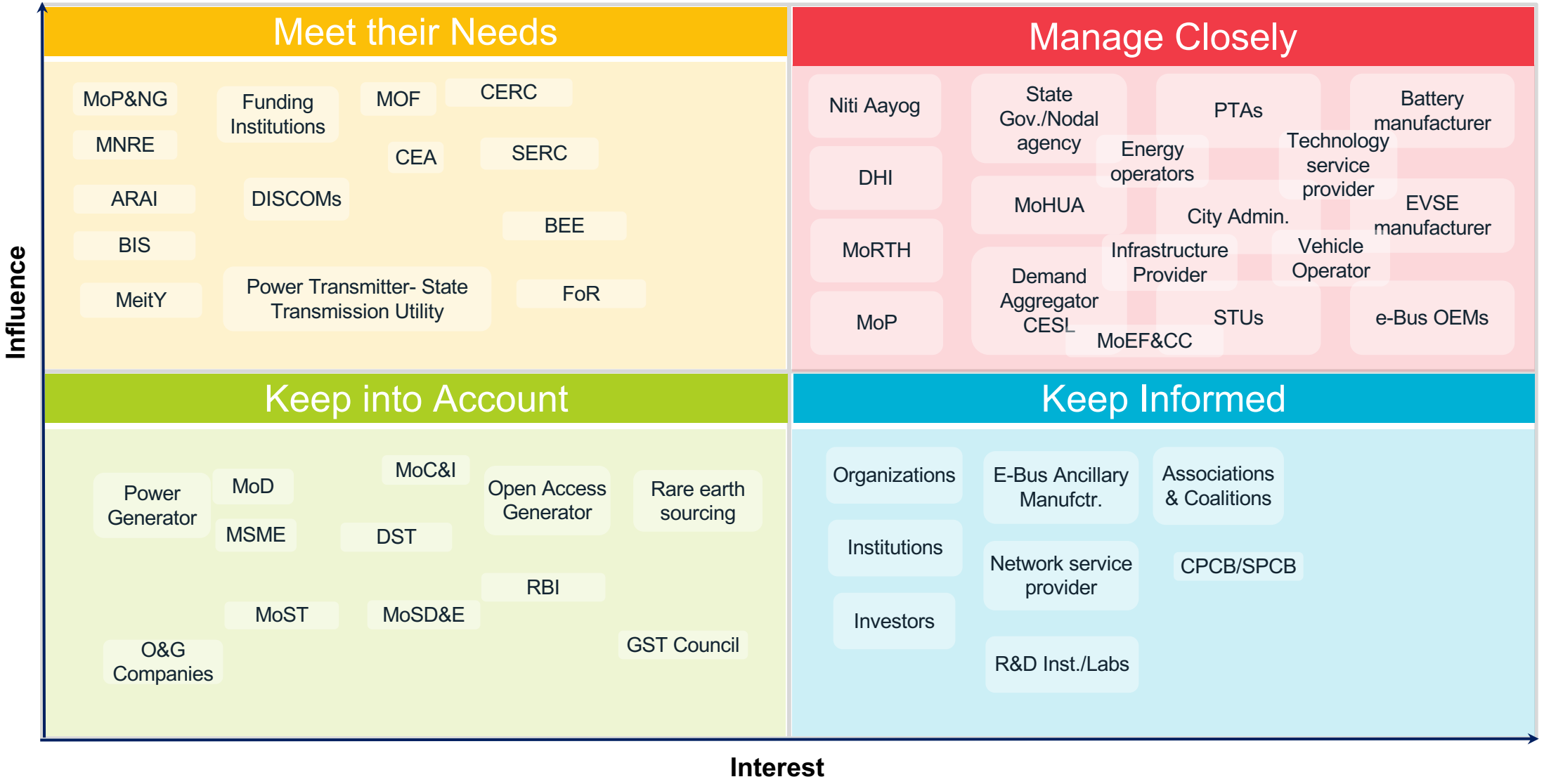
C ZE-Bus Demand Landscape

D ZE-Bus Supply Landscape

E ZE-Bus Business Models

Indian e-Bus Ecosystem: Strong Stakeholders' Support

Stakeholder Mapping



Influence: *Ability of the stakeholder to stop or change the project & level of influence a stakeholder has to mobilize key actors to in favour or against the subject*

Interest: *Level of positive or negative interest a stakeholder has on the subject defined by size of the overlap between the stakeholder's and the project's goals*

ZE-Bus Landscape in India

A e-Bus Ecosystem

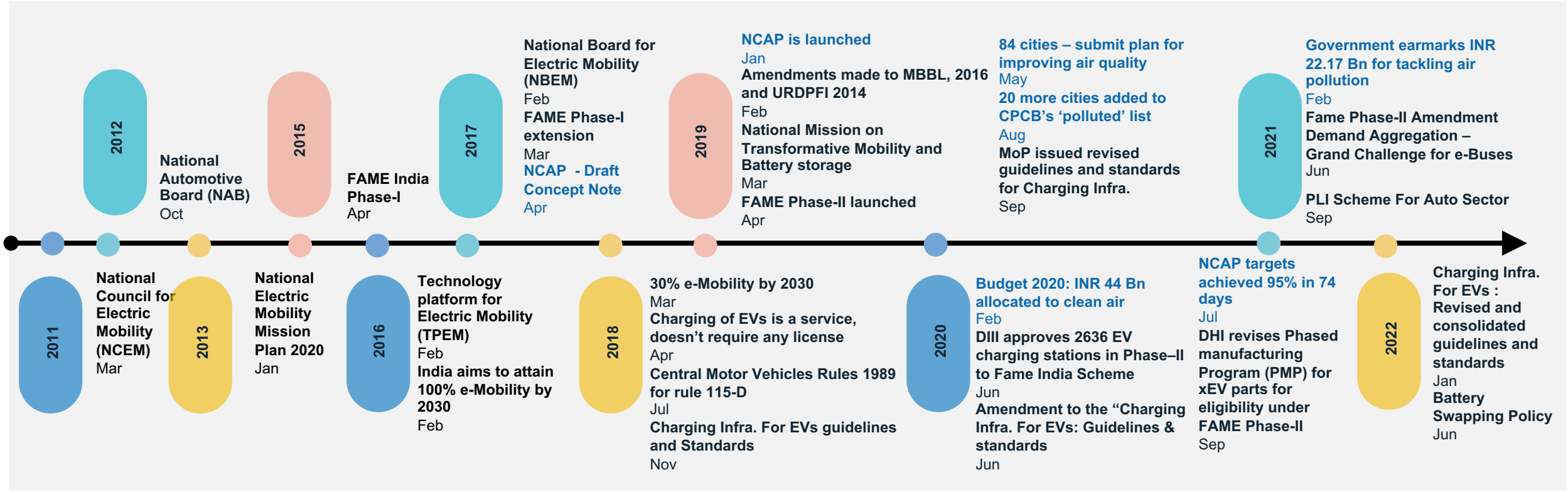
B **ZE-Bus Policy Landscape**

C ZE-Bus Demand Landscape

D ZE-Bus Supply Landscape

E ZE-Bus Business Models

Timeline of Govt. Initiatives for e-Buses

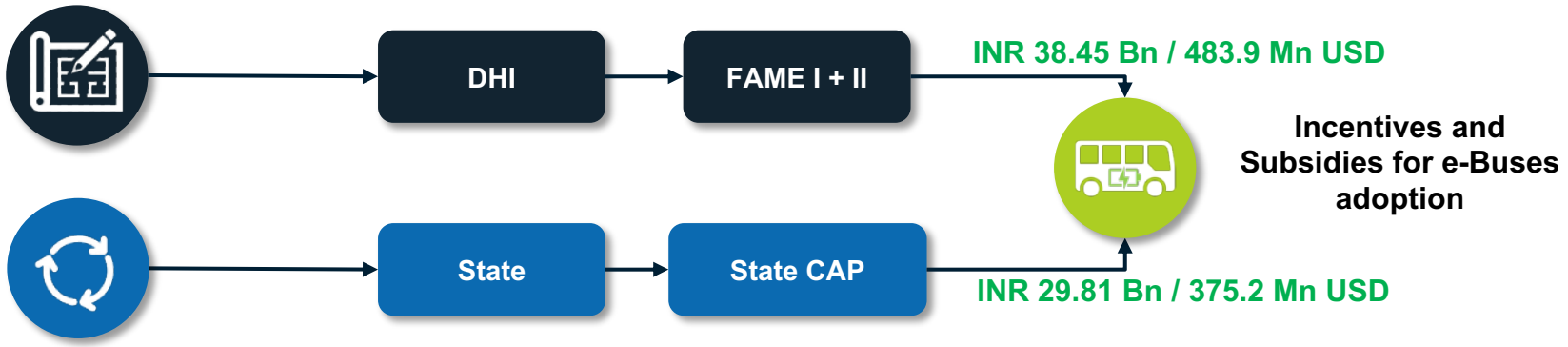


NEMMP 2020

National Electric Mobility Mission Plan- Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India

NCAP

National Clean Air Programme



*Refer NCAP- Slide

FAME Phase-I

Four Focus areas of FAME I

Demand Creation | **Technology Platform**

Pilot Project | **Charging Infrastructure**

- Phase 1 initially launched for **2 year period** starting from **FY 2015-16 to FY 2016-17** with an overall outlay of **INR 7.95 Bn**
- Original scheme did not include demand incentive allocation for e-Buses until it was partially modified in September 2017.
- Later extended 4 times for 6 months each with **additional** outlay of **INR 1 Bn (Total 8.95 Bn)**
- Total outlay for e-Buses deployment ~INR **3 Bn** (**31%** of total outlay)
- Target minimum deployment of **500 e-Buses** however, **425 e-Buses were sanctioned to various cities/states.**
- 2 Business model choices under FAME 1 for selection of mode of e-Bus deployment – **Capex (OPM) and Opex model (GCC)**
- **Limited Coverage**: Initially, an EOI was issued for a minimum of 5 cities. The participation was restricted within **million-plus cities** (as per Census 2011). However, the grant was later sanctioned for **9 cities**.

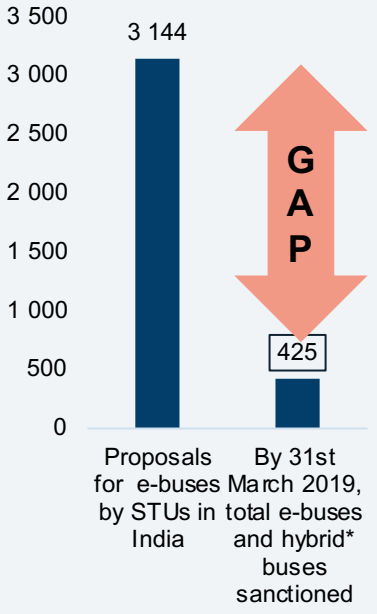
GAP

Target for 500 buses; Delhi used the state budget for deployment and some states couldn't process tenders timely.

Incentives for 'fully electric buses' (CMVR category – M2 &M3).

Incentive Level 1	(Min. Localization level – **15%**)	60% of purchase cost or INR 8.5 Mn (whichever is lower)
Incentive Level 2	(Min. Localization level – **35%**)	60% of purchase cost or INR 10 Mn (whichever is lower)
Additional incentive for setting up **charging infrastructure** for e-Buses		10% of total demand incentive

No of e-Buses under FAME I



State/City	No of Buses Sanctioned & Deployed	OPM	GCC
MP/Indore	40	40	0
UP/Lucknow	40	40	0
Assam/Guwahati	15	15	0
J&K	40	40	0
West Bengal	80	80	0
Maharashtra/Best Mumbai	40	0	40
Telangana/ Hyderabad	40	0	40
Himachal Pradesh	75	50	25
Maharashtra/Navi Mumbai	30	30	0
Maharashtra/MMRD	25*	NA	NA
Total - 425		**74%**	**26%**

(*Hybrid)

Source: PIB FAME India Scheme, Jul 2019

FAME Phase-II

- In March 2019, the MoHI&PE notified FAME –II scheme with an increased outlay of **INR 100 Bn**, which **includes a spill over of INR 3.66 Bn from FAME I.** Applicable from **FY 2019-20 till FY 2021-22**
- FAME II **tried to address several limitations of FAME I**, including coverage (eligibility criteria of cities extended from million plus cities), promotion of cleaner technology, setting up clear deployment targets along with dedicated fund allocation etc.
- FAME II scheme. The scheme aims to support sale of **~ 1.56 Mn** vehicles across all categories.

e-Bus outlay

Maximum Number of Vehicle to be supported
7,090

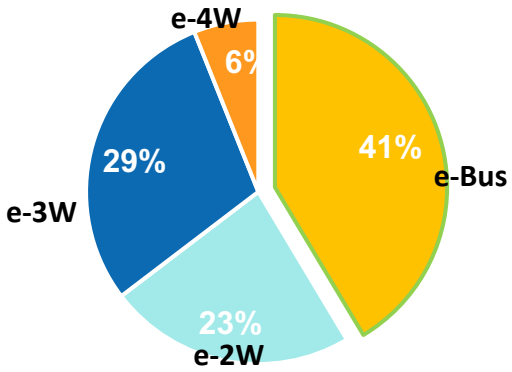
Approximate Size of battery (kWh)
250 kWh

Total Incentive (INR 20,000/ kWh)
INR 5 Mn

Maximum price to avail incentive
INR 20 Mn

Total Fund for **e-Bus**
(Max compared to other vehicle segments)
INR 35.45 Bn
(41.2 % of total fund)

FAME II Vehicle segment wise demand Incentives division



- **Opex mode/ wet lease model** of deployment by the transport undertaking **mandated** in order to be eligible for FAME II subsidy
- The bidding model to be adopted by operators/ suppliers for bus deployment would be solely **Gross Cost Contract (GCC) based bidding**

Model Concession Agreement (MCA)

- Formulated by NITI Aayog, also known as **Supply-Cum-Operation and Maintenance Agreement** which must be adopted by the selected city
  - **Concessionaire/ operator/ supplier-** responsible to meet the financial requirements for procurement of buses, operation & maintenance of buses and allied-infrastructure
  - **Transport corporation-** to incur **operational cost on per km** basis

Source: DHI notification of Phase-II of FAME , 2019

FAME II Amendment

» The scheme has been extended for a further period of 2 years i.e. **up to March 31, 2024**

Electric Buses

EESL to aggregate demand in **9 cities** (with population of 4 million+) for **e-Buses** under the scheme on **OPEX basis**

» **EESL** is nominated to aggregate the demand for electric 3-wheelers and **electric buses**. EESL will fulfil this mandate through its wholly owned **subsidiary CESL**

» MHI through Gazette Notification issued a Corrigendum with Amendments to FAME II Scheme on 11 June, 2021

» For Electric Buses, **9 cities with 4 million plus population** (Mumbai, Delhi, Bangalore, Hyderabad, Ahmedabad, Chennai, Kolkata, Surat, and Pune) will be targeted**.

Source: Ministry of Heavy Industries and Public Enterprises (DHI) CORRIGENDUM New Delhi, 11th June 2021

» NITI Aayog has asked CESL to scale up to **50,000 buses**

» MoRTH has asked CESL to explore replacement of all 10+ year old buses with eBuses – over 40,000 in stock

» Demand in-hand: Approx 7,000

» Inter-Ministerial group reviewed by the Prime Minister's Office

» Clearly **India offers a huge market for e-Buses**

» **Tender conditions** are **bankable** – designed with financiers, STCs and OEMs

» No impact on balance sheet of STCs – shows the possibility of how private sector can be leveraged even with poor STC finances given the backing of the Government

***Further detailed under demand landscape -Grand challenge by CESL in slide*

National e-Bus Targets, Incentives and Initiatives

INR **35.45 Bn** Allocated by GOI for adoption of **7,090 e-Buses**

5,594 electric buses sanctioned by Govt. to 64 cities for intercity and intracity operations
2,100+ ZE-Buses operational

National Incentives and Initiatives

Union Budget 2019-20:

Income tax reduction of INR 150,000 on the interest of loans for EV purchases

Customs duty exemption on import of specific components

GST on EVs and charging stations reduced to 5%; Local authorities hiring e – **Buses exempts from GST**

Production Linked Incentive (PLI) Scheme

- **Financial incentives** to certain **EV OEMs and component manufacturers.**
- Incentives worth **INR 259.38 billion till FY27**

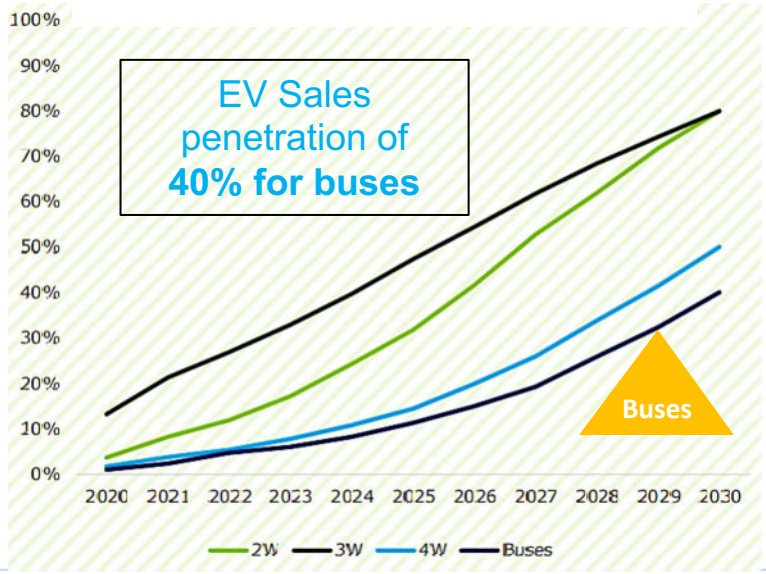
Grand Challenge for developing Indian Standards for EV Charging Infrastructure

Phased Manufacturing Programme (PMP)- Mandate to indigenize the use of all components for bus models to be eligible for the FAME-II subsidy

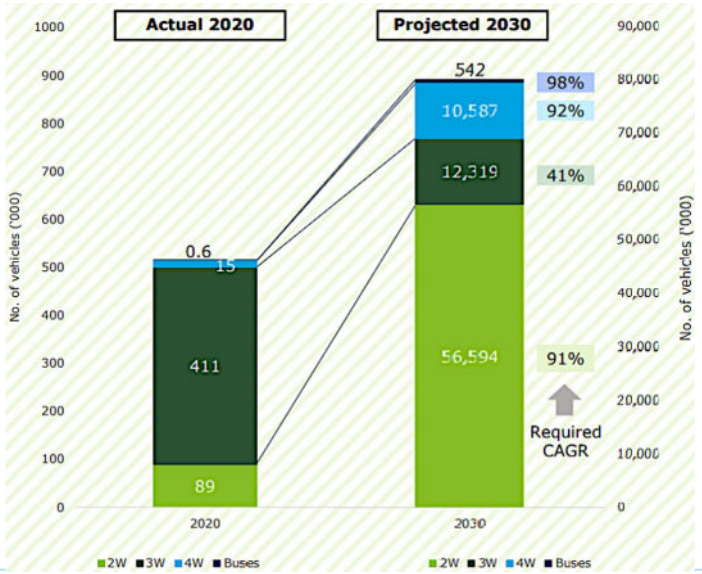
Basic Customs Duty (BCD) for buses on completely built units (CBUs) was increased from 25 to 40 % in 2020

National Projections by NITI Aayog

EV sales penetration by 2030



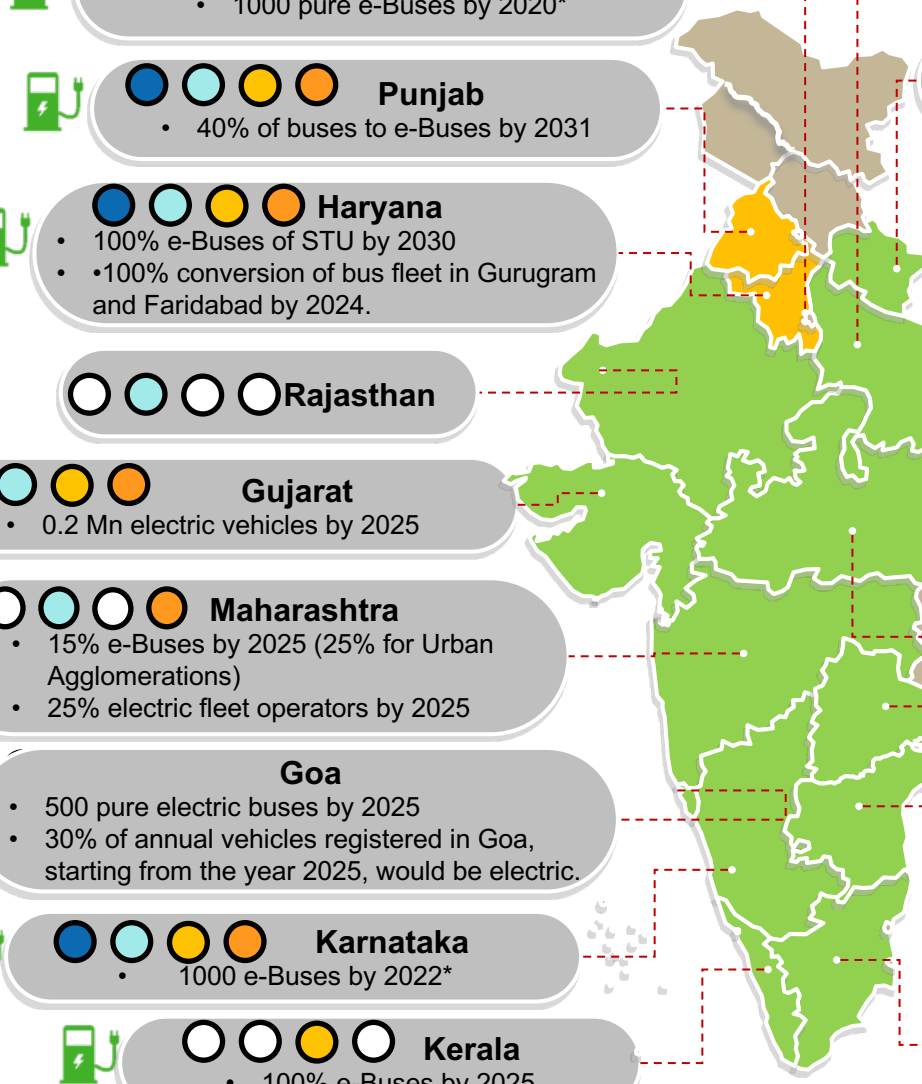
Actual and projected EV sales by 2030



Source: Niti Ayog

State e-Bus Targets and Incentives

States with Notified EV Policy
States with Draft EV Policy



Delhi
- 1000 pure e-Buses by 2020*

Punjab
- 40% of buses to e-Buses by 2031

Haryana
- 100% e-Buses of STU by 2030
- •100% conversion of bus fleet in Gurugram and Faridabad by 2024.

Rajasthan

Gujarat
- 0.2 Mn electric vehicles by 2025

Maharashtra
- 15% e-Buses by 2025 (25% for Urban Agglomerations)
- 25% electric fleet operators by 2025

Goa
- 500 pure electric buses by 2025
- 30% of annual vehicles registered in Goa, starting from the year 2025, would be electric.

Karnataka
- 1000 e-Buses by 2022*

Kerala
- 100% e-Buses by 2025

Uttarakhand
- 500 e-Buses by 2023

Bihar
- 100% e-Mobility by 2030

Uttar Pradesh
- 1000 electric buses by 2030

Assam
- 100% electric buses by 2030
- 100% of government vehicles to be converted to electric vehicles by 2030

Manipur
- 15% electric vehicles by 2025

West Bengal

Odisha
- 50% e-Buses by 2026

Madhya Pradesh
- •100% e-Buses by 2028
- •100% government vehicles by 2028

Telangana
- 100% e-Buses by 2030 for intra-city, intercity and inter state transport with 25% target by 2022 and 50% by 2025.

Andhra Pradesh
- 100% e-Buses by 2029
- 100% electric fleet in electric mobility cities by 2024

Tamil Nadu
- STUs to replace around 5% of the buses as EV every year and around 1000 EV buses may be introduced every year.

Manufacturing Incentives

Capital Subsidy	Tax Exemptions and Interest Subsidy	Land development incentives	Concession and Infrastructure	No incentives

Charging Infrastructure Incentives

Source: State EV Policies

*Plans have been extended by the specific states and cities, numbers will be updated as the study progress with stakeholder consultations

Incentives & Initiatives across e-Bus Value Chain

Customs duty exemption on import of EV components.

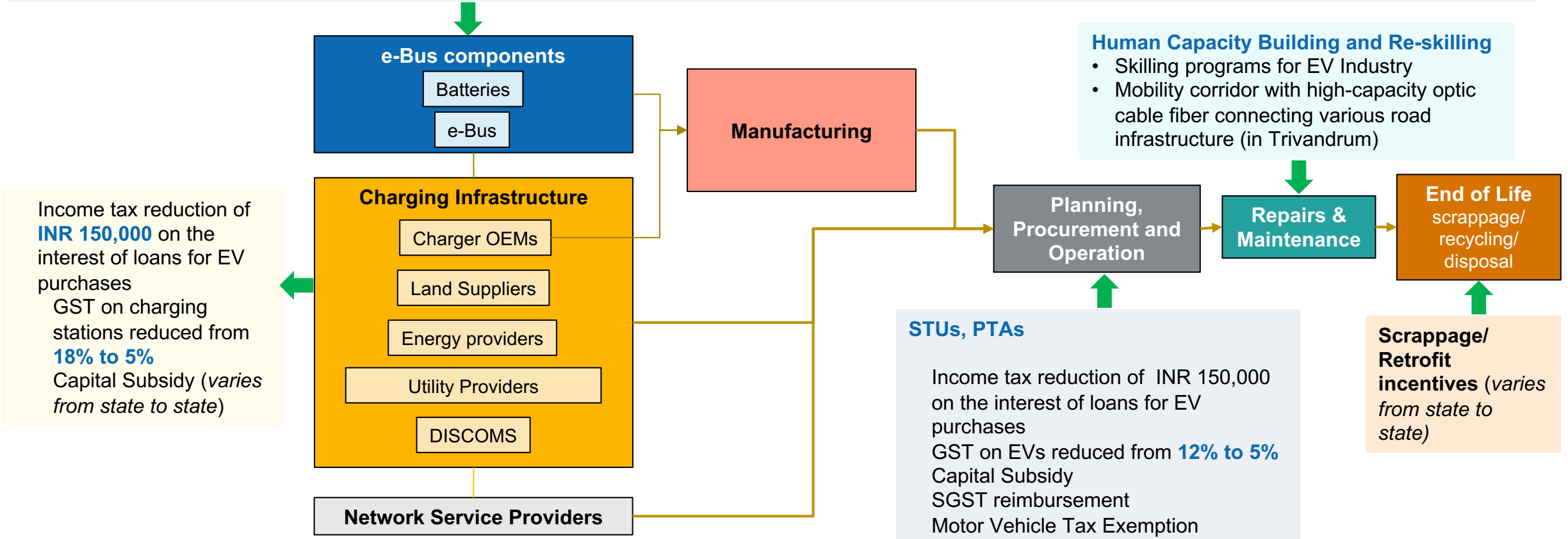
Phased Manufacturing Programme (PMP)

- **Timeline-based hike in Basic Customs Duty (BCD)-** For buses, BCD on completely built units (CBUs) was increased from 25 to 40 percent in 2020.

Production Linked Incentive (PLI) Scheme

- Automobile and Auto Component - **INR 259.38 Bn**
- For Advanced Chemistry Cell (ACC) - **INR 181 Bn**

Capital Subsidy
Electricity duty exemption
Land Conversion Fee/Subsidy
SGST Reimbursement
Stamp duty exemption



Human Capacity Building and Re-skilling

- Skilling programs for EV Industry
- Mobility corridor with high-capacity optic cable fiber connecting various road infrastructure (in Trivandrum)

Income tax reduction of **INR 150,000** on the interest of loans for EV purchases
GST on charging stations reduced from **18% to 5%**
Capital Subsidy (*varies from state to state*)

STUs, PTAs

Income tax reduction of INR 150,000 on the interest of loans for EV purchases
GST on EVs reduced from **12% to 5%**
Capital Subsidy
SGST reimbursement
Motor Vehicle Tax Exemption
Registration Fee Exemption
Road Tax Exemption

Scrappage/ Retrofit incentives (*varies from state to state)*

ZE-Bus Landscape in India

A e-Bus Ecosystem

B ZE-Bus Policy Landscape

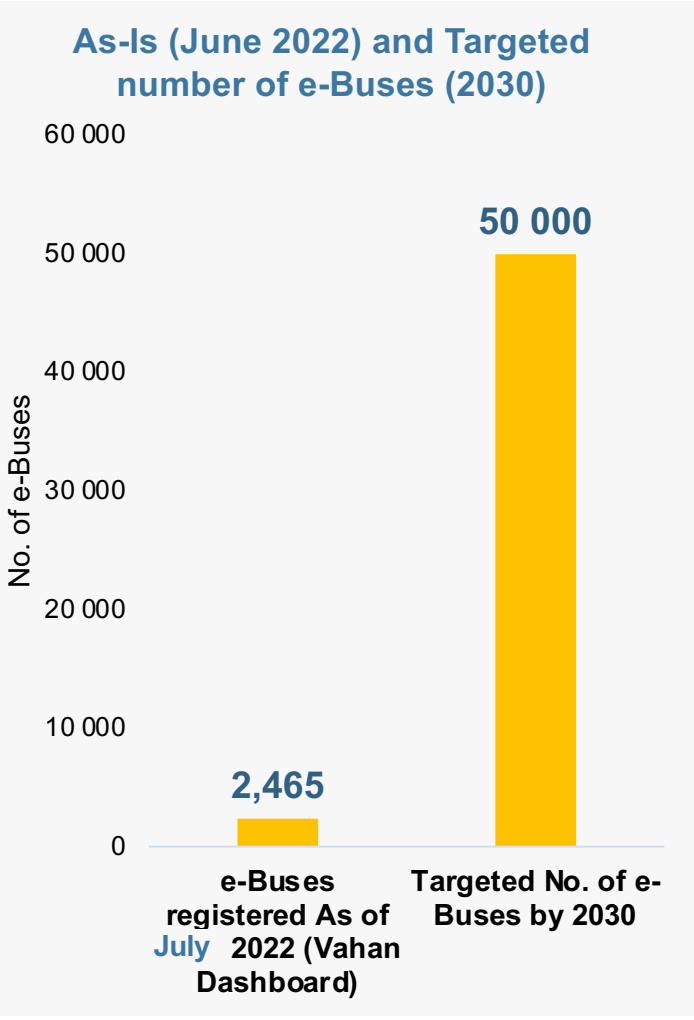
C **ZE-Bus Demand Landscape**

D ZE-Bus Supply Landscape

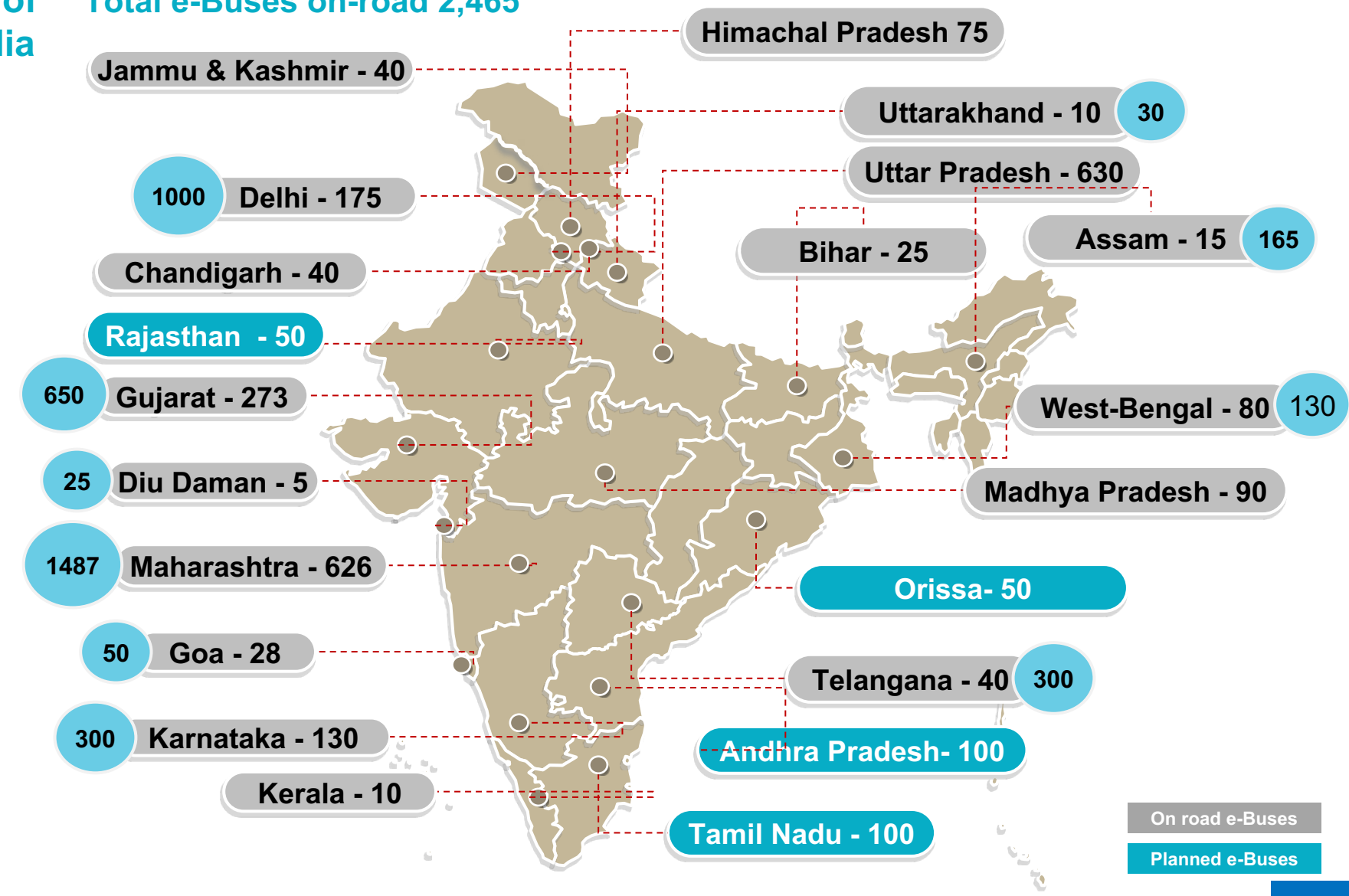
E ZE-Bus Business Models

Demand to grow e-Buses – 50,000 targeted by 2030

CESL to accelerate deployment of 50,000 electric buses across India

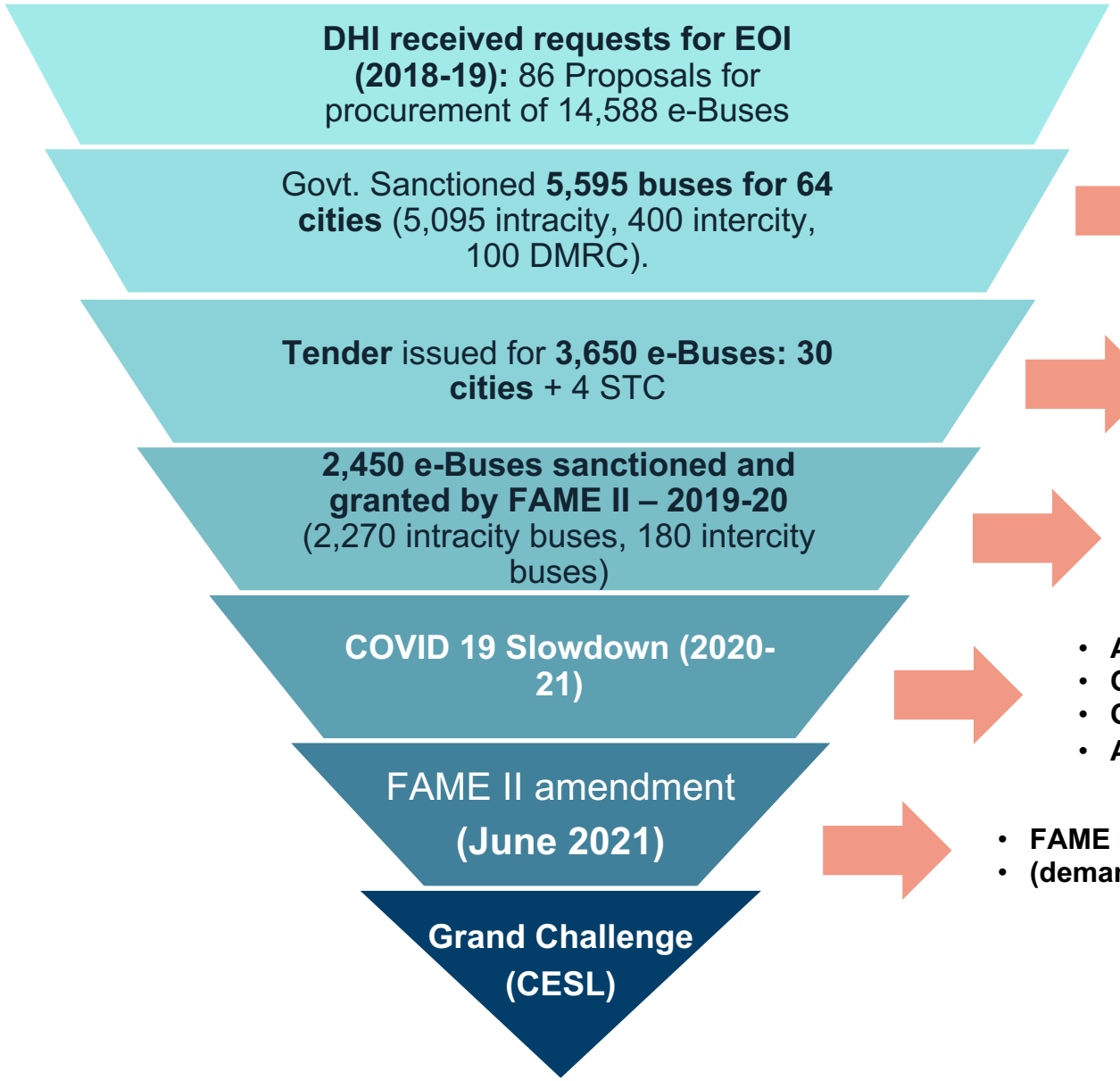


Total e-Buses on-road 2,465*



** As of July 2022, Vahan dashboard and Industry consultations*

Govt. efforts to aggregate e-Bus demand



Expected to save 1.2 billion liters of oil import Reduction of 2.6 Mn t CO_2

Navi Mumbai, Nagpur, UP 13 Cities, GSRTC, Delhi (DMRC), Bhubaneshwar, Delhi, Indore, UKSRTC, Chandigarh, Jabalpur, Jabalpur, Ahmedabad, Surat, Ujjain, Patna, BEST-Mumbai, Gwaliar, BEST Navi Mumbai, Pune, Nasik, Kolkata new town, Silvasa, Kadamba SRTC (S), Kadamba SRTC (S)

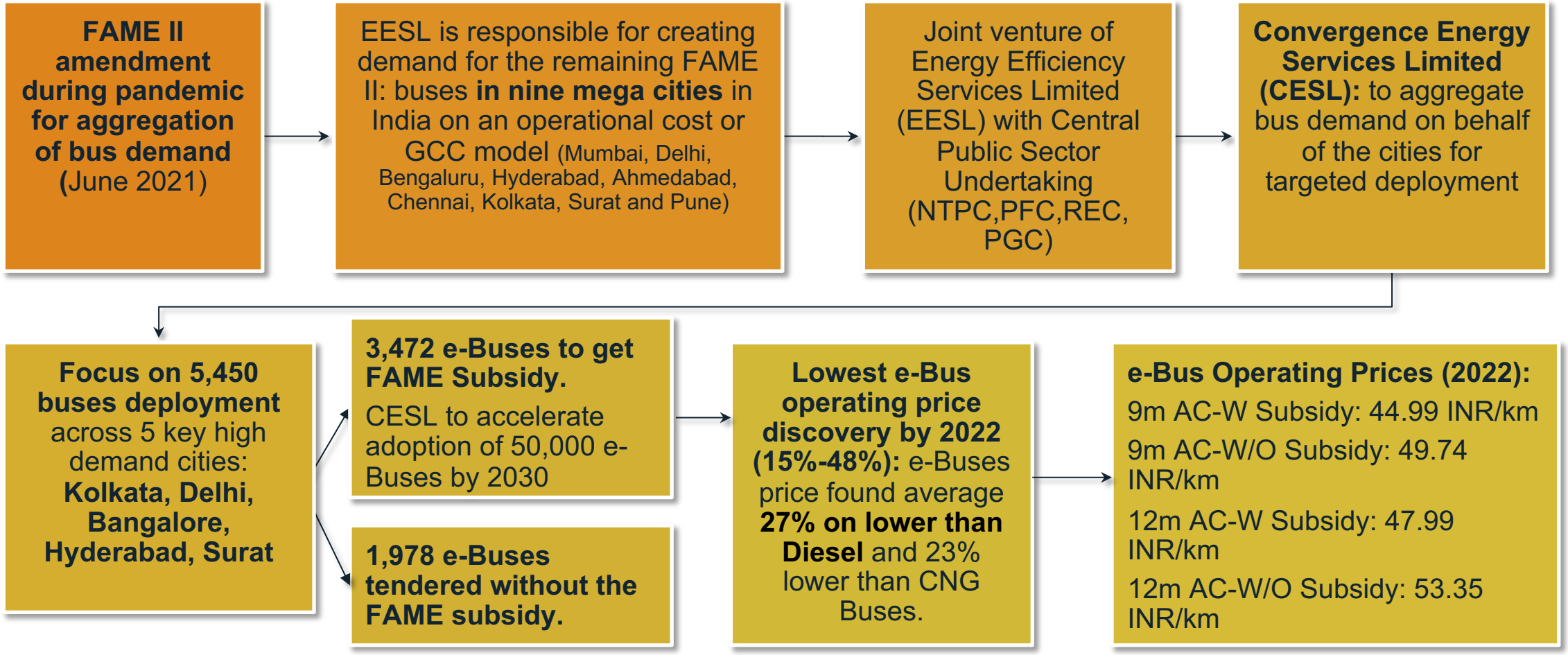
18 cities lost opportunity by not initiating tendering process

- **Announcement for remaining 2,000 buses awaited**
- **OEMs started to stop production**
- **OEMs unable to supply sanctioned 2,450 buses even after supply orders**
- **Additional 950 bus order received during pandemic 2020-21**

- **FAME II amendment during pandemic for aggregation of bus demand – June 2021**
- **(demand incentive also increased by 5,000 INR/kWh)**

Demand aggregation – Grand Challenge

- Ministry of Heavy Industries asked CESL to aggregate demand and deploy the subsidy - with the expectation that market would respond with lower prices if they saw larger sized orders.
- The **role of CESL to standardize, make bankable contracts and make them look like 'infrastructure contracts' and move from buses to service**



FAME II MCA to CESL CA: Improving Bankability (Summary)

BEFORE

1. Assured Kms: Subject to change for city-to-city
2. 7 KPIs
3. Small volumes and lot sizes (25-300)
4. Lack of clarity in risk sharing and force majeure
5. Authority bound to pay fixed payment, penalty on under-utilization
6. Operator's liability in case of any default in performance. Lack of clarity in payment security terms; penalties, escrow, designated account, and others
7. No provision for Repurposing
8. Electricity cost computed within per km cost and subject to revision with change in electricity tariff. Normalized variables such as electricity, labor wages, etc.
9. Design of charging infrastructure would depend and may change city-to-city / Case-to-case

AFTER

1. Assured kms: Min 70,000
2. 9 KPIs with (assured) incentives and disincentives clearly mentioned for each indicator (with 30% cap)
3. Increased volumes and lot sizes: 5,000+ buses
4. Level playing field for operators, conflict resolution, force majeure, etc.
5. Buses are a "public/essential" service
6. X% for under-utilized KMs, payment for over utilized
7. Enhanced payment security terms; escrow, designated account, seniority to operator
8. Provision for Repurposing
9. Normalized variables such as electricity, labor wages, etc.
10. Standardized charging infrastructure across cities

FAME II MCA to CESL CA: Overall scope

7,000 e-Buses

5,000 e-Buses procurement in 5 cities

FAME II	CESL Grand challenge
• **Authority to set-out demand** on e-Buses and **inviting individual tenders for e-Bus procurement** as per Model Concession Agreement (High prices discovered)	• Authority to set-out demand and **CESL to aggregate demand** by inviting tenders **on behalf of authorities** for e-Bus procurement as per amended Concession Agreement (lower prices discovered for bulk)
• **Supply of Buses conforming to standards + O&M**	• **Design, Manufacture and Supply of e-Buses conforming to the Specifications and Standards + O&M**
• **Procurement period: 16 Years** (contract tenure More than useful life of asset)	• **Procurement period: 10 Years** (contract tenure reduced near to average useful life of asset)
• **Yearly Assured kms** Authority shall Commit to provide Annual Assured Kilometer for payment of fees (Risk to Authority)	• **Yearly Assured kms: Minimum 70,000 km** Authority shall pay for Unutilized kms while to carryforward and utilize it in further contract and after contract period (reduced risk and full utilisation of asset
• **Obligations by Authority:** to provide land, permits, access to site, enabling grid access to locations within 500 km of nearest access point and enabling operators to deploy and operate e-Buses.	• **Obligations by Authority:** to provide land, permits, access to site, **enabling grid access to locations on planned locations, bear the electricity charges for e-Bus charging** and enabling operators to deploy and operate e-Buses. (Grid upgradation and increased accessibility)
• **Obligations by Operator:** bear the cost of e-Buses, infrastructure; their operations maintenance and electricity required for e-Bus charging	• **Obligations by Operator:** bear the cost of e-Buses, Infrastructure; their operations maintenance required (cut down operational cost to some extent)

CESL Demand aggregation price discovery

- **CESL Discovered e-Buses operating prices 27% lower than diesel (without subsidy) and 23% less than CNG)**
- The prices are lower than prices in earlier bids for e-Buses by State Transport Corporations and lower than prices in earlier bids for diesel and CNG buses

Bus Type	Cost/ km (INR/ km)				% Change			
					without subsidy		with subsidy	
	e-Bus with subsidy	e-Bus without subsidy	Diesel Bus*	CNG Bus**	% Diesel	% CNG	% Diesel	% CNG
9m standard-floor AC	44.99	49.75	71.07	58	30%	14%	37%	22%
9m standard-floor non-AC	39.21	43.61	48	48	9%	9%	18%	18%
12m low-floor AC	47.99	53.35	95.14	86.14	44%	38%	50%	44%
12m low-floor non-AC	43.49	48.85	65.45	71.41	25%	32%	34%	39%
Average % change					27%	23%	35%	31%

**** GCC rates of diesel buses in Surat, Bhubaneswar and Mumbai***
*****GCC rates of CNG buses in Delhi, Surat, etc.***
Figures in grey are CPKM of diesel low floor buses without cost of conductor (Source: BMTC) which are procured outright.

ZE-Bus Landscape in India

A e-Bus Ecosystem

B ZE-Bus Policy Landscape

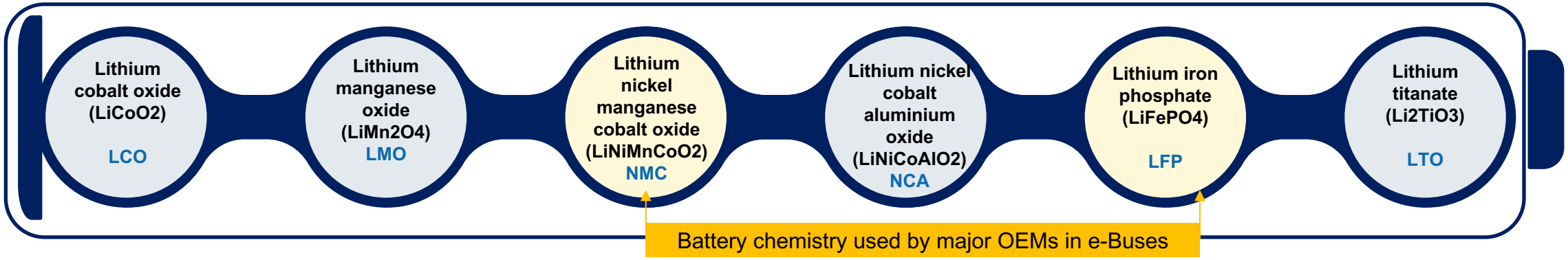
C ZE-Bus Demand Landscape

D **ZE-Bus Supply Landscape**

E ZE-Bus Business Models

Technologies available: Battery Chemistry

Types of available e-Bus technology depending upon their source of energy



- At present, most of the electric vehicles sold in **India uses imported batteries** as the major players in **e-Bus battery manufacturing such as BYD, Panasonic, CATL, CALB, LG Chem** etc. have manufacturing facilities outside India.

- **Govt. of India** has taken several steps in **building domestic battery manufacturing capability** for the future such as setting up of localization targets to avail FAME subsidy and setting deadlines

Exide Industries and Leclanché Joint Venture

Exide Industries and Leclanché, entered in an exclusive agreement in June 2018 to form a **new joint venture (75:25) to build lithium-ion batteries and energy storage solutions to power the growth of India's electric vehicle market**. The plant is located in Gujarat and is expected to be operational in 2020.

Technologies available: Charging Infrastructure

Chargers Type

Conductive

- **AC Charging**
- **DC Charging**
  - **Plug-in**
  - Pantograph

» Uses direct contact between the EV connector and charge inlet

» **Predominant technology deployed** for charging infrastructure in India due to its **design simplicity** and **lower infrastructural expenses**

Inductive

Wireless Charging

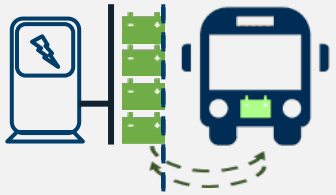
» **Wireless charging method**

» Required service voltage level in India for inductive charging is 415V or above

» Has **very limited application all across the world-** highly **expensive** and its **infrastructure** is quite **complex**

Swapping

External Battery Charging



» Has **limited deployment in India**

» 1st and only case-**introduced** in Ashok Leyland-Sun Mobility partnership for **Ahmedabad BRTS**

» **Range** is **low** (40 km) but **swapping** takes **less than 4 minutes**, making it suitable for intra-city transport

Charging technology for e-Buses prevalent in India (Plug In)

Power	Classification basis	Type of AC/DC charging	Used in e-Bus charging? (Y/N)
AC	Service Voltage level	AC level 1 (120 V)	N
		AC level 2 (230 V)	N
		AC level 3 (415 V)	Y - requires e-Buses to have on-board chargers **More economical, Higher charging time**
DC	Charging system design	**DC Plug-in (415V)**	Y- doesn't require e-Buses to have on-board chargers **Expensive, Low charging time**
		DC Pantograph	N

Indian Charging Ports & Protocols

World Map of Charging Standards

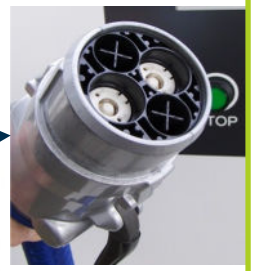
Indian Charging Standards

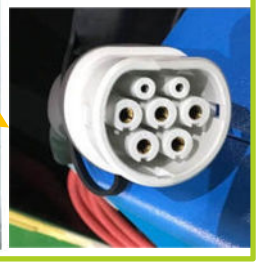
No.12/2/2018-EV
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg,
New Delhi, 1st October 2019

Technical requirement of slow and fast chargers

Charger Type	S. No.	Charger Connectors*	Rated Output Voltage(V)	No. of No. of Connector guns (CG)	Charging vehicle type (W=wheeler)
Fast	1	Combined Charging System (CCS) (min 50 kW)	200-750or higher	1 CG	4W
	2	CHArge de MOve (CHAdeMO) (min 50 kW)	200-500 or higher	1 CG	4W
	3	Type-2 AC (min 22 kW)	380- 415	1 CG	4W, 3W, 2W
Slow/ Moderate	4	Bharat DC-001 (15 kW)	48	1 CG	4W, 3W, 2W
	5.	Bharat DC-001 (15 kW)	72 or higher	1 CG	4W
	6.	Bharat AC-001 (10 kW)	230	3 CG of 3.3 kW each	4W, 3W, 2W

*In addition, any other fast/slow/moderate charger as per approved DST/BIS standards whenever notified.
Note :Type -2 AC (min 22 kW) is capable of charging e-2W/3W with the provision of an adapter





Initially e-Buses used to be evenly split between CCS and GB/T but with recent tenders, the **Indian government is moving towards the CCS standard** and some of the manufacturers **are shifting from GB/T to CCS.** India has yet to finalize charging standard.
Pantograph charging standards** are in development **by BIS committee

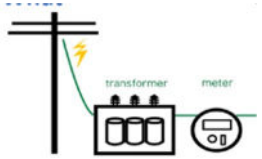
Overall Regulations (India: AIS-138)

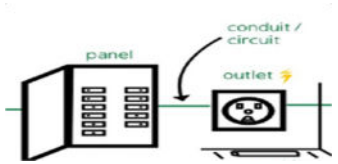
AIS 138 Part 1 is for AC Charging Systems
AIS 138 Part 2 is for DC Charging Systems

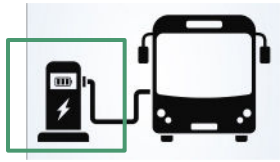
ARAI Charger Definitions

- **Charger**
  Power converter that performs the necessary functions for charging a battery.
- **Class I charger**
  Charger with basic insulation as provision for basic protection and protective bonding as provision for fault protection.
  NOTE- Protective bonding consists of connection of all exposed conductive parts to the charger earth terminal.
  AIS-138 (Part 2)
- **Class II charger**
  Charger with
  - Basic insulation as provision for basic protection, and
  - Supplementary insulation as provision for fault protection or in which
  - Basic and fault protection are provided by reinforced insulation
- **Off-board charger**
  Charger connected to the premises wiring of the AC supply network (mains) and designed to operate entirely off the vehicle. In this case. direct current electrical power is delivered to the vehicle.
- **Dedicated off-board charger**
  Off-board charger designed to be used only by a specific type of EV. which may have control charging functions and/or communication.
- **On-board charger**
  Charger mounted on the vehicle and designed to operate only on the vehicle.

Core components of infrastructure for EV charging





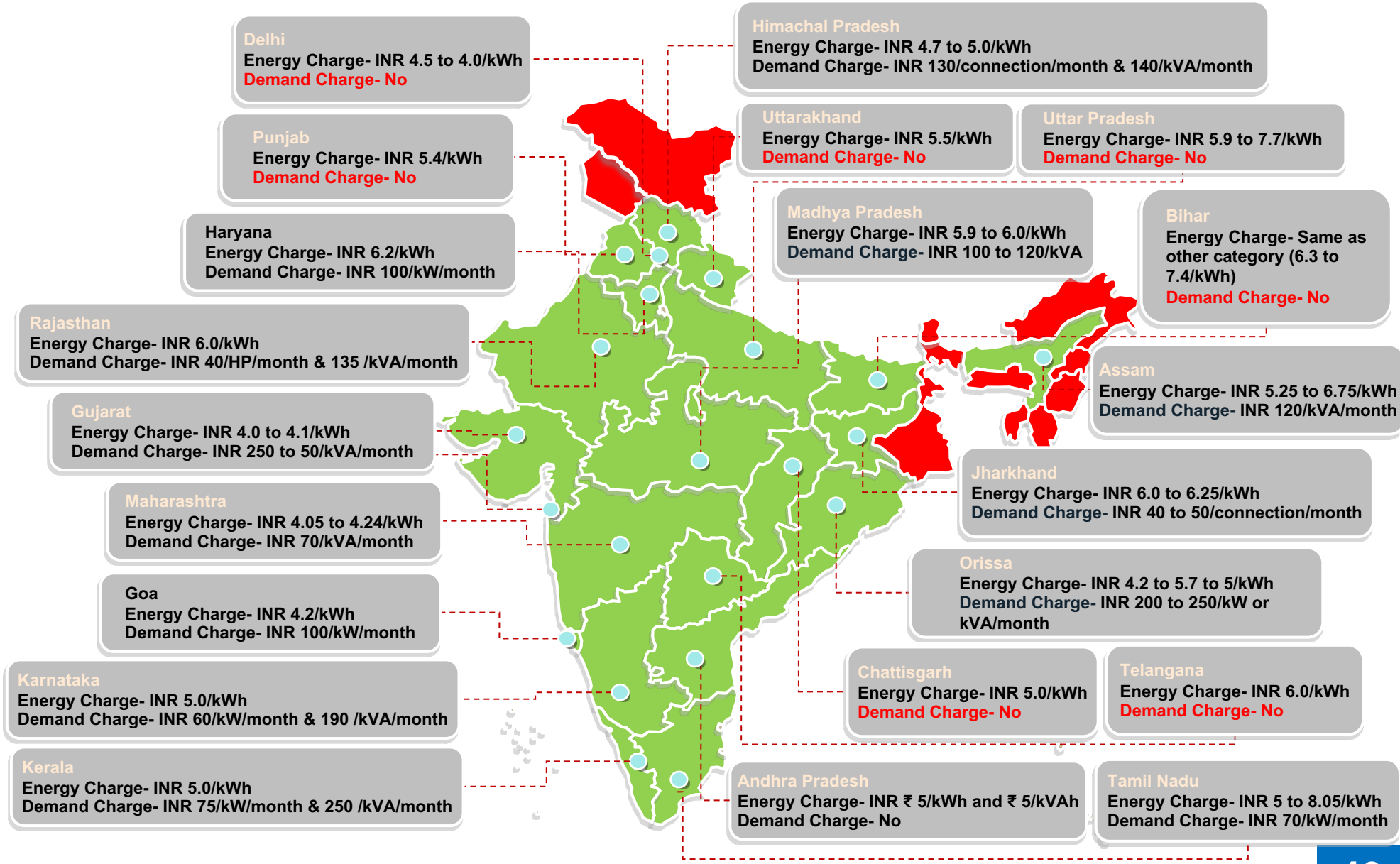


Business Models with Utility providers and Pvt partnership	Service connection	Supply infrastructure	Charging infrastructure	Example Markets
1 *Make ready*	Utility will service both – connection and cabling component		3rd party responsibility to bring charging	**Last mile, buses,** public charging
2 *End to end ownership*	Utility will serve end-to-end			**Buses,** Public charging

- As per guidelines laid by Ministry of Power, provision for charging points for long range EV charging station (generally the case for e-Buses), **at least 2 chargers** of minimum 100 kW power output of different specification (CCS/CHAdeMo etc.) with single connector gun each should be installed.
- **Many states** have notified a **special category tariff for charging stations** for electric vehicles on single point delivery

Electricity cost for charging in India

- **Electricity tariff** is a critical **fiscal and regulatory tool** available to **state governments** to promote EVs deployment
- **National Tariff Policy**: Overarching guidance for SERCs in determining tariffs, regulates electric vehicle (EV) commission, which shall not exceed the Average Cost of Supply (ACoS) by more than 15%



Exempted Demand Charges and reduced energy charges by different states

https://e-amrit.niti.gov.in/electricity-cost-for-charging

e-Bus Manufacturers in India and their Market share

Broadly **3 categories** of e-Bus manufacturers in India

Traditional bus manufacturers with **tie-ups with different Indian or foreign companies** for e-Bus technology & parts including EV-power train, battery and charging technology

Dependent on their partners for developing fully built e-Buses, the ownership of the brand and responsibilities of vehicle performance rest on them

TATA

ASHOK LEYLAND

Comparatively new Indian bus manufacturers/ traditional bus-body makers forming **JVs with foreign bus manufacturers** for e-Bus technology transfer & management

Big foreign bus OEMs and/or makers are tying up with their Indian partners to sell e-Buses in India

Olectra BYD *

FOTON PMI

JBM Group Our milestones are touchstones SOLARIS *

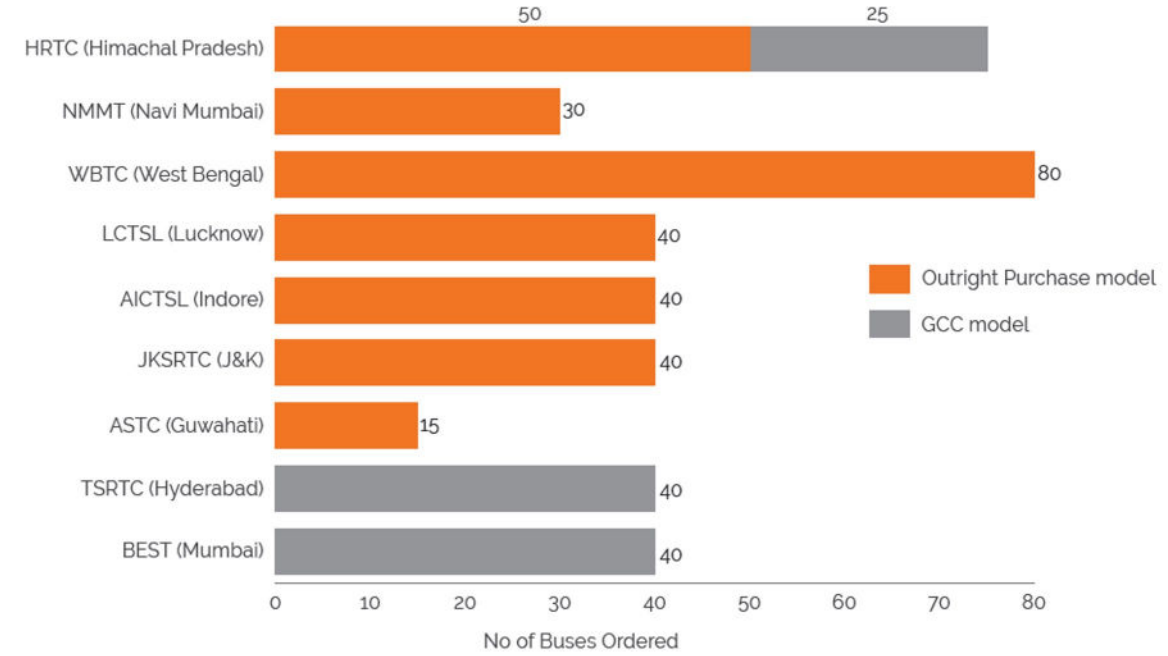
New companies that are new to the bus business and have started manufacturing e-Buses by **assembling various e-Bus parts from India and abroad**

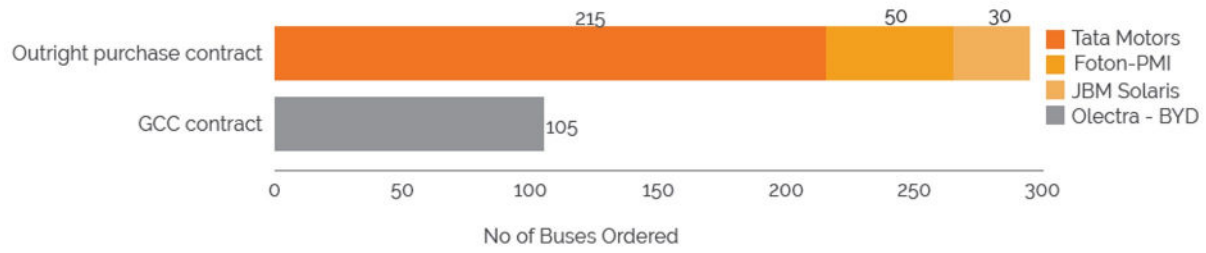
Started as a technology company to support e-Bus development in India

MOZEV

VEERA The Force To Drive...

FAME 1 – Culminated e-bus procurement tenders

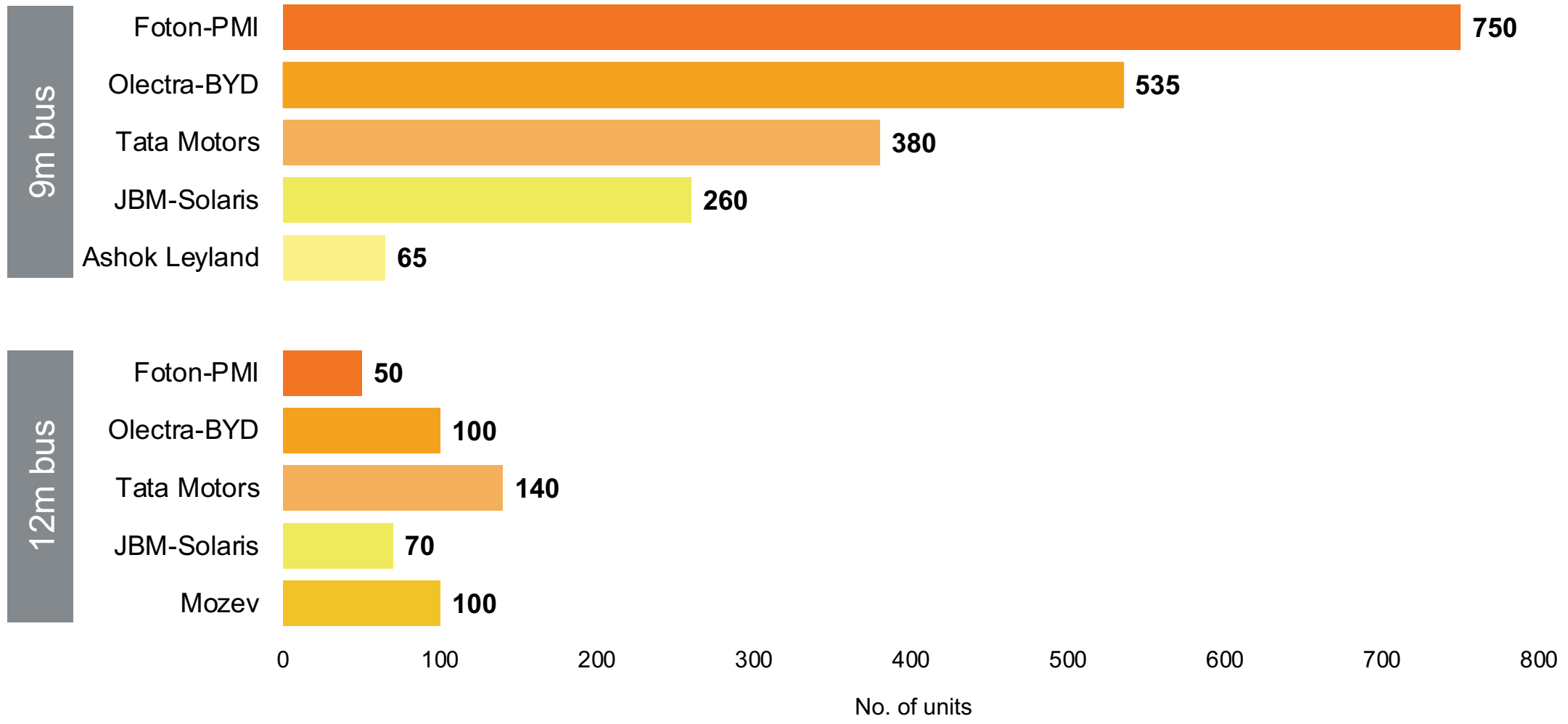




Source: MHI

* OEM consortium partners

Supplier wise share under FAME II



* OEM consortium partners

Source: MHI

e-Bus Manufacturers in India

- The average **annual production** capacity/targets of the OEMs is **~1,600 buses**
- The most widely used Charging technology is **Plug in charging**

- 7m bus price range – 0.72 cr (Non-AC) to 1 cr
- 9m bus price range - 0.77 cr (Non-AC) to 1.5 cr
- 12m bus price range – 1.4 cr to 2 cr

	OEM	Model	Battery Pack (kWh)	Declared Range (Km/charge)	Price (INR)	Battery chemistry	Charging Technology	Production (annually) /Targets	Manufacturing Plants	Key highlights
Olectra	**Olectra-BYD**	ebus K6 (7m),	135	200	1 cr	Lithium phosphate	Plug-in	1000 buses	Hyderabad, Telangana Another 3,000-unit plant coming up soon	Olectra is owned by Megha Engineering. It has collaborated with BYD for ebuses. First company to **deploy 100 electric buses** in India. Has **400 e-Buses deployed (delivered) in India and has won a tender for 600** more **buses under FAME II**
		ebus K7 (9m),	200	200	1.25 cr					
		ebus K9 D(12m) ebus K9 DS(12m)	368	300	1.8 cr - 2 cr 1.6 cr					
TATA	**TATA Motors**	Star Bus Ultra Electric 9/9	176 (88X2)	150	approx 1 cr	lithium nickel manganese cobalt (lithium-NMC)	Plug-in	-	Dharwad, Karnataka	60% market share in FAME-I bus deployment. Has won order for 300 e-Buses from Ahmedabad Janmarg Limited and 220 bus contract under FAME II Incorporated a new subsidiary for the manufacture of electric vehicles, with an initial capital outlay of approximately INR 7 billion
		Star Bus Ultra Electric 9/12	264 (88X3)	161-170	1.4 cr					
		Star Bus Ultra Electric 4/12	352	200-220	1.8 cr					
JBM Group Our milestones are touchstones	**JBM Solaris**	Ecolife Electric e9 (9m),	196	150	1 cr	NMC	Pantograph, Plug in	2000 buses	Faridabad and Kosi	JBM is originally among the largest auto component manufacturers in India, especially for Maruti Suzuki A JV between the Indian firm, JBM Auto and Polish bus manufacturer, Solaris. JBM have made the full shift to e-Buses Only JBM-Solaris currently offers opportunity charging facilities in their buses
		Eco-Life e12 (12m)	200	200	1.6 cr					

e-Bus Manufacturers in India

	OEM	Model	Battery Pack (kWh)	Declared Range (Km/charge)	Price (INR)	Battery chemistry	Charging Technology	Production (annually) /Targets	Manufacturing Plants	Key highlights
	Ashok leyland	Circuit-S (9m to 12m)		50 km for swapping and 200 kms for no swapping	Above 1.5 cr	Lithium-ion Battery	Battery Swapping, Plug in	-	Chennai	In collaboration with Sun Mobility, the first of its kind electric bus powered by swappable battery was launched Ashok Leyland is also trying to develop opportunity charging facilities in their buses for future applications Transferred its e-Mobility to "switch mobility," for a consideration of INR 2.4 billion Also lined up a ₹ 500 crore investment to develop powertrains based on alternative fuels like CNG, hydrogen and electric for its commercial vehicles range
	Foton PMI	Lito (7m) Regio (9m) Urban (12m)	102 150 150	NA 168 144	0.72 cr (Non-AC) 0.77 cr (Non-AC) 1.4 cr	LFP	Plug-in	-	Daruhera, Haryana plans for another manufacturing plant in Pune plans to set up an in-house battery manufacturing plant in Haryana next year	JV between PMI Electro Mobility and Beiqi Foton Motor (China). Won contract for 760 buses under FAME-II (secured an order to supply 700 e-Buses to Uttar Pradesh) claims that 55 % of its products are localised
	VECV	Eicher Skyline Pro electric	205	177	1.2 cr	LFP	Plug-in	-	Indore	A Volvo Group and Eicher Motors joint venture Eicher Skyline Pro electric bus was developed in partnership with KPIT Technologies.

e-Bus Manufacturers in India

	OEM	Model	Battery Pack (kWh)	Declared Range (Km/charge)	Price (INR)	Battery chemistry	Charging Technology	Production (annually) / Targets	Manufacturing Plants	Key highlights
MOZEV	**Mytrah Mobility (MOZEV)**	-	322	300	1.8 cr – 2 cr	LFP	-	350-500	Jaipur	Have an order of 170 buses of which 125 are 12 metres and 50 are DMRC feeder buses
VEERA The Force To Drive...	Veera Vahana			-				Manufacturing target of 3,000 buses a year	Anantapur district, Andhra Pradesh	AP Govt. signed an MoU with Veera Vahana Udyog Private Limited for the setting up of an electric bus manufacturing unit near Gudipalli village of Somandepalli mandal in Anantapur district of Andhra Pradesh allocated 124 acres of land total cost of INR 1,000 crores plan to take up the full-scale production of e-Buses within the next two years
CAUSIS	Causis E-Mobility	Will start with 3 variants, the 9-, 11- and 12-metre buses	-	250-300	-	-	-	Manufacturing target of 1,000 buses a year	Talegaon, Pune, Maharashtra	75-acre facility Causis is investing INR 2,800 crore in the EV plant target to roll out buses in the first week of November 1, 2022 Battery-manufacturing facility is also in the pipeline and is expected in the next phase
Pinnacle INDUSTRIES	Pinnace Mobility Solutions	City bus- initially target the company staff movement segment				-		500-1,000 buses	Pune, Maharashtra and Pithampur, Madhya Pradesh smaller assembly plants planned across multiple locations	Pinnacle has tied up with Europe-based VDL for this venture. Majority of the parts would be made or sourced from within the country working on the electric bus project for the last three years Its INR 2,000 crore electric vehicle project was recently approved under the government's automotive PLI scheme **e-Bus is ready and had gone to Automotive Research Association of India for homologation** Work begins in April 2022 and the company will start with a INR 300 crore investment in the first year and `600 crore in the second year

Production Capacity in India for Key e-Bus Components

Indian Government schemes have been pushing for increased localisation in EV components manufacturing

Production Capacity in India for Key EV Components

EV Critical component	Net Localisation	Remarks
Batteries	10-15%	• Battery pack assembly capacity has been developing • Some capacity for thermal management systems
Traction motor and controller	0-5%	• Possible domestic capacity for rotor, stator, bearings, brackets, and housing • Domestic components have low power capability
Wiring harness and connector	15-20% (High voltage)	• Competing demand from the power sector leads to less availability, despite production capacity
Vehicle control unit	0-5%	
DC-DC converter	0-10%	• Some capacity for software development and testing
On-board charger	0-5%	
Electric safety devices	30-35%	• Limited capacity for producing printed circuit boards, passive components, and fuse breakers and contactors
Electric compressor	0%	
Transmission	100%	• Extensive capacity from existing ICE vehicles • With increasing automatic transmission systems for EVs, imports could increase
Body and chassis	100%	• Extensive capacity from existing ICE vehicles • Specially for buses, Might require some changes for light weighting, • This could lead to increased use of lighter materials such as aluminium
Tyres	90-95%	

Source: Compiled from SIAM, ACMA, Nomura Research Institute and stakeholder consultations

Localisation timelines under PMP for key components and potential for EV components by 2030

Component (% cost contribution)	Current localization	Localization potential by 2030	Rationale
Battery Cell (30-35%)	Very Low	Low	• Unavailability of core raw materials like lithium • Battery R&D is capital intensive • Rapid evolving of battery technology • Cost competitiveness of Chinese Li-ion batteries
Chassis and Body (10-15%)	High	Very High	• No requirement of special raw materials or technology • Manufacturing know-how already exist locally
BMS and TMS (10-12%)	Moderate	Very High	• Primarily require software • India is known for development and export of software
Motor (10-12%)	Very Low	Moderate	• Unavailability of rare earth magnets such as the Neodymium magnet • China is the leading producer of rare earth magnets accounting for over 90% production and over 40% reserves. Geopolitical risk involved in sourcing raw material.
Power Electronics (8-10%)	Very Low	Very High	• No major challenge exists except requirement for capital for doing R&D and setting-up of infrastructure
Others (HVAC, Control units etc)	Moderate	Very High	• Indian manufacturers have experience and know-how • Already manufacturing such system, minor adaptation is required for EVs

- Extent of localization of e-Bus components achieved as per targets is low and expected to move towards 100% by 2030
- Battery cell remains a key component with low localization potential

Source: Status Quo report, Niti Aayog

ZE-Bus Landscape in India

A e-Bus Ecosystem

B ZE-Bus Policy Landscape

C ZE-Bus Demand Landscape

D ZE-Bus Supply Landscape

E **ZE-Bus Business Models**

Business models for e-Bus Operations

- Under FAME I; e-Buses were procured using two (2) business models namely; 1) Outright Purchase Model (OPM), 2) Gross Cost Contract Model (GCC)
- FAME II: Made GCC model as one of the eligibility criteria

Outright Purchase Model (OPM)

Vehicle Manufacturer supplies the bus, battery and chargers to the STU which purchases them and carries out ownership, operation and maintenance using internal resources

80% of e-Bus procurement happened through OPM under FAME I; Kolkata, Indore, Jaipur, Guwahati and Jammu

Gross Cost Contract Model (GCC)

Vehicle manufacturer owns, operates and maintains the buses, batteries and charging infrastructure and gets a fixed remuneration from the STUs based on assured km;

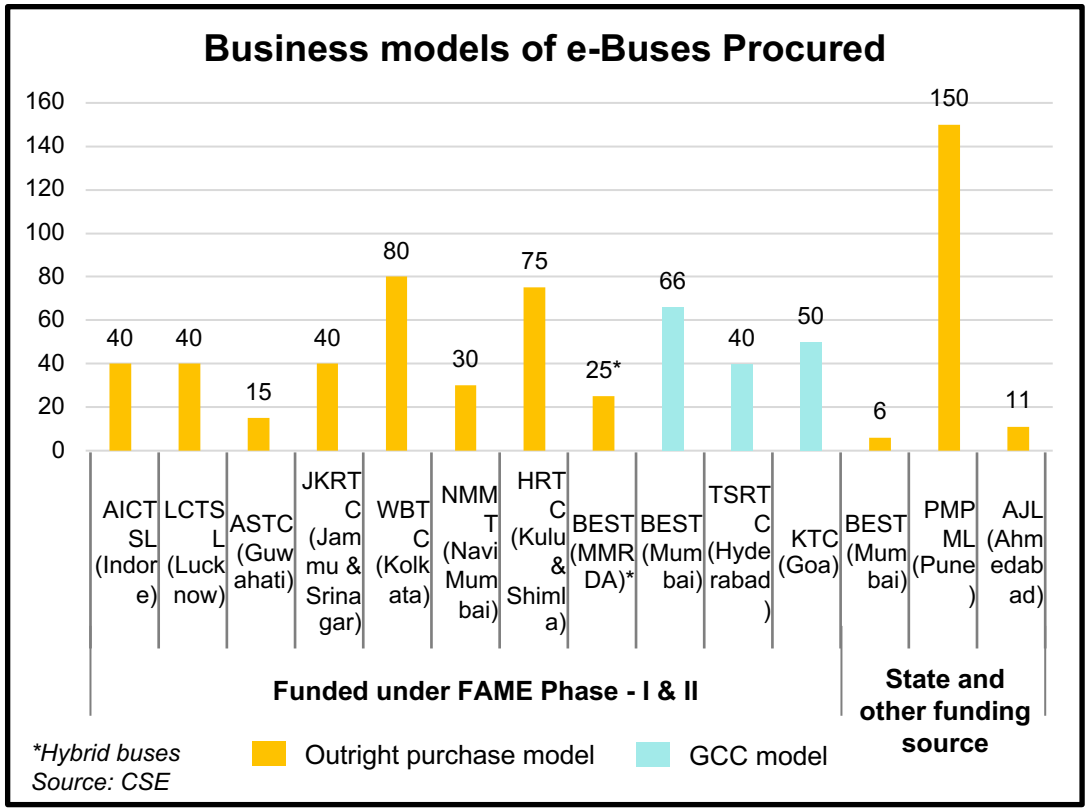
Mandatory Model under FAME II

Predominant model In India

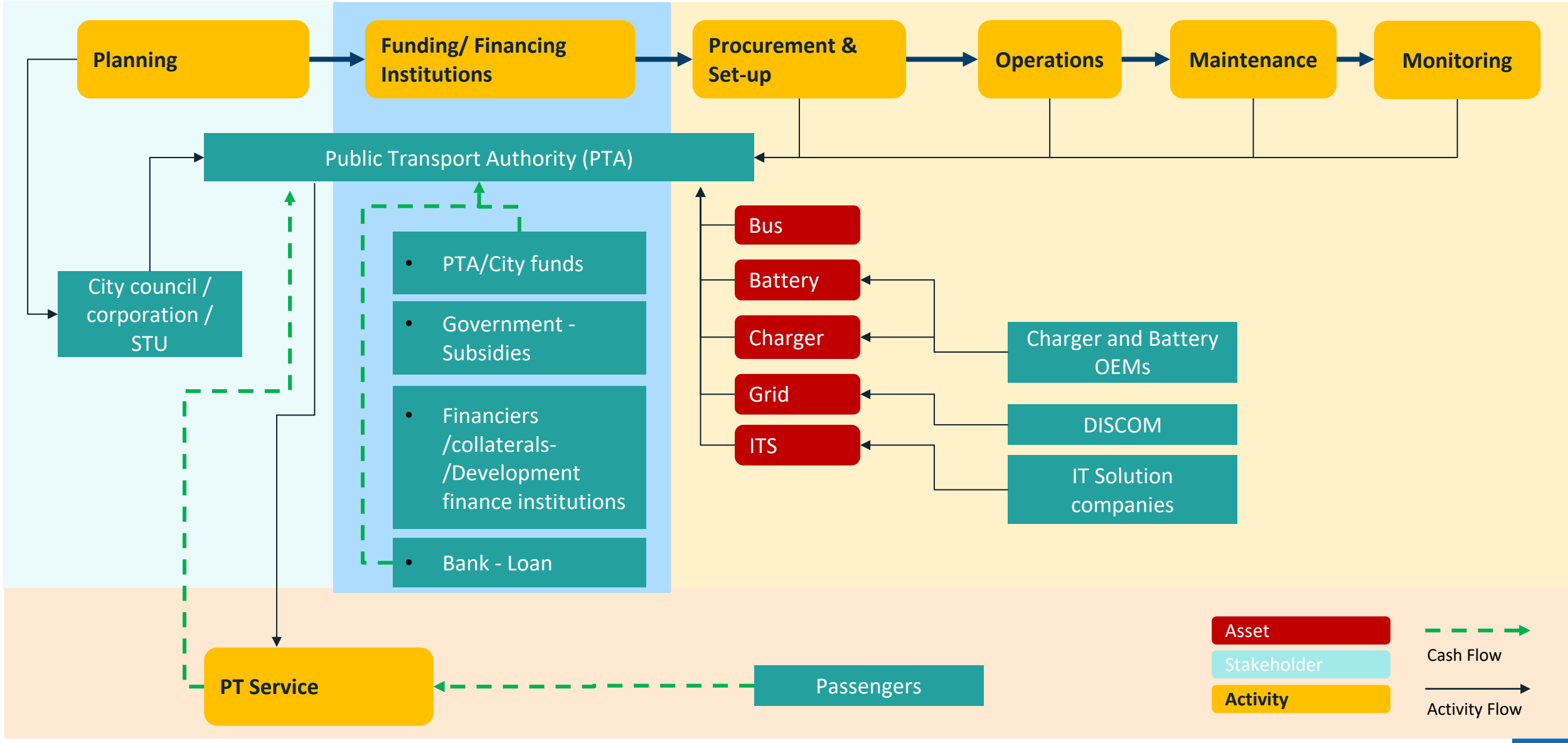
Energy Utility Model

Energy Utility Company the key stakeholder who owns the services and goes into agreement with private parties for operation and maintenance

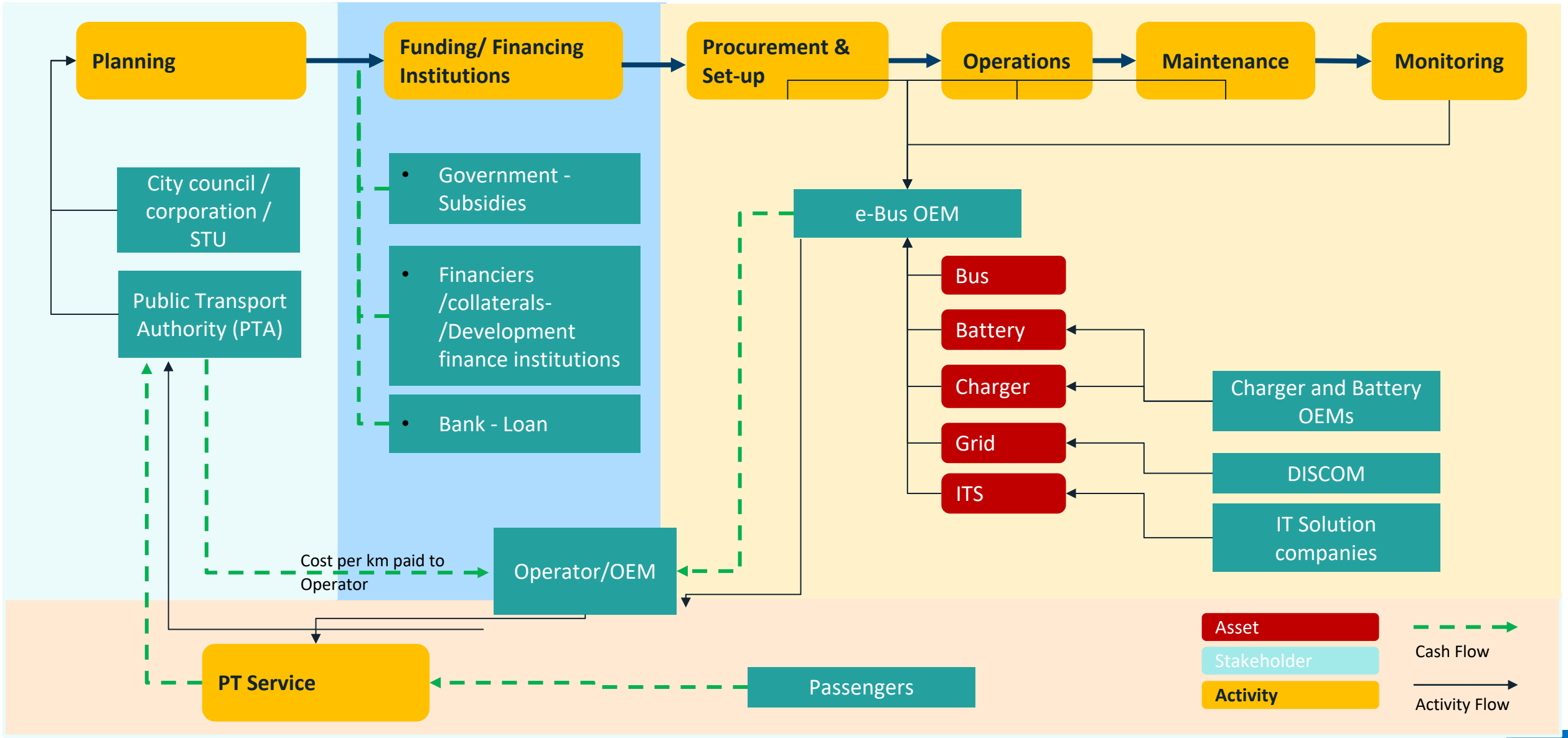
Experimented by NTPC in Andaman Nicobar, Not replicated further



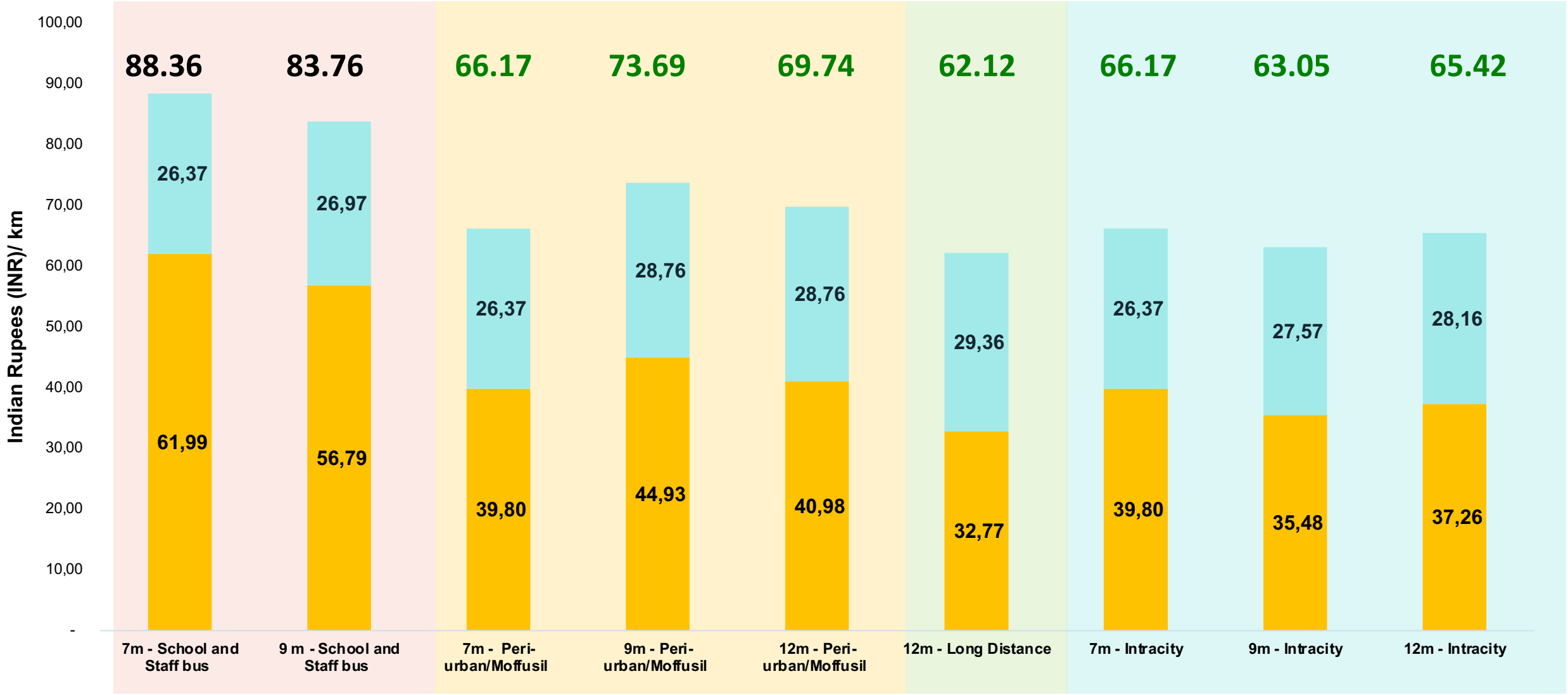
Outright Purchase Model



GCC Model


Planning
Funding/ Financing Institutions
Procurement & Set-up
Operations
Maintenance
Monitoring
City council / corporation / STU
Public Transport Authority (PTA)
Government - Subsidies
Financiers /collaterals-/Development finance institutions
Bank - Loan
e-Bus OEM
Bus
Battery
Charger
Grid
ITS
Charger and Battery OEMs
DISCOM
IT Solution companies
Cost per km paid to Operator
Operator/OEM
PT Service
Passengers
Asset
Stakeholder
Activity
Cash Flow
Activity Flow

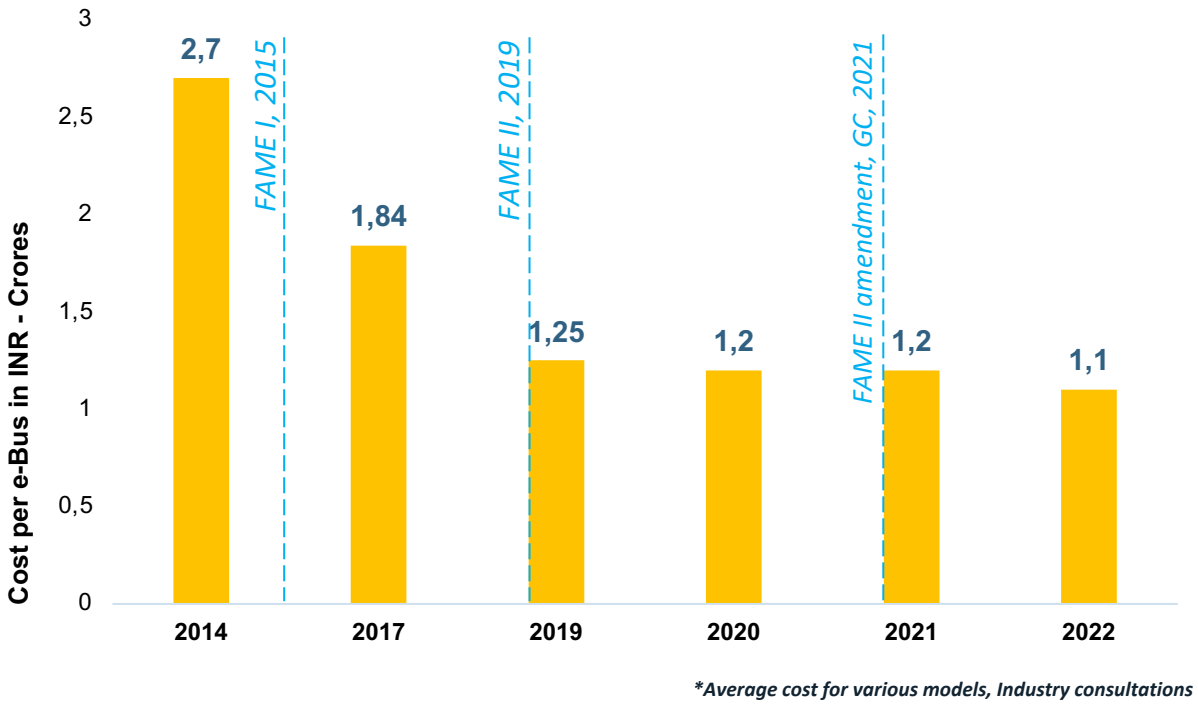
Intracity and Intercity use cases presents lower TCO for e-Buses



Source: pManifold analysis

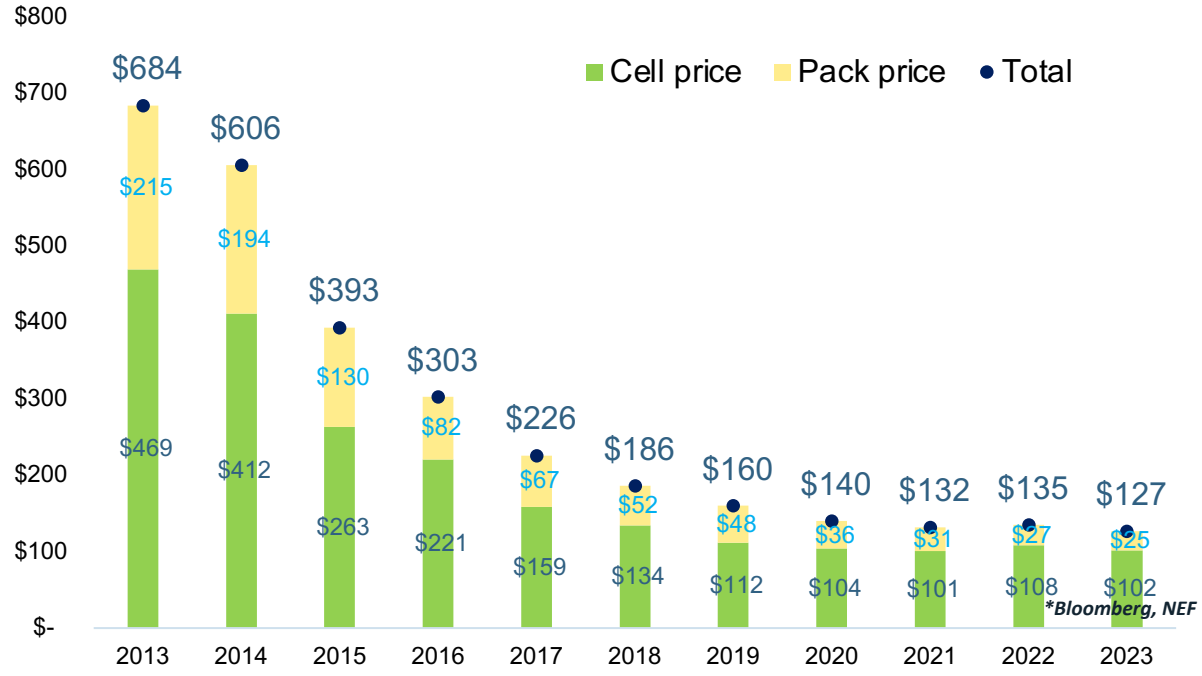
e-Bus opportunity: Reduction in overall prices of e-Buses

~60% reduction in 9m e-Bus costs in past 8 years*



*Average cost for various models, Industry consultations

~40% reduction in Li-Ion global battery Price in past 5 yrs*



*Bloomberg, NEF

- The push from the timely inducement of the **policies, strong local industry** supported by the the **technological advancement**, increasing **scale of demand** from cities supported by the **declining battery prices** have resulted in lower costs and **higher adoption of e-Buses.**

4

6 Cities Market Readiness

*This section aims to provide a **market readiness assessment of 6 select cities in India** for electric bus adoption and present insights to guide investors*

Delhi | Mumbai | Pune | Ahmedabad | Surat | Chennai

6 Cities Market Readiness Assessment

A Delhi

B Mumbai

C Pune

D Ahmedabad

E Surat

F Chennai

Delhi- Public Transport buses

City: Delhi

State/UT: National Capital Territory (NCT) of Delhi

Pop: 19 million *(2021)*

CAGR: 9.28%

Area: 1,483 sq km

Public Transport Buses in Delhi

Avg. Daily Bus ridership: 4.2 million
Total DTC Buses: 7,391

Delhi Transport Corporation (DTC)

- 4,012 — 12 m buses (low floor)
- 3,762 CNG buses
- 250 Electric buses
- *+1,500*

DTC & Delhi Integrated Multi-Modal Transit System (DIMTS)

- 3,379 CNG buses — 12 m buses (semi low floor)
- *17 clusters- DTC operate 40% buses (3,379) in every cluster while the private entity operates the remaining 60% buses*

Delhi Metro Rail Corporation (DMRC)

- 56 — 7 m buses
- 31 CNG buses
- 25 Electric buses
- *+100*





e-Bus Targets and Opportunities (DTC)

- **50** More e-Buses by Sep **2022**
- **1,500** More e-Buses by Nov **2023**
- **6,380** More e-Buses by **2025**
- **80%** Total Public bus fleet electrified by **2025**

DTC Bus Market to grow to **10,380 buses** with **8,000+ e-Buses by 2025**

Delhi has completely phased out diesel buses, running its fleet on compressed natural gas (CNG) for the past two decades, and is currently the leading case in the country for fleet decarbonization.

Institutional and Policy Readiness (Delhi)

Delhi has progressive provisions and regulatory frameworks for e-Bus adoption but still lacks supply-side incentives for manufacturers.

State/ UT- EV Policy *Policy announced in 2020 and applicable for 3 years*	**Provisions and Incentives**
Target	**Pure e-Buses** to constitute at least **50% of all new public transport vehicles** with 15 seats or more procured for the city fleet including for last mile connectivity
Capital Subsidy	*Not Provided*
Tax exemptions	**Road Tax and registration fees** shall be **waived** for all Battery Electric Vehicles (including buses) during the period of EV policy
Interest subsidies	*Not Provided*
Land development incentives	*Not Provided*
Concession on Infrastructure	*Not Provided*
Concessional power tariff for Charging	**Provided- INR 4.0 to 4.5/kWh**

State EV Policy	**Ambitious targets to deploy e-Buses**
500 charging stations target	**EESL target installing 500 charging station in Delhi-NCR**
Highest demand of 1,500 e-Buses in Grand Challenge	In the **CESL grand challenge**, the highest demand of **1,500 e-Buses** (12m low floor AC) was placed across five megacities.
Switch Delhi	Created Switch Delhi- **EV Cell,** a separate institutional body
Working Group for Accelerated Roll-out of Charging Infrastructure	The Delhi Government constituted a **Working Group for Accelerated Roll-out of Charging Infrastructure, which** has representatives from the Power Department, Transport Department, and all Municipal Corporations.
Other Unions	*DTC bus unions*

Delhi has been a progressive city with over and above central institutional reforms and matching central government subsidies in EV policy to promote e-Buses.

Procurement & Tendering: Technical Readiness (Delhi)

FAME I

Got sanctioned 40 e-Buses but retracted from floating the tender as the city opted to procure e-Buses separately from state budget

FAME II

Sanctioned 300 e-Buses & 100 feeder DMRC e-Buses; **250** intracity and **25** feeder e-Buses are deployed currently under FAME II

Grand Challenge

Submitted demand for 1,600 e-Buses-

- *12 m low floor AC Buses- 1,500*
- *9.5 m Double decker bus- 100*

- Initial allocation under FAME II Subsidy- **921** e-Buses (12m low floor AC)
- Buses tendered without FAME II subsidy- **579** e-Buses (12m low floor AC) and 100 double decker e-Buses (9.5m AC)

Technological Specifications (FAME II Intracity Tender & Grand Challenge)

		Intracity-DTC
Tenders	Bids received	04
	L1 and L2 Players	JBM, Tata Motors,, Olectra, PMI
	Assured km/month	5,000
e-Bus	Floor height (mm)	400
	Bus length	12m
	Air-Conditioning	Yes
	Passenger capacity	35+Driver+Wheelchair
	Time for Charging(Overnight/specific duration mentioned?)	After a shift at Depot- Overnight
	Vehicle range on single charge (km)	140 Km
	Opportunity charging (Time allowed in minutes)	60 minutes
	Rated Battery Capacity (kWh)	261 kWh and 354 kWh
	Battery Chemistry	NMC
	Range provided-km (by L1)	120 (80% SOC) and 200 km (at 100% SOC)
Chargers	Rating (kW)	200 and 240 kW
	Type of Chargers	Fast Chargers (0.5 to 2C rate)
Depot	No. of Electrified Depots	3 (2 operational)
Grid	Current load provision	4.97 MVA for 5 acre depot 12.62 MVA for 11 acre depot

DTC e-Bus performance compared to CNG buses

*Last tenders comparison of GCC bid rate (CNG vs electric): INR 80-85/km vs INR 68-72/km- (**subsidies considered)*

Key Highlights:

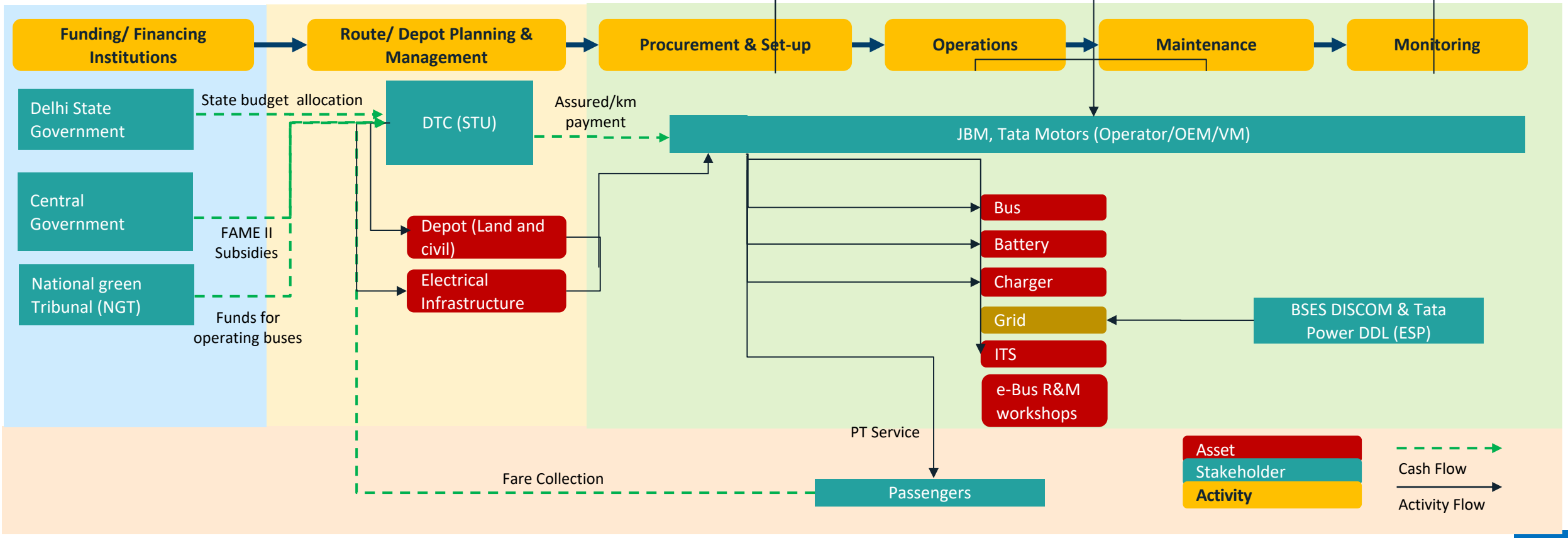
- Technological Demand in Delhi: **9.5 m & 12 m e-Buses (260 to 350 kWh)** with **overnight fast charging**
- *Performance of e-Buses so far has proven operations beneficial over CNG buses (cost of operation+ pollution +comfort)*

Deployment & Business Model: e-Bus Operations (Delhi)

Electric Buses in Delhi (DTC)

- **250** Total no of e-Buses *(as of Sep 2022)*
- **12%** of India's e-Buses are in Delhi
- **3.4%** of DTC fleet is electric
- **3** Electric Depots and 2 operational
- **80** Chargers Installed- Fast Chargers (200 & 240 kW)
- **17** e-Buses operating Routes

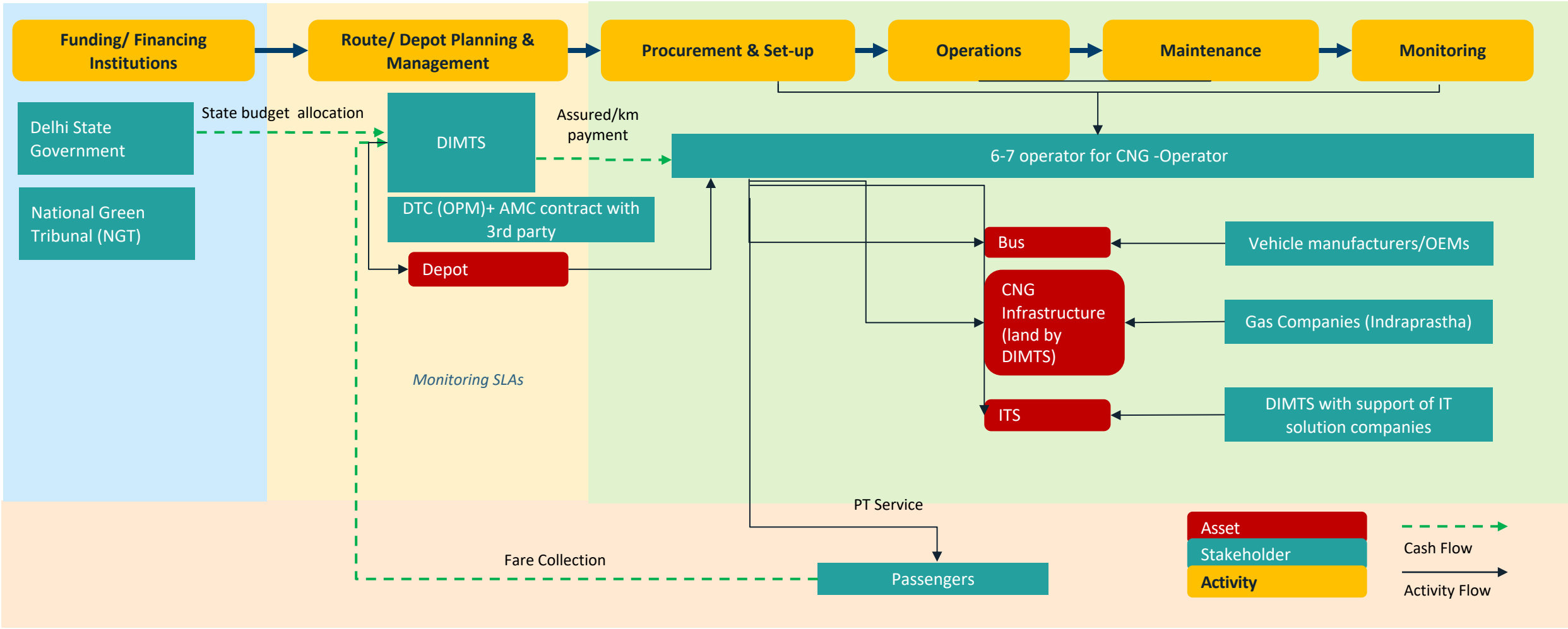
DTC concessions its e-Bus operation to the private OEMs



OEM – Manufacturer, Operator, Joint Venture | STU – State Transport Undertaking | ESP – Energy Service Provider

Deployment & Business Model: CNG Operations (Delhi)

DIMTS stage contract model



OEM – Manufacturer, Operator, Joint Venture | STU – State Transport Undertaking | ESP – Energy Service Provider | SLA – Service Level Agreement

Overall Delhi e-Bus Readiness

	S.No	Indicator	Score
POLICY & REGULATORY READINESS	P1	Extent of city commitment and targets achievements for e-Bus deployment	
	P2	Extent of Financial Incentives for e-Bus uptake other than National Subsidy	
	P3	Extent of planning for efficient e-Bus system deployment	
	P4	Extent of Viability Gap Funding Provisions for sustainable e-Bus operations	
INSTITUTIONAL READINESS	I1	Presence of organized Public transport with PTA/STU	
	I2	Track record on e-Bus tenders	
	I3	Track record on e-Bus deployment	
	I4	Presence of City level dedicated EV and/or e-Bus taskforce	
TECHNOLOGICAL READINESS	T1	Presence of diverse Bus models in the city bus fleet	
	T2	Ability to provide bespoke specifications and planning for e-Bus Depot	
	T3	Track record in managing bus public transportation (Presence of multiple suppliers for e-Bus in the city)	
	T4	Experience to plan and execute e-Bus solutions (Extent of e-Bus system planning and executive capacity in city)	
	T5	Adequacy of Access to Grid and Service quality	
FINANCIAL READINESS	F1	Level of City's STU/PTA Creditworthiness	
	F2	Transparent and comprehensive state budget support (Level of Collateral Security and de-risking mechanisms)	
	F3	Innovation in business model and financing	
	F4	Qualification criteria for Bidders	
	F5	Additional Subsidy from city/state government	
SUSTAINABILITY READINESS	S1	Vision/Plan for use of Renewable Energy for e-Bus Charging	
	S2	Plans to consistently Improve modal share of Public Transport	
	S3	Implementation of ITS system for improvement of bus operational efficiency and customer convenience initiatives	

Legend

Low | Medium | High

Summary of Opportunity – Delhi

- Delhi is a progressive city with 74 years of experience in operating public bus transport. It has an aggressive target of 80% e-Bus adoption for public transport by 2025. To achieve this goal, the DTC Bus Market will grow to 10,380 buses, with 8,000+ e-Buses.
- DTC is the largest CNG-powered bus service operator in the world. It phased out diesel buses completely, running its fleet on CNG for the past two decades, and is currently the leading case in the country for fleet decarbonization.
- There are a total of 7,400+ buses having mini and standard buses with low and semi-low floors, including CNG and electric buses.
- With the FAME II incentives, Delhi is increasing e-Bus adoption with state support, NCAP subsidies, electricity tariffs and incentives supported by state policy, and OPEX support and VGF. Delhi has also submitted its new demand for e-Buses for the recent Grand Challenge 2.
- e-Buses in Delhi are currently operating on GCC and have plans to introduce more e-Buses on GCC model deployments. Among the targeted 8,000+ buses, 2,000 buses would be achieved by 2023.
- High travel demand e-Buses are to serve millions of riders daily and help reduce GHG emissions as a metropolitan and capital city. With its policy landscape, experience in e-Buses, progressive approach and aggressive targets, Delhi provides a suitable market for e-Buses.
- Delhi has moderate policy and regulatory readiness, high institutional and technological readiness, moderate financial readiness and low sustainability readiness.

6 Cities Market Readiness Assessment

A Delhi

B **Mumbai**

C Pune

D Ahmedabad

E Surat

F Chennai

Mumbai- Public Transport buses

City: Mumbai

State/UT: Maharashtra

Pop: 1,28 million *(2020)*

CAGR: 1.12%

Area: 603.4 sq km

Public Transport Buses in Mumbai

Avg. Daily Bus ridership: 3.5 million
Total BEST Buses: 3,680

Bombay Electric Supply & Transport (BEST)

819	Diesel
2,440	CNG buses
25	Hybrid
396	Electric buses

3,680





e-Bus Targets and Opportunities (BEST)

900
More Double decker e-Buses in **2023**

3,000
More e-Buses by **2023**

10,000
e-Buses by **2025**

100%
Total Public bus fleet electrified by **2027**

BEST Bus Market to grow to **10,000 + buses** with **100% e-Buses by 2027**

Mumbai is to phase out diesel buses completely and shift to e-Buses by 2027 according to the announcement of an MLA of Maharashtra*

Institutional and Policy Readiness (Mumbai)

Mumbai has progressive provisions & regulatory frameworks for e-Bus adoption. Mumbai has put efforts with different mechanisms, private sector participation beyond conventional PT operations practices.

State/ UT- EV Policy *Policy announced in 2021 and applicable until 2025*	**Provisions and Incentives**
Target	**Pure e-Buses** to constitute at least **25 % of all new public transport vehicles** in the city fleet by 2025. Maharashtra State Road Transport Corporation (MSRTC) to convert its existing bus fleet to 15% electric fleet by 2022.
Capital Subsidy	Maximum 10% of cost of vehicle of INR 2,000,000
Tax exemptions	**Road Tax and registration fees** shall be **waived** for all battery electric vehicles (including buses) during the period of EV policy
Interest subsidies	*Not Provided*
Land development incentives	*Not Provided*
Concession on Infrastructure	Slow chargers: 60% of the cost or INR 10,000 Slow chargers: 50% of the cost or INR 500,000 National Clean Air Program (NCAP) incentives under 15th Finance Commission (FCC)
Concessional power tariff for Charging	Provided by MSEDCL 4.5 INR/kWh (from reduced from 10 INR/kWh) ***(As per Maharashtra Electricity Regulatory commission (MERC))***

State EV Policy	**Ambitious targets to deploy e-Buses**
e-Bus Fleet to be augmented	The BEST plans to increase the e-Bus fleet to over 2,000 (by 2023) in a year and 10,000 in five years (by 2027)
Plans to start on-demand bus service	In the plan of 10,000 e-Buses, 3,000 buses are planned to be deployed under an on-demand bus service model and other buses to be operated for regular PT services
Proposed e-Bus charging stations	55 charging stations with 660 charging points (with 24X7) to be developed across MCGM jurisdictions. Tender floated (12 years operating period)

Mumbai has been a progressive city with over and above central institutional reforms and matching central Govt. subsidies in EV policy to promote e-Buses

Procurement & Tendering: Technical Readiness (Mumbai)

FAME I

Got sanctioned 40 e-Buses which are currently operational

FAME II

Requested 340 intracity e-Buses were sanctioned which are currently operational

Grand Challenge

Did not opt to undergo Grand challenge

Adoption without Incentives

Tender for 3,000 e-Buses was floated and are contracted and are estimated to start operations by August 2023

Technological Specifications (FAME II Intracity Tender & Grand Challenge)

		Intracity-BEST	
Tenders	Bids received	4	
	L1 and L2 Players	Tata Motors, Olectra,, JBM, Switch,	
	Assured km/month	4,750	4,000
e-Bus	Floor height (mm)	900	900
	Bus length	12 m	9 m
	Air-Conditioning	Yes	Yes
	Passenger capacity	35+Driver+Wheelchair (78 for a double decker bus)	31+Driver
	Time for Charging (Overnight/specific duration mentioned?)	Opportunity charging 2 hr + Overnight 4 hr	
	Vehicle range on single charge (km)	250 Km	180 km
	Opportunity charging (Time allowed in minutes)	90 minutes	60 minutes
	Rated Battery Capacity (kWh)	250 to 350 kWh	~186 kWh
	Battery Chemistry	LFP,NMC	LFP,NMC
	Range provided-km (by L1)	120 – 140 km (Single charge), 200 km (per day)	
Chargers	Rating (kW)	200 and 240 kW DC Fast charger	
	Type of Chargers	DC Fast Chargers 0.5	
Depot	No. of Electrified Depots	5	
Grid	Current load provision	4-5 TO 10 MV for each charging depot (depending on number of chargers and peak load)	

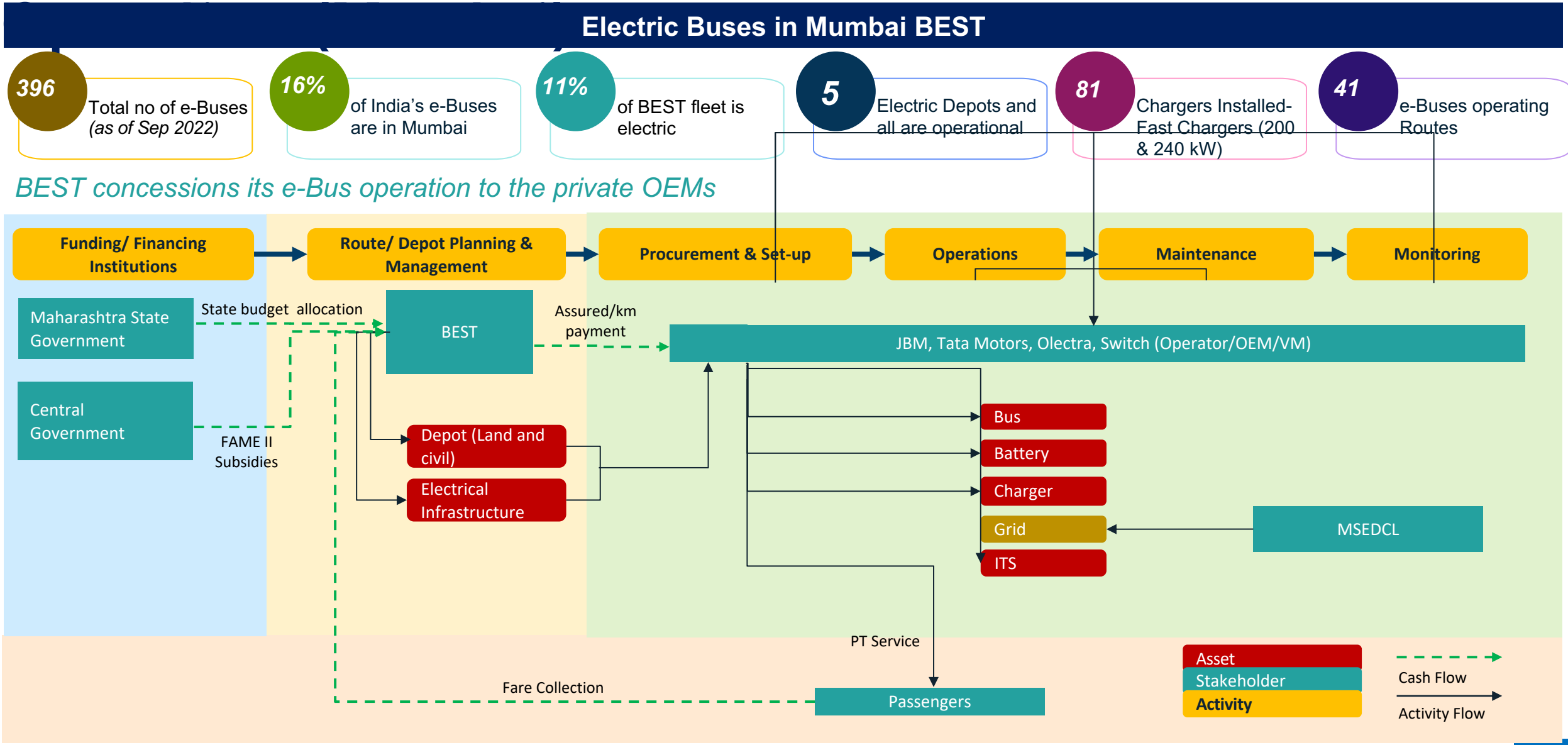
BEST e-Bus performance compared to CNG buses

CNG Buses GCC Rate	e-Buses GCC Rate
56.9-89.9 INR/km	**46-56.4 INR/km**

Key Highlights:

- Technological Demand in Mumbai: **9 m (~186 kWh) & 12 m e-Buses (including double decker) (260 to 350 kWh)** *Performance of e-Buses so far has proven beneficial over CNG buses (cost of operation+ pollution +comfort)*

Deployment & Business Model: e-Bus



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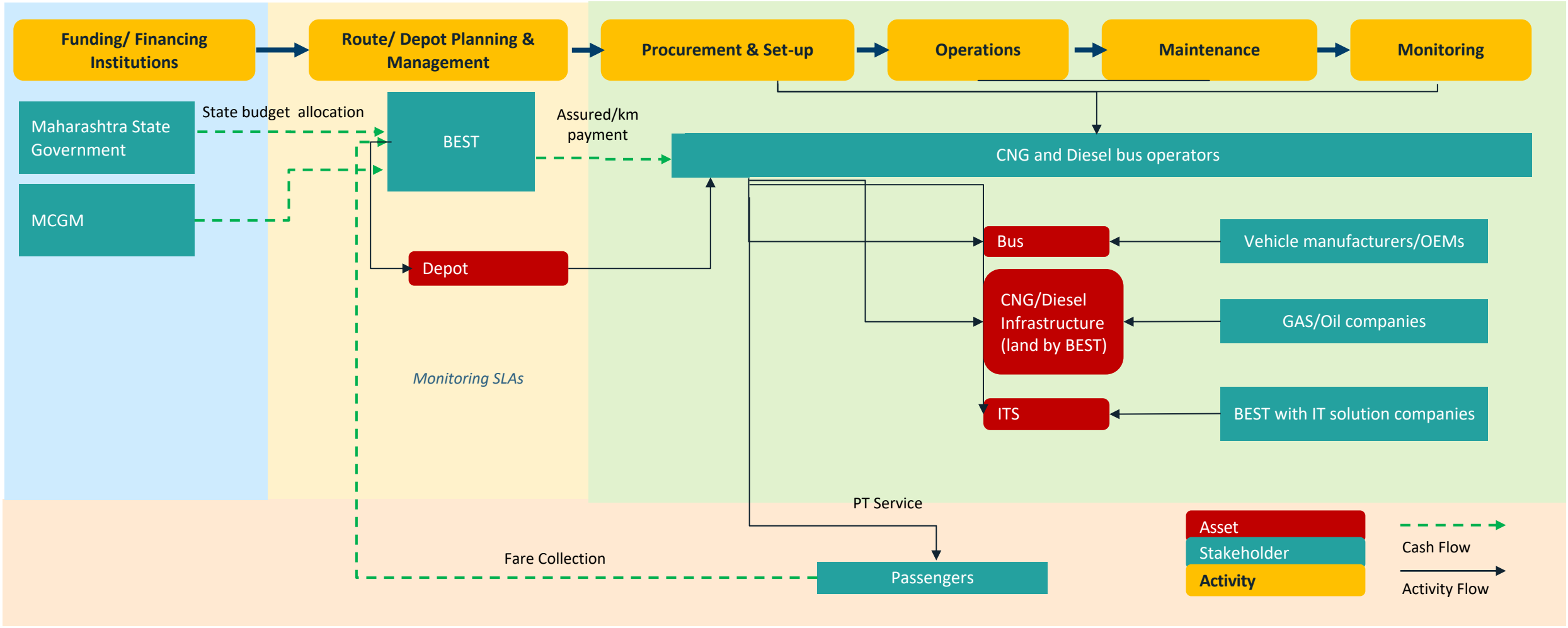
Deployment & Business Model: CNG/ICE Operations (Mumbai)

BEST wet lease model for Diesel and CNG buses



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	T3	Track record in managing bus public transportation (Presence of multiple suppliers for e-Bus in the city)	
	T4	Experience to plan and execute e-Bus solutions (Extent of e-Bus system planning and executive capacity in city)	
	T5	Adequacy of Access to Grid and Service quality	
FINANCIAL READINESS	F1	Level of City's STU/PTA Creditworthiness	
	F2	Transparent and comprehensive state budget support (Level of Collateral Security and de-risking mechanisms)	
	F3	Innovation in business model and financing	
	F4	Qualification criteria for Bidders	
	F5	Additional Subsidy from city/state government	
SUSTAINABILITY READINESS	S1	Vision/Plan for use of Renewable Energy for e-Bus Charging	
	S2	Plans to consistently Improve modal share of Public Transport	
	S3	Implementation of ITS system for improvement of bus operational efficiency and customer convenience initiatives	

Legend

Low | Medium | High

Summary of Opportunity – Mumbai

- Mumbai is a progressive city having 70+ years of experience in operating public bus transport in Mumbai. It has an aggressive target of 100% e-Bus adoption by 2027.
- BEST currently operates 3,000+ buses having mini, midi and standard buses including Diesel, CNG and electric buses. It continues to experiment with its variety in e-Buses also with adding e-Double decker buses, retaining the flavor and replacing old double decker buses; and has plans to deploy 900 more e-Buses by 2023.
- Starting from FAME I to Now FAME II incentives, Mumbai is scaling-up the e-Bus adoption with support from State, NCAP subsidies, availing electricity tariffs and incentives supported by strong state policy, supporting CAPEX and OPEX support and VGF.
- e-Buses in Mumbai are currently operating on GCC and have plans to introduce a new business model for upcoming e-Bus deployments. Among targeted 10,000 buses; 3,000 buses are planned to be operated on 'Demand-based PT' model.
- Being a metropolitan city, high travel demand e-Buses are to serve millions of ridership daily and help reduce GHG emissions. With its policy landscape, experience in e-Buses, progressive approach and aggressive targets Mumbai provides a suitable market for e-Buses.
- Mumbai has moderate policy & regulatory and institutional readiness, high technological readiness, low financial readiness and moderate sustainability readiness.

6 Cities Market Readiness Assessment

A Delhi

B Mumbai

C **Pune**

D Ahmedabad

E Surat

F Chennai

Pune- Public Transport buses

City: Pune

State: Maharashtra

Pop: 10 million *(2021)*

CAGR: ~2.8%

Area: 512 sq km

Public Transport Buses in Pune

Avg. Daily Bus ridership: 0.9 million
Total PMPML Buses: 2,010

Pune Mahanagar Parivahan Mahamandal Ltd (PMPML)

2,010
- **1,608** ICE + CNG buses
- **402** Electric buses

9m + 12 m buses





e-Bus Targets and Opportunities (PMPML)

650
Total e-Buses by Sep **2022**

300
More e-Buses by Nov **2023**

1,000
e-Buses by **2025**

30%
Total Public bus fleet electrified by **2025**

PMPML Bus Market to grow to **3,500+ buses** with **1,000+ e-Buses** by 2025

Pune to phase out the remaining diesel buses completely and will ply only CNG and Electric buses as an active step towards decarbonisation

Institutional and Policy Readiness (Pune)

Pune has progressive provisions & regulatory frameworks for e-Bus adoption but still has lower targets to adopt e-Buses in the fleet

State/ UT- EV Policy *Policy announced in 2021 and applicable till 2025*	**Provisions and Incentives**
Target	**Pure e-Buses** to constitute at least **25 % of all new public transport vehicles** in the city fleet by 2025. The Maharashtra State Road Transport Corporation (MSRTC) is converting its existing bus fleet to 15% electric.
Capital Subsidy	Maximum 10% of cost of vehicle of INR 2,000,000
Tax exemptions	**Road tax and registration fees** shall be **waived** for all Battery Electric Vehicles (including buses) during the period of EV policy
Interest subsidies	*Not Provided*
Land development incentives	*Not Provided*
Concession on Infrastructure	Slow Chargers: 60% of the cost or INR 10,000 Slow Chargers: 50% of the cost or INR 500,000 National Clean Air Program (NCAP) incentives under 15th Finance Commission (FCC)
Concessional power tariff for Charging	Provided by MSEDCEL 4.5 INR/kWh (reduced from 10 INR/kWh) ***(As per Maharashtra Electricity Regulatory commission (MERC))***

State EV Policy	**Ambitious targets to deploy e-Buses**
10 New Charging stations target	PMPML identifying **10 new spaces to develop e-Bus charging stations**
New Opportunity Charging stations in planning	PMPML is planning **3 new charging stations for the buses 2023**
New e-Buses to be added in the fleet	**300 mini (7m/9m) e-Buses** to be added in the city transport fleet by **2023** (Specifications yet to be provided by the authorities)
PMPML to remove ICE buses from fleet	All **Diesel buses to be scrapped** and fleet to be augmented with electric and CNG buses
A new charging station to be soon developed in Charoli, Pune	A **new charging station** soon to start operations by **September-October 2022**

Procurement & Tendering: Technical Readiness (Pune)

FAME I

Pune applied for 150 e-Buses while no buses were sanctioned/procured under FAME I.

Non-FAME

For the first two batches of funding PMC, PCMC and PSCDCL (smart city funding) Provided the subsidy of ~ INR 5 Mn per bus. Total 252 e-Buses are procured through municipal and other schemes fundings.

FAME II

Requested and got sanctioned 150 intracity e-Buses, 90 PMC and 60 PCMC buses. In total currently 402 e-Buses are operational.

Grand Challenge

No e-Buses demanded under the Grand Challenge

Technological Specifications (FAME II Intracity Tender & Grand Challenge)

		Intracity-PMPML	
Tenders	Bids received	3	
	L1 and L2 Players	Tata Motors, Olectra, Neuton Auto	
	Assured km/month	6,000	6,000
e-Bus	Floor height (mm)	900	900
	Bus length	12 m	9 m
	Air-Conditioning	Yes	Yes
	Passenger capacity	35+Driver+Wheelchair	31+Driver
	Time for Charging (Overnight/specific duration mentioned?)	Opportunity charging 2 hr + Overnight 4 hr	
	Vehicle range on single charge (km)	250 Km	180 km
	Opportunity charging (Time allowed in minutes)	90 minutes	60 minutes
	Rated Battery Capacity (kWh)	200 kWh	280 kWh
	Battery Chemistry	LFP	LFP
	Range provided-km (by L1)	120 – 140 km (Single charge) 200 km (per day)	
Chargers	Rating (kW)	80 kW AC slow charger; 150 kW DC Fast charger	
	Type of Chargers	AC Chargers 0.2; DC Fast Chargers 0.5	
Depot	No. of Electrified Depots	5 (1 additional in set-up process)	
Grid	Current load provision	15 MV for each charging depot	

PMPML e-Bus performance compared to CNG buses

CNG Buses GCC Rate	e-Buses GCC Rate
90 INR/km	**40 to 68 INR/km**

Key Highlights:

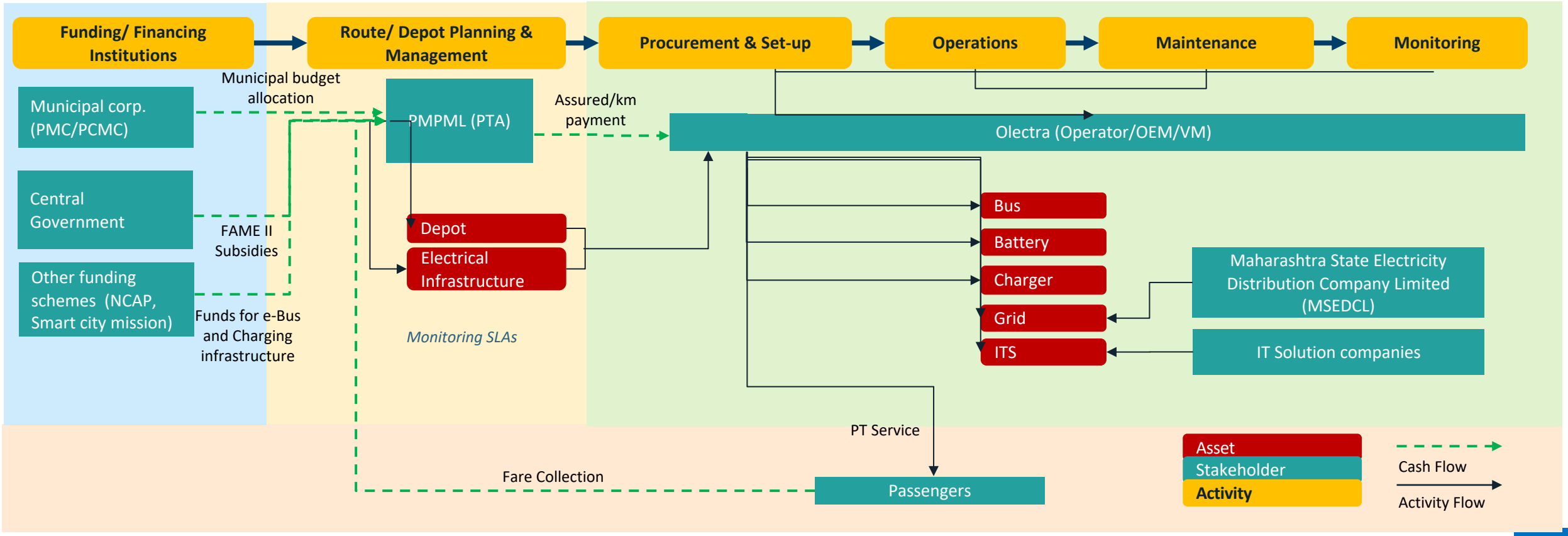
- Technological demand in Delhi: **9m (200 kWh) & 12 m e-Buses (380 kWh) with overnight fast charging + Opportunity charging**
- *Performance of e-Buses so far has proven operationally beneficial over CNG buses*

Deployment & Business Model: e-Bus Operations (Pune)

Electric Buses in Pune (PMPML)

- **402** Total no of e-Buses *(as of Sep 2022)*
- **16%** of India's e-Buses are in Pune
- **20%** of PMPML fleet is electric
- **5** Electric Depots and all operational
- **253** Chargers Installed- Fast Chargers (80 & 150 kW)
- **42** e-Buses operating Routes

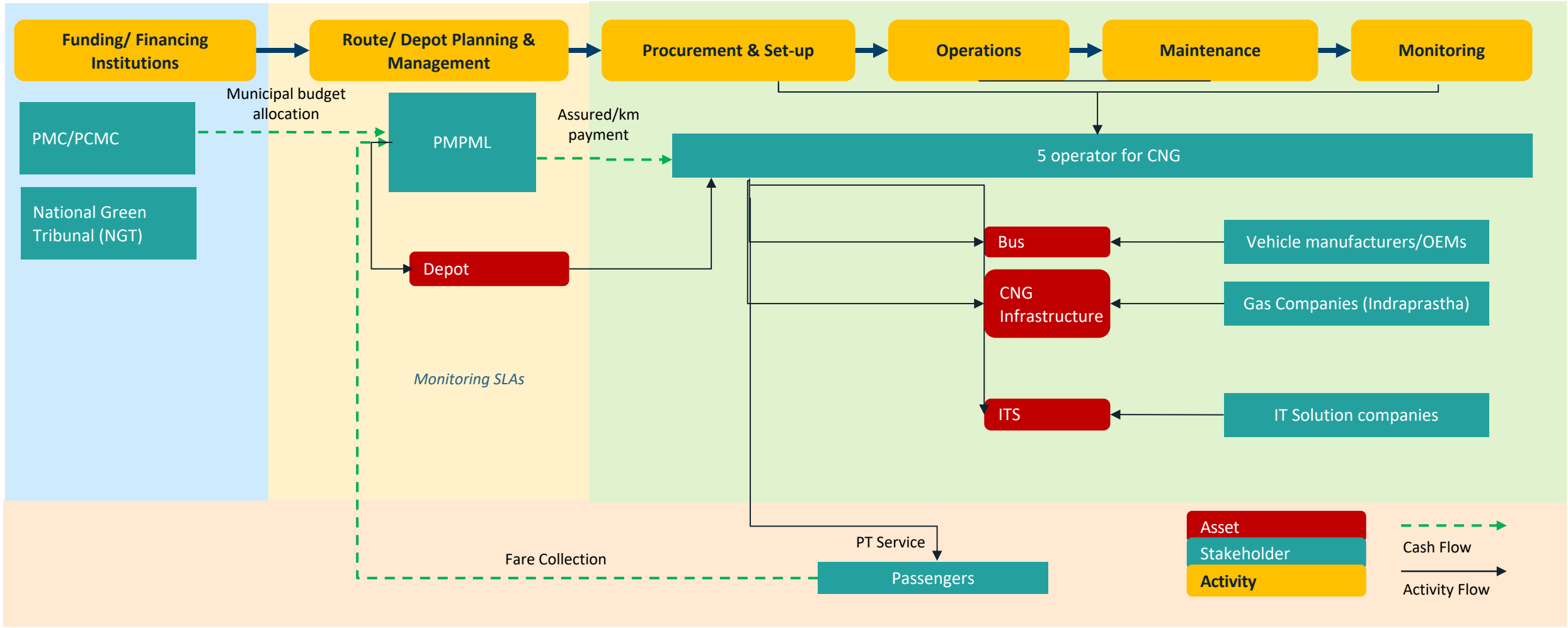
PMPML concessions its e-Bus operation to the private OEMs



OEM – Manufacturer, Operator, Joint Venture | STU – State Transport Undertaking | ESP – Energy Service Provider | SLA – Service Level Agreement

Deployment & Business Model: CNG Operations (Pune)

PMPML stage contract model (GCC - Gross Cost Contract)



OEM – Manufacturer, Operator, Joint Venture | STU – State Transport Undertaking | ESP – Energy Service Provider | SLA – Service Level Agreement

Overall Pune e-Bus Readiness

	S.No	Indicator	Score
POLICY & REGULATORY READINESS	P1	Extent of city commitment and targets achievements for e-Bus deployment	
	P2	Extent of Financial Incentives for e-Bus uptake other than National Subsidy	
	P3	Extent of planning for efficient e-Bus system deployment	
	P4	Extent of Viability Gap Funding Provisions for sustainable e-Bus operations	
INSTITUTIONAL READINESS	I1	Presence of organized Public transport with PTA/STU	
	I2	Track record on e-Bus tenders	
	I3	Track record on e-Bus deployment	
	I4	Presence of City level dedicated EV and/or e-Bus taskforce	
TECHNOLOGICAL READINESS	T1	Presence of diverse Bus models in the city bus fleet	
	T2	Ability to provide bespoke specifications and planning for e-Bus Depot	
	T3	Track record in managing bus public transportation (Presence of multiple suppliers for e-Bus in the city)	
	T4	Experience to plan and execute e-Bus solutions (Extent of e-Bus system planning and executive capacity in city)	
	T5	Adequacy of Access to Grid and Service quality	
FINANCIAL READINESS	F1	Level of City's STU/PTA Creditworthiness	
	F2	Transparent and comprehensive state budget support (Level of Collateral Security and de-risking mechanisms)	
	F3	Innovation in business model and financing	
	F4	Qualification criteria for Bidders	
	F5	Additional Subsidy from city/state government	
SUSTAINABILITY READINESS	S1	Vision/Plan for use of Renewable Energy for e-Bus Charging	
	S2	Plans to consistently Improve modal share of Public Transport	
	S3	Implementation of ITS system for improvement of bus operational efficiency and customer convenience initiatives	

Legend

Low | Medium | High

Summary of Opportunity – Pune

- Pune is a progressive city, having 70+ years of experience in operating public bus transport. It has a target of 25% e-Bus adoption by 2025.
- PMPML currently operates 2,000+ buses, including mini, midi, and standard buses, including CNG and electric buses. PMPML has plans to add another 300 buses to its fleet by 2023.
- Starting from FAME II incentives, Pune has also taken an independent step towards scaling-up e-Bus adoption through support from the municipal budget, state, NCAP subsidies, etc. As per state policy, Pune is availing electricity tariff incentives (OPEX support).
- e-Buses in Pune are currently operating on GCC and have plans to introduce more e-Buses on GCC model deployments. Among the targeted 1,000 buses, 900 buses would be achieved by 2023.
- Being Maharashtra's IT hub Pune has an active response to PT. With high travel demand, e-Buses will serve thousands of riders each day while helping to reduce GHG emissions. With its policy landscape, experience in e-Bus operations, progressive approach, and targets, Pune provides a potential market for e-Buses.
- Pune has high policy & regulatory readiness, moderate institutional readiness, high technological readiness, moderate financial readiness and low sustainability readiness.

6 Cities Market Readiness Assessment

A Delhi

B Mumbai

C Pune

D **Ahmedabad**

E Surat

F Chennai

Ahmedabad- Public Transport buses

City: Ahmedabad

State/UT: Gujarat

Pop: 8.2 million *(2021)*

CAGR: 2.39%

Area: 1,866 sqkm

Public Transport Buses in Ahmedabad

Avg. Daily Bus ridership: 0.67 million
(AMTS – 0.51 + AJL – 0.16)
Total Buses : 1,202

Ahmedabad Municipal Transport Service (AMTS)

800 — CNG buses

9 m buses

Ahmedabad Janmarg Limited (AJL) - BRTS

402 — *9 m buses*

- 150 — Diesel buses
- 50 — CNG buses
- 202 — Electric buses

+ 50 planned

e-Bus Targets and Opportunities (AJL)

50
More **e-Buses** by **Sep 2022**

100%
Bus Fleet electrification by **2024**

Planned projects – 450 (9 m) AC e-Buses to be procured under FAME-II (**150 of 1st set and 300 of 2nd set) by 2023.**

Ahmedabad has a long plan to electrify their fleet in a phased manner aiming electrification by 2024

Ahmedabad is progressing towards the use of CNG buses and is moving forward with e-Bus deployment, supporting the country's fleet decarbonisation.

Institutional and Policy Readiness (Ahmedabad)

Ahmedabad has progressive provisions & regulatory frameworks for e-Bus adoption in terms of both demand side incentives and supply side incentives.

State/ UT- EV Policy *Policy announced in 2020 and applicable for 3 years*	**Provisions and Incentives**
Target	**Full electrification by 2024 of e-Buses (0.2 Mn Electric vehicles by 2025)**
Capital Subsidy	**Provided**
Tax exemptions	**Stamp Duty exemption, Electricity duty exemption, SGST Reimbursement, Land Conversion Fee/Subsidy, Registration fees etc.**
Interest subsidies	*Not Provided*
Land development incentives	**Lease of government land is provided at 6% of market value up to 50 years under Gujarat Industrial Policy 2020**
Concession on Infrastructure	**25% capital subsidy of the charging station equipment/machinery up to INR 1 Mn for the first 250 commercial public EV charging stations**
Concessional power tariff for Charging	**Provided - INR 4.0 to 4.1/kWh**

Special Purpose Vehicle	**Ahmedabad Janmarg Limited (AJL) - BRTS**
Initiatives & Incentives	**Clean and Green Public Transport initiatives by DHI (FAME I & II)** **Project Green Mobility Incentive by IREDA**
The Chief Minister Urban Bus Scheme (CMUBS)	The Gujarat state government and the city authorities each offer a viability gap funding **(VGF)** of **INR 12.50/ km** towards operations expenditure of every new city bus (electric or ICE).

Ahmedabad has provisions over and above central institutional reforms and additional subsidies in state EV policy, also supported by the state government's support in funding to promote e-Buses.

Procurement & Tendering: Technical Readiness

FAME I

Ahmedabad applied for 50 e-Buses while no buses were sanctioned/procured under FAME I.

Non-FAME

50 e-Buses have been procured under the scheme with funding from AJL, AMC, and CM Urban Bus Scheme.

FAME II

Tendered 300 e-Buses under FAME II and **202 e-Buses** are deployed, funded by AJL, AMC and CM Bus Scheme.
More **300 (9 m)** AC e-Buses to be procured under FAME-II by 2023.

Grand Challenge

No e-Buses demanded under the Grand challenge

Technological Specifications (FAME II Intracity Tender)

		Intracity-AJL
Tenders	Bids received	3 (each for 2 rounds)
	L1 and L2 Players	Tata Motors, Evey Trans, Ashok Leyland
	Assured km/month	5,850
e-Bus	Floor height (mm)	900±10
	Bus length	9m
	Air-Conditioning	Yes
	Passenger capacity	24-27+Driver+Wheelchair
	Time for Charging(Overnight/specific duration mentioned?)	Overnight
	Vehicle range on single charge (km)	220 Km
	Opportunity charging (Time allowed in minutes)	75 minutes
	Rated Battery Capacity (kWh)	180 kWh and 190 kWh
	Battery Chemistry	Li ion NMC
	Range provided-km (by L1)	120 km (at 100% SOC)
Chargers	Rating (kW)	150 kW, 200kW
	Type of Chargers	Fast Chargers (2 Mn INR)
Depot	No. of Electrified Depots	3

Key Highlights:

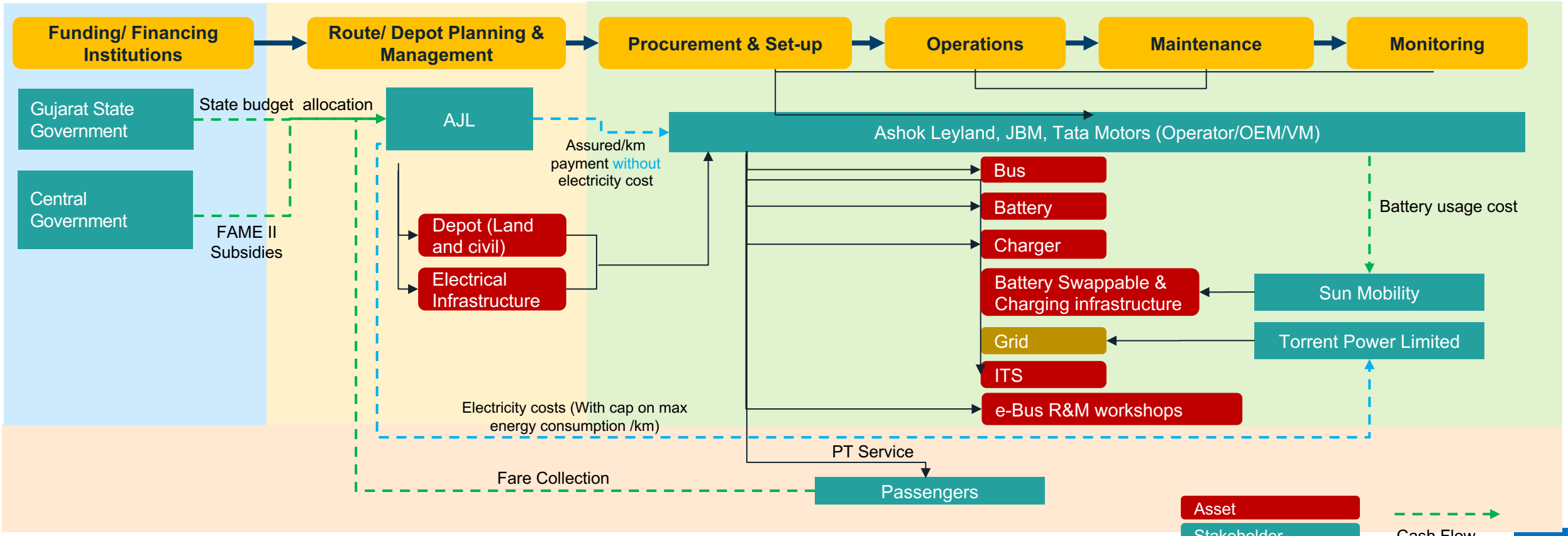
- Technological Demand in Ahmedabad: **9 m (180kWh and 190kWh) overnight fast charging and opportunity charging.**
- *Performance of e-Buses so far has proven to be operationally beneficial over CNG and ICE buses (cost of operation+ pollution +comfort).*

Deployment & Business Model: e-Bus operations

Electric Buses in Ahmedabad (AJL)

- **202** Total no of e-Buses *(as of Sep 2022)*
- **8%** of India's e-Buses are in Ahmedabad
- **50%** of AJL- BRTS fleet is electric
- **3** Electric Depots
- **48** Chargers Installed- Fast Chargers (200 & 240 kW)
- **17** e-Buses operating Routes

AJL concessions its e-Bus operation to the private OEMs



OEM – Manufacturer, Operator, Joint Venture | STU – State Transport Undertaking | ESP – Energy Service Provider

Overall Ahmedabad e-Bus Readiness

	S.No	Indicator	Score
POLICY & REGULATORY READINESS	P1	Extent of city commitment and targets achievements for e-Bus deployment	
	P2	Extent of Financial Incentives for e-Bus uptake other than National Subsidy	
	P3	Extent of planning for efficient e-Bus system deployment	
	P4	Extent of Viability Gap Funding Provisions for sustainable e-Bus operations	
INSTITUTIONAL READINESS	I1	Presence of organized Public transport with PTA/STU	
	I2	Track record on e-Bus tenders	
	I3	Track record on e-Bus deployment	
	I4	Presence of City level dedicated EV and/or e-Bus taskforce	
TECHNOLOGICAL READINESS	T1	Presence of diverse Bus models in the city bus fleet	
	T2	Ability to provide bespoke specifications and planning for e-Bus Depot	
	T3	Track record in managing bus public transportation (Presence of multiple suppliers for e-Bus in the city)	
	T4	Experience to plan and execute e-Bus solutions (Extent of e-Bus system planning and executive capacity in city)	
	T5	Adequacy of Access to Grid and Service quality	
FINANCIAL READINESS	F1	Level of City's STU/PTA Creditworthiness	
	F2	Transparent and comprehensive state budget support (Level of Collateral Security and de-risking mechanisms)	
	F3	Innovation in business model and financing	
	F4	Qualification criteria for Bidders	
	F5	Additional Subsidy from city/state government	
SUSTAINABILITY READINESS	S1	Vision/Plan for use of Renewable Energy for e-Bus Charging	
	S2	Plans to consistently Improve modal share of Public Transport	
	S3	Implementation of ITS system for improvement of bus operational efficiency and customer convenience initiatives	

Legend

Low | Medium | High

Summary of Opportunity – Ahmedabad

- Ahmedabad is a progressive city with 70+ years of experience operating public bus transport. It has a target of 100% public bus fleet electrification by 2024.
- Ahmedabad currently operates 1,000+ buses having mini, midi and standard buses including CNG and electric buses. AJL-BRTS has plans to further add 450 buses into its fleet by 2023.
- Starting from FAME II incentives, Ahmedabad has also taken independent steps towards scaling-up e-Bus adoption with the support from Municipal budget, State, NCAP subsidies etc. As per state policy Ahmedabad is availing both CAPEX, OPEX support and VGF.
- e-Buses in Ahmedabad are currently operating on GCC and have plans to introduce more e-Buses on GCC model deployments. AJL-BRTS also has experience in working with the Battery Swapping model.
- With the usage of the first set of 50 e-Buses, it is estimated to reduce emission of about 3,000 tons of carbon, a big step towards a cleaner planet. AJL have gone one step further and have installed rooftop solar panels on the BRTS bus-stations.
- Ahmedabad has an active response to PT with well established BRTS. With high travel demand e-Buses are to serve thousands of ridership daily and help reduce GHG emissions. With its policy landscape, experience in e-Bus operations, progressive approach and targets; Ahmedabad provides a potential market for e-Buses.
- Ahmedabad has moderate policy & regulatory readiness, high institutional and technological readiness, low financial and sustainability readiness.

6 Cities Market Readiness Assessment

A Delhi

B Mumbai

C Pune

D Ahmedabad

E Surat

F Chennai

Surat – Public Transport buses

City: Surat

State/UT: Gujarat

Pop: 7.5 million *(2021)*

CAGR: 3.93%

Area: 474 Sq.km

Public Transport Buses in Surat

Avg. Daily Bus ridership: 0.28 million
Total Buses : 850

Surat Municipal corporation (SMC) - Sitilink

Surat City Buses

675 — Diesel buses

9 m buses

BRTS

175

9 m buses

100 — Diesel buses

75 — Electric buses

+150 planned

e-Bus Targets and Opportunities (SMC)

60%

Bus fleet electrification by 2023

600

Total e-Buses by 2023

Surat Municipal Corporation (SMC) aims to convert **60%** of the SMC-run buses into electric buses by the end of **2023**, which adds up to **600 e-Buses.**

Surat has started its journey of fleet decarbonisation and phased out major targets to achieve the fleet electrification.

Institutional and Policy Readiness (Surat)

Surat has progressive provisions & regulatory frameworks for e-Bus adoption in terms of both demand side incentives and supply side incentives.

State/ UT- EV Policy *Policy announced in 2020 and applicable for 3 years*	**Provisions and Incentives**
Target	**Full electrification of e-Buses by 2024 (0.2 Mn Electric vehicles by 2025)**
Capital Subsidy	**Provided**
Tax exemptions	**Stamp Duty exemption, Electricity duty exemption, SGST Reimbursement, Land Conversion Fee/Subsidy, Registration fees etc.**
Interest subsidies	*Not Provided*
Land development incentives	**Lease of government land is provided at 6% of market value up to 50 years under Gujarat Industrial Policy 2020**
Concession on Infrastructure	**25% capital subsidy of the charging station equipment/machinery up to INR 1 Mn for the first 250 commercial public EV charging stations**
Concessional power tariff for Charging	**Provided - Energy Charge : INR 4.10 per unit**
Special Electricity Tariff for EVs	**Provided - INR 6.5 per unit**

Special Purpose Vehicle	**Surat Municipal Corporation – Sitilink (PPP model)**
Initiatives & Incentives	**Clean and Green Public Transport initiatives by DHI (FAME I & II)** **Project Green Mobility Incentive by IREDA**
The Chief Minister Urban Bus Scheme (CMUBS)	The Gujarat state government and the city authorities each offer a viability gap funding **(VGF)** of **INR 12.50/ km** towards operations expenditure of every new city bus (electric or ICE).

Surat has provisions over and above central institutional reforms and additional subsidies in state EV policy, also supported by the state government's support in funding to promote e-Buses.

Procurement & Tendering: Technical Readiness (Surat)

FAME I

No e-Buses under FAME I

FAME II

Tendered 75 e-Buses under FAME II and currently **75** e-Buses are deployed.

Grand Challenge

150 (9 m) AC e-Buses to be deployed by Dec 2022.

Technological Specifications (FAME II Intracity Tender & Grand Challenge)

		Intracity-SMC Sitilink
	L1 and L2 Players	Greencell Mobility (PMI consortium)
	Assured km/month	5,850
e-Bus	Floor height (mm)	900±10
	Bus length	9m
	Air-Conditioning	Yes
	Passenger capacity	24-27+Driver+Wheelchair
	Time for Charging(Overnight/specific duration mentioned?)	Overnight
	Vehicle range on single charge (km)	220 Km
	Opportunity charging (Time allowed in minutes)	75 minutes
	Rated Battery Capacity (kWh)	151kWh
	Range provided-km (by L1)	180-200 km per charge
Chargers	Rating (kW)	180 kW (by Starcharge)
	Type of Chargers	AC and DC
Depot	No. of Electrified Depots	2

Key Highlights:

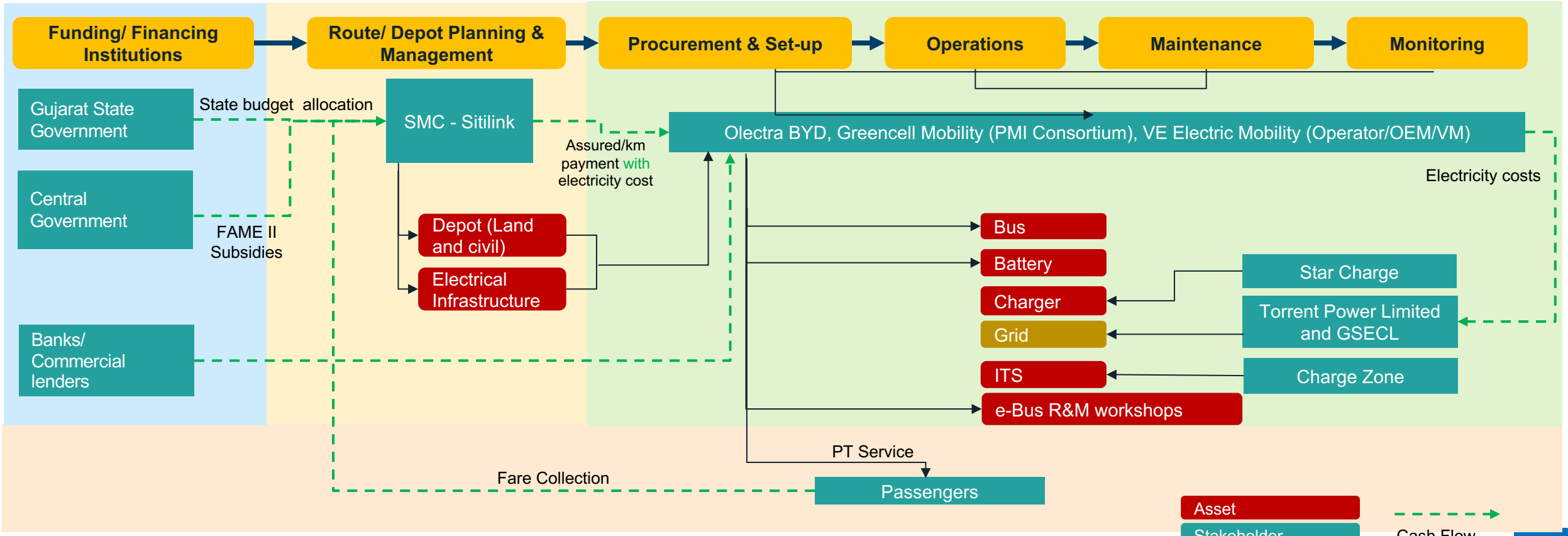
- Technological Demand in Surat: **9 m (151 kWh) (overnight charging)**
- *Performance of e-Buses so far has proven to be operationally **beneficial** over ICE buses (cost of operation+ pollution + comfort)*

Deployment & Business Model: e-Bus Operations

Electric Buses in Surat (SMC- Sitilink)

- **75** Total no of e-Buses *(as of Sep 2022)*
- **3%** of India's e-Buses are in Delhi
- **43%** of BRTS fleet is electric
- **2** Electric Depots *(6 planned depots)*
- **46** Chargers Installed- 44 AC and 2 DC chargers
- **6** e-Buses operating Routes

SMC – Sitilink BRTS concessions its e-Bus operation to the private OEMs



OEM – Manufacturer, Operator, Joint Venture | STU – State Transport Undertaking | ESP – Energy Service Provider

Overall Surat e-Bus Readiness

	S.No	Indicator	Score
POLICY & REGULATORY READINESS	P1	Extent of city commitment and targets achievements for e-Bus deployment	
	P2	Extent of Financial Incentives for e-Bus uptake other than National Subsidy	
	P3	Extent of planning for efficient e-Bus system deployment	
	P4	Extent of Viability Gap Funding Provisions for sustainable e-Bus operations	
INSTITUTIONAL READINESS	I1	Presence of organized Public transport with PTA/STU	
	I2	Track record on e-Bus tenders	
	I3	Track record on e-Bus deployment	
	I4	Presence of City level dedicated EV and/or e-Bus taskforce	
TECHNOLOGICAL READINESS	T1	Presence of diverse Bus models in the city bus fleet	
	T2	Ability to provide bespoke specifications and planning for e-Bus Depot	
	T3	Track record in managing bus public transportation (Presence of multiple suppliers for e-Bus in the city)	
	T4	Experience to plan and execute e-Bus solutions (Extent of e-Bus system planning and executive capacity in city)	
	T5	Adequacy of Access to Grid and Service quality	
FINANCIAL READINESS	F1	Level of City's STU/PTA Creditworthiness	
	F2	Transparent and comprehensive state budget support (Level of Collateral Security and de-risking mechanisms)	
	F3	Innovation in business model and financing	
	F4	Qualification criteria for Bidders	
	F5	Additional Subsidy from city/state government	
SUSTAINABILITY READINESS	S1	Vision/Plan for use of Renewable Energy for e-Bus Charging	
	S2	Plans to consistently Improve modal share of Public Transport	
	S3	Implementation of ITS system for improvement of bus operational efficiency and customer convenience initiatives	

Legend

Low | Medium | High

Summary of Opportunity – Surat

- Surat has 15+ years of experience in operating public bus transport. It has a target of 100% e-Bus adoption by 2024.
- Surat currently has 850+ public transport buses, including 9 million buses, including diesel and electric buses. SMC-Sitilink has plans to have a total of 600 buses in its fleet by 2023.
- Starting from FAME II incentives, Surat has also taken an independent step towards scaling-up e-Bus adoption with support from the municipal budget, state, NCAP subsidies, etc. As per state policy, Ahmedabad is availing both CAPEX and OPEX support and VGF.
- e-Buses in Surat are currently operating on GCC and have plans to introduce more e-Buses on GCC model deployments. Among the targeted 600 buses, a 150-bus target would be achieved by Dec 2022.
- Currently, with 75 e-Buses in Surat, there is a reduction of 2,700+ tonnes of GHG emissions (CO_2e) and a saving of 1 million litres of fuel.
- Being the city with the best public transport system in the country, buses are a crucial part of local transport in Surat. With high travel demand, e-Buses will serve thousands of riders each day while helping to reduce GHG emissions. With its policy landscape, experience in e-Bus operations, progressive approach, and targets, Surat provides a potential market for e-Buses.
- Surat has moderate policy & regulatory, institutional, and technological readiness, low financial readiness and moderate sustainability readiness.

6 Cities Market Readiness Assessment

A Delhi

B Mumbai

C Pune

D Ahmedabad

E Surat

F Chennai

Chennai- Public Transport buses

City: Chennai

State/UT: Tamil Nadu

Pop: 11.2 million *(2021)*

CAGR: 2.41%

Area: 426 sqkm

Public Transport Buses in Chennai

Avg. Daily Bus ridership: 2.88 million
Total Buses : 3,457

Metropolitan Transport Corporation (Chennai)

3,457 Diesel buses

9/11/12 m buses

e-Bus Targets and Opportunities (MTC)

100 e-Buses by Sep **2022**

300 Total e-Buses by **2023**

1,000 Total e-Buses by **2025**

75% All new purchases to be electric by **2027**

100% All new purchases to be electric by **2032**

Target average annual purchase of **250-300 e-Buses**

Chennai is starting its journey of fleet decarbonisation and has phased out the major targets to achieve fleet electrification.

Institutional and Policy Readiness (Chennai)

Chennai has progressive provisions & regulatory frameworks for e-Bus adoption in terms of both demand side incentives and supply side incentives.

State/ UT- EV Policy *Policy announced in 2020 and applicable for 3 years*	**Provisions and Incentives**
Target	STUs to **replace around 5% of the buses** as e-Buses every year and around **1000 e-Buses** may be introduced every year
Capital Subsidy	**15%** capital subsidy on eligible investments over 10 years. EV Battery Manufacturing: 20% capital subsidy on eligible investments over 20 years
Tax exemptions	**Stamp Duty exemption, Electricity duty exemption etc.**
Interest subsidies	EV component and charging manufacturing: 6%
Land development incentives	**Provided** EV related and charging infrastructure manufacturing industries that obtain land from SIPCOT, SIDCO or other governmental agencies will be provided **15% subsidy on the cost of land**
Concession on Infrastructure	*Not Provided*
Concessional power tariff for Charging	**INR 5 to 8.05/kWh**

KFW Financing	• State Government has purchased **100 e-Buses** with the financial support of KfW
SWITCH Mobility	• An arm of Ashok Leyland, is planning to a lot of **500 e-Buses by 2022** among a total of **2,000 e-Buses** to be **financed by KfW**
C40 Cities Finance Facility	• Supports Chennai to **prepare and deliver climate change projects related to e-Buses.**
MoU with C40	• **In 2018,** the **state government** and the **department of Environment, Climate Change and Forest department of Government of Tamil Nadu** signed an MoU with C40.
Climate Action Plan by C40	• The **Climate action plan** by C40 for Chennai is out for public comment and will be soon **launched with the with the City of Chennai administration and Government of Tamil Nadu**

Chennai constitutes over and above central institutional reforms and matching central Govt. subsidies in EV policy also supported by the State government support in funding to promote e-Buses

Overall Chennai e-Bus Readiness

	S.No	Indicator	Score
POLICY & REGULATORY READINESS	P1	Extent of city commitment and targets achievements for e-Bus deployment	
	P2	Extent of Financial Incentives for e-Bus uptake other than National Subsidy	
	P3	Extent of planning for efficient e-Bus system deployment	
	P4	Extent of Viability Gap Funding Provisions for sustainable e-Bus operations	
INSTITUTIONAL READINESS	I1	Presence of organized Public transport with PTA/STU	
	I2	Track record on e-Bus tenders	
	I3	Track record on e-Bus deployment	
	I4	Presence of City level dedicated EV and/or e-Bus taskforce	
TECHNOLOGICAL READINESS	T1	Presence of diverse Bus models in the city bus fleet	
	T2	Ability to provide bespoke specifications and planning for e-Bus Depot	
	T3	Track record in managing bus public transportation (Presence of multiple suppliers for e-Bus in the city)	
	T4	Experience to plan and execute e-Bus solutions (Extent of e-Bus system planning and executive capacity in city)	
	T5	Adequacy of Access to Grid and Service quality	
FINANCIAL READINESS	F1	Level of City's STU/PTA Creditworthiness	
	F2	Transparent and comprehensive state budget support (Level of Collateral Security and de-risking mechanisms)	
	F3	Innovation in business model and financing	
	F4	Qualification criteria for Bidders	
	F5	Additional Subsidy from city/state government	
SUSTAINABILITY READINESS	S1	Vision/Plan for use of Renewable Energy for e-Bus Charging	
	S2	Plans to consistently Improve modal share of Public Transport	
	S3	Implementation of ITS system for improvement of bus operational efficiency and customer convenience initiatives	

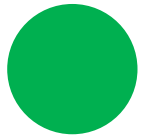
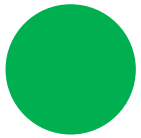
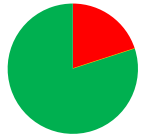
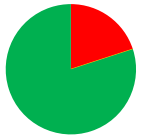
Legend

Low | Medium | High

Summary of Opportunity – Chennai

- Chennai has 75+ years of experience in operating public bus transport. It has a target of 100% new purchases of e-Bus adoption by 2032.
- Chennai currently has 3,400+ public transport buses, including mini, midi, and standard buses, which are diesel buses. MTC has plans to have a total of 1,000 e-Buses by 2025.
- Chennai has taken the independent step towards scaling-up e-Bus adoption through with support from the municipal budget, State subsidies and external funding from KfW.
- The State Government of Tamil Nadu has purchased 500 e-Buses with the financial support of KfW funding, among which 100 e-Buses have been allotted to MTC (yet to be operational).
- Being a metropolitan city and with one of the largest public transport systems in the country, buses are a crucial part of local transport in Chennai. With high travel demand, e-Buses will serve thousands of riders each day while helping to reduce GHG emissions. With its policy landscape, experience in e-Bus operations, progressive approach, and targets, Chennai provides a potential market for e-Buses.
- Chennai has low policy & regulatory readiness, institutional readiness, moderate technological readiness, low financial readiness and moderate sustainability readiness.

Overall City Readiness Comparison

	Pune	Delhi	Ahmedabad	Surat	Mumbai	Chennai
POLICY & REGULATORY READINESS						
INSTITUTIONAL READINESS						
TECHNOLOGICAL READINESS						
FINANCIAL READINESS						
SUSTANABILITY READINESS						

Legend

Refer the Slide - Readiness assessment framework and the indicators of each readiness

*Ranking high to low

5

ZE-Bus Investments

This section aims to provide country market potential and the necessary investments to be made to supply the Indian demand. It presents the opportunities within the current ZE-Bus value chain for the investors. It analyzes the opportunities for expanding the local production/assembling of batteries, how to make the most of the incentives offered by the government for an investor.

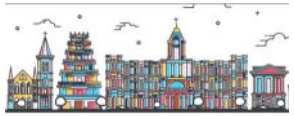
ZE-Bus Investments

A **Market Sizing**

B Investment Opportunities

City Adoption and Growth of e-Buses in India


Ahmedabad


Chennai


Delhi


Mumbai


Pune


Surat

Total Intracity Buses *(as of Dec' 22)*	1,202	3,457	7,391	3,680	2,010	850	**18,590**
Intracity e-Buses *(as of Dec' 22)*	254	-	418	652	467	125	**1,916 (10%)**
No. of e-Buses in active pipeline	50	100	1,500	--	--	150	**1,800**
e-Bus stated Targets by cities	By 2024 – 100% electrification	By 2025 – 1,000+	By 2025 – 8,000+	By 2025 – 10,000+	By 2025 – 1,000+	By 2025 – 600+	
Realistic Targets*	By 2030 – 100% electrification	By 2025 – 1,000+	By 2028 – 8,000+	By 2030 – 8,000+	By 2025 – 1000+	By 2025 – 600+	
Intracity e-Bus stock *(2030)*	1,504	3,550	11,873	8,032	2,647	1,817	**29,423**
e-Bus % of overall bus stock *(2030)***	16%	12%	7%	11%	11%	9%	**11%**

- As on 2022, this 6 cities have **18,590** intracity buses. Out of which **1,916** (10%) are e-Buses.
- By 2030, it is estimated that these 6 cities will have **29,423** e-Buses considering city-level targets
- Overall Delhi would have highest no. of e-Buses followed by Mumbai – both cities accounting 60-65% of new e-Buses

Source: VAHAN, Industry experts, City Representatives

**Industry consultations'22*

***Bus stock includes intracity + intercity buses of all fuel type*

Key Drivers for e-Bus Adoption in India

Key Enabling factors that have aided e-Bus adoption in India

NATIONAL TARGETS AND POLICY SUPPORT

GoI taken considerable measures to keep e-Bus targets aligned to NEMPP. **FAME I** outlay ~INR 300 Cr. (31% of total outlay) for e-Buses deployment and that of **FAME II** as ~INR 3,545 Cr. (41.2 % of total fund).

Offers significant National & Local subsidies (up to **40% - 50%** of procurement costs), both to reduce capital costs as well as to improve operator profitability

Effective **State EV Policies*** in place with defined EV targets, capital subsidies, tax exemptions, interest subsidies, land development incentives, concessional tariffs - **17 states** with notified EV policies and **3 states** with draft EV policies

BULK PROCUREMENT AND AGGREGATED MODEL DRIVEN BY CESL

CESL to aggregate demand - with the expectation that market would respond with lower prices if they saw larger sized orders.

MATURED LOCAL INDUSTRY & SUPPLY WITH INCREASING LOCALISATION TARGETS

Localization of e-Bus components expected to move towards 100% by 2030

CHARGING INFRASTRUCTURE AND DISCOUNTED ELECTRICITY TARIFF FACILITATION

Setup of Charging infrastructure is aided through subsidies (capital subsidy, tax exemption & interest subsidy, land development incentives, etc.)

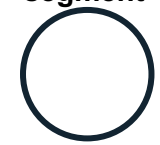
National-level Targets for electrification of buses in India

NITI Aayog

NITI Ayog Targets

- Projected 500,000 sales of e-Buses by 2030
- e-Bus Sales penetration is projected as 40% of total bus registration by 2030

All bus segment



CONVERGENCE energy. simplified
Convergence Energy Services Limited

CESL Targets

- Projected to deploy 50,000 public e-Buses under a "National Electric Bus Program (NEBP)" by 2030

Only intracity bus segment

Key highlights of 6 selected cities

- As on 2022, Intracity bus stock (all types) of selected 6 cities accounts for 60% of national stock.
- By 2030, these 6 cities would deploy **~30,000** e-Buses, which is 60% of CESL targets i.e., 50,000 public e-Buses.
- **Given the past trends, deployment pipeline and the e-Bus city-level target, there is good possibility that India would be able to achieve 50,000 intracity e-Buses by 2030.**

*State EV policies - Refer Slide

USD 100 billion investment estimated for **500,000 e-Buses** and associated Charging infrastructure by 2030

10%

Intra city Buses

55%

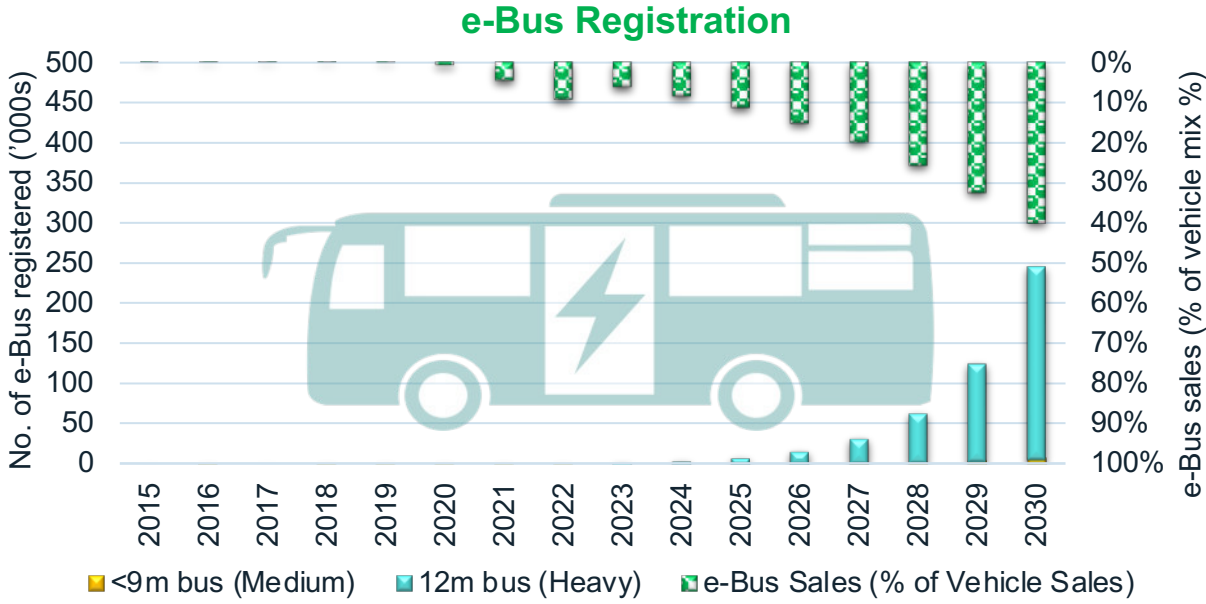
School Buses

Employee Transport Buses

35%

Semi-urban and long distance Buses

- Intracity public e-Bus is most popular use case, which has already started and created the initial demand signal for e-Bus adoption in India and will also lead to scale-up. It is expected that other market segment such as school buses, private buses will also adopt e-Buses in medium to long term and last point
- Among the other use case, school and employee transport account for more than 50% buses followed by semi-urban and long distance buses (35%). This segment will also switch to e-Buses through right policy intervention and reducing battery cost.
- All these bus use cases are expected to add up 500,000 e-Buses by 2030.**Our internal analysis expects 50% of target to be achieved by 2030



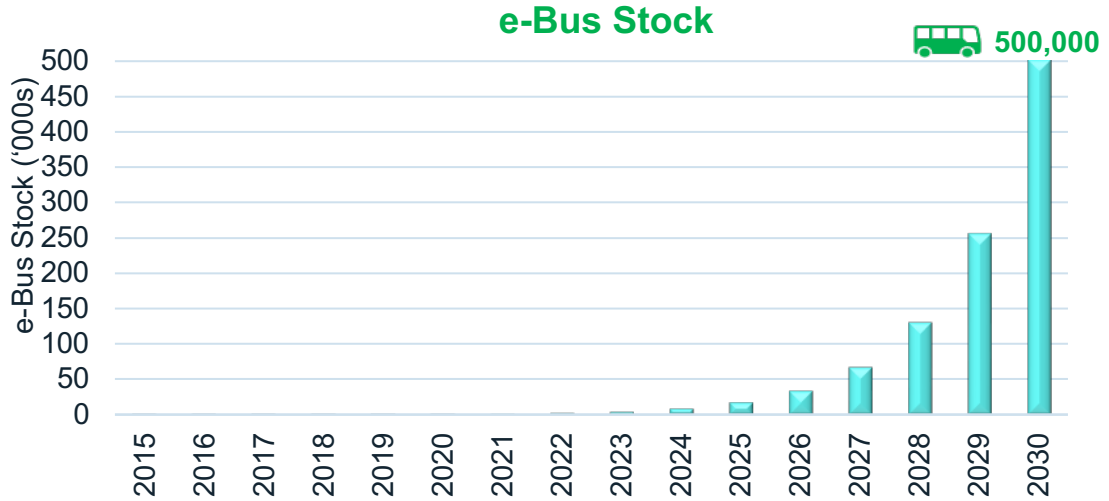
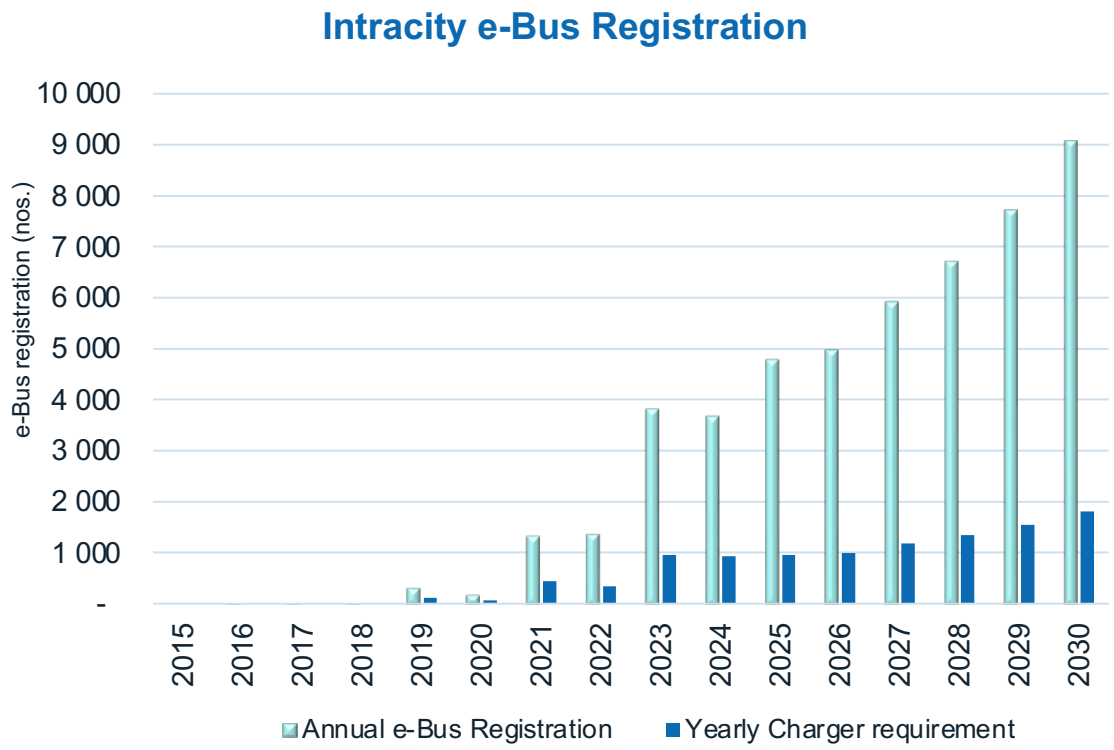
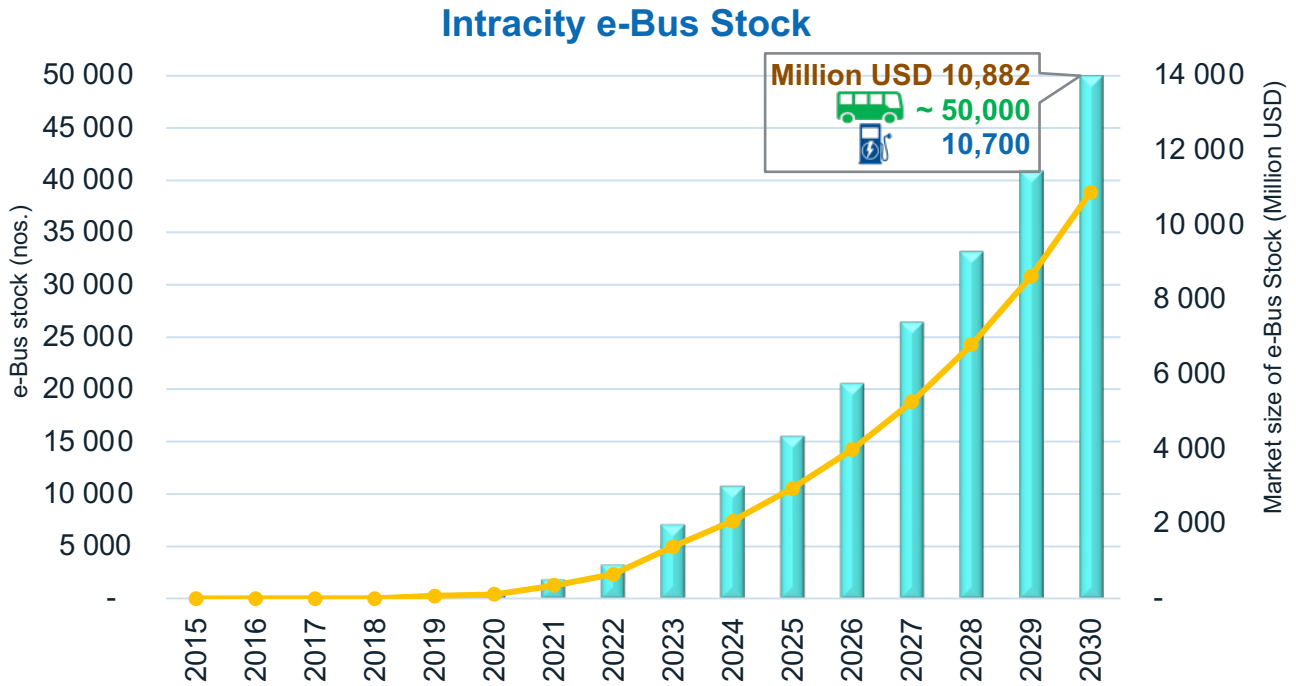


Chart includes Country-level demand of e-Buses

The above chart is based on an assumption that NITI Ayog projected 500,000 sales of e-Buses by 2030. As per pManifold internal Analysis, based on past registration data, GDP & population trend and other factor, it may be possible to reach only 50% of target by 2030. It is also worth noting that if NITI targets are met, bus population ratio will be 1.7 per 1,000 population (includes both intra & intercity buses) which is desirable over the long term. This is because countries like Mexico, Brazil, and China have more than 2 buses per 1,000 population

Investment Analysis of Intracity e-Bus Market in India





~50,000

Intracity e-Buses should be acquired within this decade.

~10,000 Mn USD

In investments are expected for the bus electrification in this decade considering the e-Bus units and charging infrastructure.

Ahmedabad, Chennai, Delhi, Mumbai, Pune & Surat

Account for ~60% of the market until 2030

ZE Bus Investments

A Market Sizing

B Investment Opportunities

Investor Opportunities

Indian e-Bus market offers following **4 distinct opportunities** where investment is already transpiring and will continue to rise in order to meet growing market demands. The interested stakeholders can enter the market as a -

Manufacturing

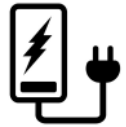
As a Domestic Manufacturer:

- **Manufacture** e-Buses/ battery (cell assembly)/ chargers indigenously

Mobility as a Service

As an Operator/Aggregator:

- **Procure** e-Buses, **operate** depots and e-Buses on routes specified by STU/PTA, carry out preventive and breakdown **maintenance** of buses under various business models such as Outright Purchase model, Gross Cost Contract model *(paid per km)*



Charging as a Service

As a Charging service provider:

- **Deploy chargers** and necessary grid infrastructure including civil work. Also undertake preventive and breakdown maintenance of overall charging infrastructure *(e.g., paid per kWh unit charging)*

Financing

As a Financier:

- **Provide the growth capital through various financial instruments** to market participants. For e.g., e-Bus manufacturer, e-Bus operator, etc.

Investment Opportunity for e-Bus Manufacturing

Switch to electric mobility has created a new paradigm in the manufacturing ecosystem

Typical investments and returns of e-Bus manufacturing in India

Parameters	CAPEX	OPEX
Investment Amount *(for 3,500 annual e-Bus production)*	USD ~35 Mn* *(Towards machinery, construction and others. It doesn't include land cost)*	Typical manufacturing facility will require 35 manpower in engineering department, 400 in manufacturing and 20 in sales. In addition, electricity & general administration expenses needs to be considered

**Land cost is location specific and state govt. may provide special incentives/packages (Land @ concessional rates) for setting up e-Bus manufacturing facilities*

- Margin on e-Bus sales will typically range between 5% to 7% because base value of e-Bus is higher than ICE buses, where typical margin is about 15%
- Overall IRR of the project ranges between 12% to 15%
- Payback of 5+ years
- Break-even capacity – 55% to 60%

Investments in electric mobility in India[4]

- In 2021, India has USD 13 billion (~INR 988 Bn) of total investment in automobile sector, Out of which, **48%** (~INR 482 Bn) of the total investments was **in electric mobility**
- With the government focus on green mobility, **traditional automotive companies** accounted for **67.7%** (INR 328 Bn) of the total investment on EV product development and manufacturing set-up and rest accounted by start-ups
- Among which, **Tata motors** has the highest investment of **46.6% (INR 225 Bn)** of the total investment and **Riding EV Revolution in India**

Existing e-Bus Manufacturing Landscape & Strategic Viewpoint

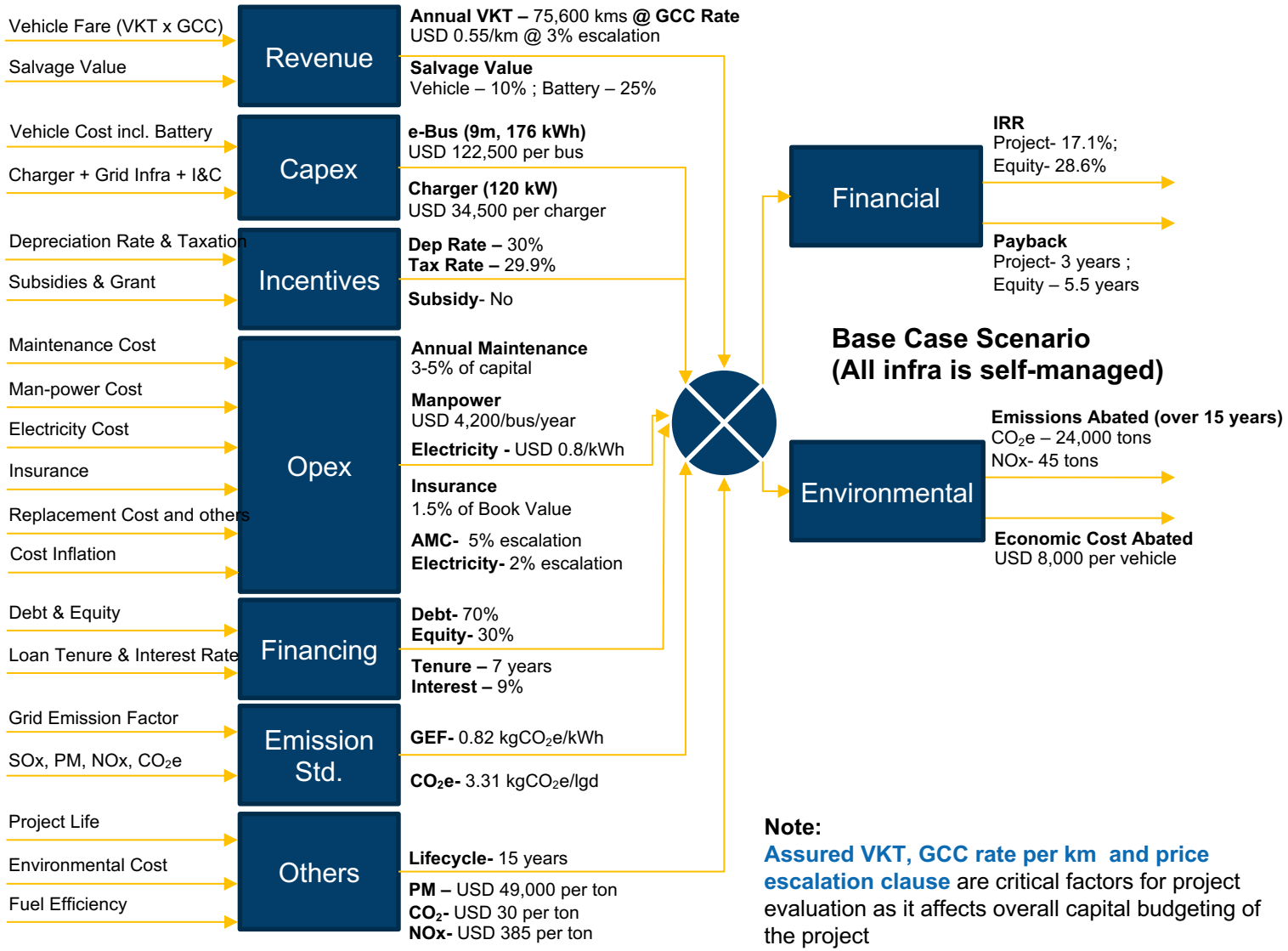
- India is the second-largest manufacturer of buses and coaches in the world[1]
- There are **6+ major*** **e-Bus OEMs** (Tata Motors, Ashok Leyland, Olectra Greentech, JBM-Solaris, PMI-Foton, Volvo-Eicher) with a total production capacity of **6,000+ bus** units per year
- As of 2021, e-Bus sales represent 2% of total bus sales (26,000 units) and **33% of production capacity** usage.
- The opportunities provided by e-Bus market have encouraged **many new players** (Simple energy, Omega Seioki, Ola Electric, Kinertic Energy, Matter, etc.) to enter the space, and joint ventures (JV) have been drafted between Indian and foreign firms
- OEMs have managed to build dedicated platforms for assembling e-Buses and some **component players** such as JBM have **made the full shift to e-Buses**
- Majority of the e-Bus components can be sourced from **domestic market**. However, some components related to battery pack, motor, electronics and wiring harnesses are still import-dependent
- Between FY16 and FY20, **domestic automobile production** increased at a **CAGR of 2.36%** despite the overall slowdown in the economy, extrapolating from this, annual production could be around **30 million by 2030[2] of which 30% can be expected to be EVs by 2030 in most optimistic scenario**
- **Production linked incentive (PLI) Govt. Scheme** was launched to boost **local manufacturing** with total incentives worth INR 181 Bn (USD 2,185 Mn) for all EVs[3]
- Extent of localization of e-Bus components as of 2022 is 20% and expected to move towards 50% by 2035

1. *Nation Master, Buses and Coaches Production, 2019*
2. *India Brand Equity Foundation, Auto Components Analysis, 2021*
3. *Given the similarity in components across electric vehicles, it is difficult to assess electric buses without focusing on the changes in the whole ecosystem*
4. *ETAuto Original: Putting EV at forefront, Indian auto inc proposes USD 13 bn investment in 2021, Auto News, ET Auto (indiatimes.com)*

** Major OEMs – The OEMs operating e-Buses for multiple STUs/PTAs across various cities)*

Investment Opportunity for Mobility as a Service

e-Bus India GCC Model is a viable business model and provides attractive long-term investment opportunities to private cos, PE players, commercial lenders, and financing institutions



Note:
Assured VKT, GCC rate per km and price escalation clause are critical factors for project evaluation as it affects overall capital budgeting of the project

- **For 100 e-Buses (9m, 176 kWh) and 25 Nos 120 kW Fast DC** charger, the estimated capital investment is about USD 13 Mn. The project IRR > 15% is quite achievable with good procurement and operation strategy to manage these e-Buses and chargers. By leveraging balance sheet, the leveraged IRR i.e. equity returns can be further improve (>25%) in a base case scenario.

- GCC model provides payment assurance to investors as target customers are STUs that are backed by the State Government. GCC model also provides assurance on annual VKT. This receivables can be used for bank financing against receivables.

- e-Bus GCC model has gained popularity among all the STUs. It is seeing mass adoption since it is able to compete with ICE buses without much dependency on subsidy.

Investment Opportunity for Mobility as a Service

In most of the scenarios, the project IRR is greater than acceptable rate of return; GCC rate, escalation clause and assured VKT are key parameters for business viability

Scenario	Scenario Description	Equity Payback (years)	Equity IRR (%)	Project Payback (years)	Project IRR (%)
Base	**Charging Self-managed**	2.8	28.6%	5.4	17.1%
S1	**Charging is Outsourced**	5.8	25.6%	5.6	15.9%
S2	**Interest Rate Reduced to 8%**	2.7	29.4%	5.4	17.1%
S3	**GCC Rate Lower by 10%**	8.2	21.1%	6.1	13.9%
S4	**Electricity Tariff Higher by 10%**	2.9	27.6%	5.4	16.7%
S5	**Annual VKT Lower by 10%**	8.1	22.0%	6.0	14.4%
S6	**GCC no price escalation clause**	8.2	19.9%	5.9	12.6%

Base case scenario where all infrastructure is managed in-house

Outsourcing charging strategy to CPOs **may de-risk project** but have reasonable impact on IRR

Better interest rates have **marginal impact** on equity IRR

GCC rate per km clause has **very high sensitivity to project returns**. Further decrease in GCC rate (say by another 10%) can make business value proposition unviable.

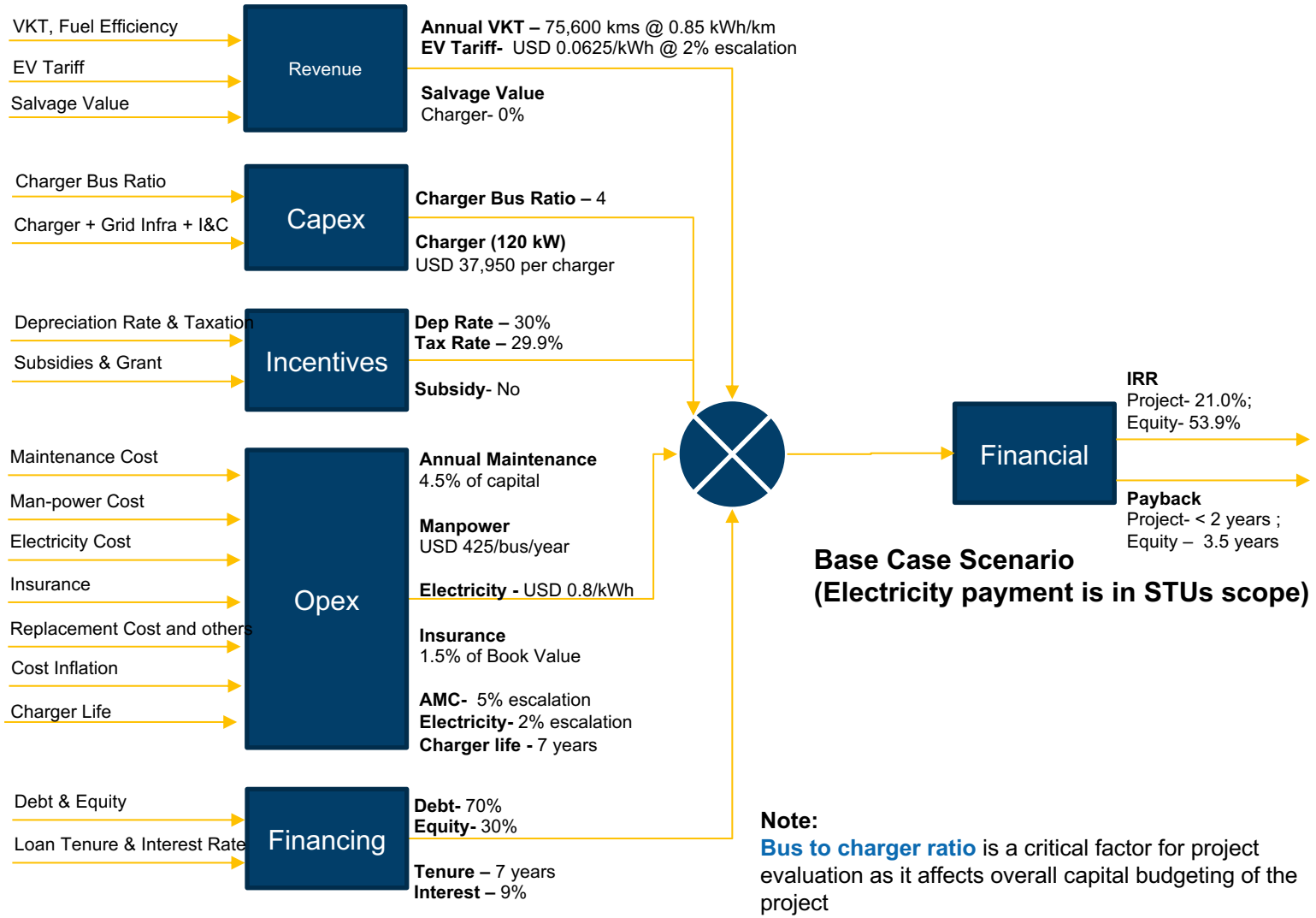
EV tariffs up to +/- 10% variation from base case scenario have marginal impact on IRR

Assured annual VKT has direct and **high impact on overall project viability**

GCC price escalation clause is **important factor for project attractiveness evaluation.** If no escalation clause is applicable then it needs to be compensated by higher GCC rate or lower interest rate, or subsidies or higher assured VKT or combination of any.

Investment Opportunity for Charging as a Service

e-Bus India GCC Model is a viable business model and provides attractive long-term investment opportunities to private cos, PE players, commercial lenders, and financing institutions



Note:
Bus to charger ratio is a critical factor for project evaluation as it affects overall capital budgeting of the project

- **For 100 e-Buses (9m, 176 kWh) about 25 Nos of 120 kW Fast DC** chargers are required. The estimated capital investment for same is about USD 0.9 Mn. The project IRR > 20% is quite achievable with right infra planning and efficient management of these chargers. By leveraging balance sheet, the leveraged IRR i.e., equity returns can be further improved (>40%) in a base case scenario.
- GCC model provides payment assurance to investors as target customers are STUs that are backed by the State Government. Therefore, CPOs may negotiate assurance on electricity consumption with e-Bus operators. This will provide certainty around revenue and project viability. Also, bank financing can be arranged against these receivables. However, payment risk can be high in this case as e-Bus operator is generally a private entity.
- Since, e-Bus fleet operation business model have long-term prospect in India. Therefore, CPOs are well-positioned to take advantage of fast-growing business i.e., charging as-a service business model.
- It is worthwhile to note that at a charging level business unit, the CO_2 emissions are added to the system due to poor grid emission factor. Henceforth, CPOs can install solar rooftops or procure renewable power via open access to reduce their carbon footprints.

Investment Opportunity for Charging as a Service

e-Bus India GCC Model is a viable business model and provides attractive long-term investment opportunities to private cos, PE players, commercial lenders, and financing institutions

Scenario	Scenario Description	Equity Payback (years)	Equity IRR (%)	Project Payback (years)	Project IRR (%)
Base	Electricity Cost in STUs Scope	1.6	53.9%	3.4	21.0%
S1	Electricity in CPOs Scope	1.8	45.5%	3.7	18.1%
S2	Fuel Efficiency (kWH/km) Improved by 10%	1.9	41.2%	3.8	16.7%
S3	Bus to Charger Sharing Ratio reduced by 1	3.0	19.1%	4.8	9.7%
S4	Electricity Tariff Higher by 10%	1.6	53.9%	3.4	21.0%
S5	Charger Infra Cost Increased by 20%	1.8	44.6%	3.7	17.8%

Base case scenario where **settlement of monthly DISCOM electricity bill is in STUs scope**. Only Infrastructure construction, charger procurement, installation and management is in CPOs scope.

The IRR may reduce because of **energy losses due to charger inefficiency and transformer losses.** To improve IRR, energy losses needs to be accounted and end-user pricing need to be increased.

Fuel efficiency of e-Bus is very critical parameter for CPOs revenue. If fuel efficiency increases than IRR reduces because fixed cost has increased but revenue decreased.

Bus Charger ratio has impact on fixed cost investment. It also has impact on operational expenses such as man-power, maintenance, etc. Therefore, it is **a critical factor for charging business planning.**

No impact on CPOs business since electricity payment is in STUs scope.

Charger infra cost can have reasonable impact on IRR. It can increase interest and repayment burden, insurance cost, maintenance cost, etc.

Investment Opportunity for Financing

Acquisition cost of e-Bus is almost 3 times higher than ICE buses because of large battery size. To support e-Bus transition necessary grid charging infrastructure needs to be commissioned which is a costly affair and increases project risk. There is also a requirement of large amount of land parcel for charging. As a result, the overall investment further increases, and multiple stakeholder needs to be onboarded in order to reduce the overall project execution risks.

Objective

Although most public e-Buses are still paid for by government grants, there is a growing need for affordable finance to help tackle the up-front investment gap and achieve scale

Today, most public e-Buses are supported by state government budget and are loss-making. The adoption of new energy public e-Buses can improve STUs finances. Debt financing is an important tool to bridge investment gap and share project risk for new energy efficient transportation technologies.

Debt Financing

By way of entering into legal arrangement that share finances as well as commercial risks

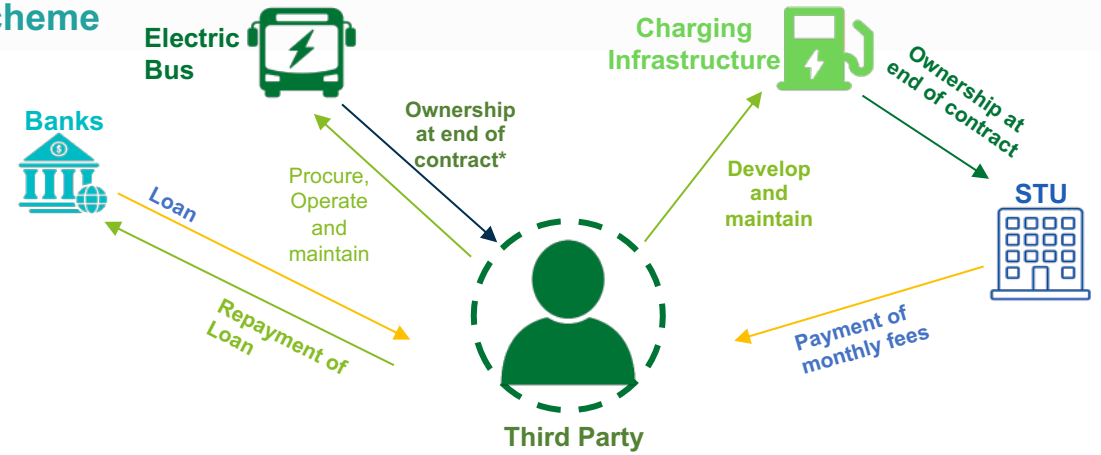
Debt Financing

- Providing Debt financing to State Transport Utility or bus operators to pay for the high up-front costs of e-Buses.
- However, **other mechanism such as concessional loans, municipal bonds and green bonds do exist for such purposes**.
- With the growing maturity of EV technology in the future, debt-financing may, however, become common.

Legal arrangements as financing option

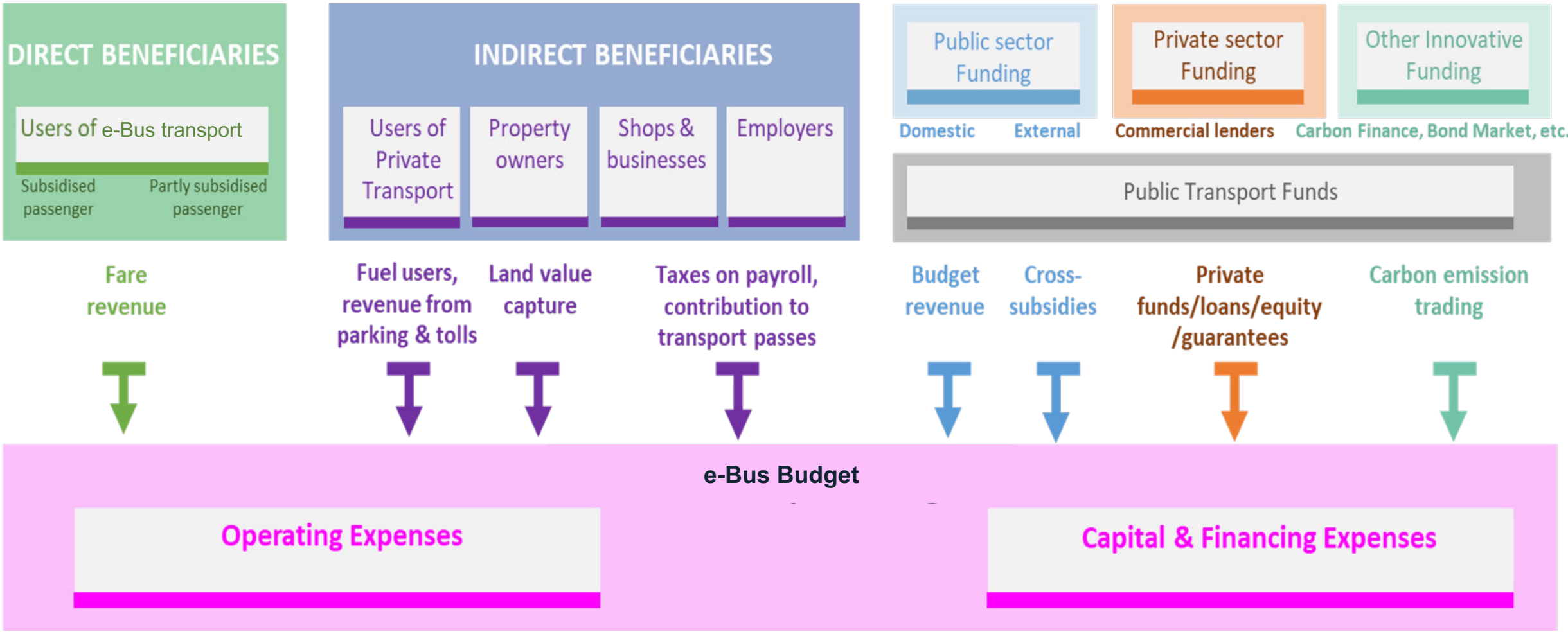
- It apportions the financial obligation on multiple interested parties thereby reducing the risk associated with the adoption of new technology.
- **Leasing** is the most prominent legal arrangement to arrange financing for the e-Buses, batteries and charging infrastructure
- Leasing arrangements have multiple variants such as **component leasing** (e.g., batteries), **operation leasing** etc.
- Under leasing arrangement, typically a **third party** (who is not the operator) **owns some or all of the legal rights over the assets** and **assumes some of the risks associated with the investment**. The **third party** could be a bus manufacturer, a service provider or a **specialized financial services company**

Operating lease arrangement in GCC model in India under FAME scheme



Financier – debt financing or equity financing to OEMs, service providers (forming consortium as third party)

Financial inflow and outflow for e-Bus investments

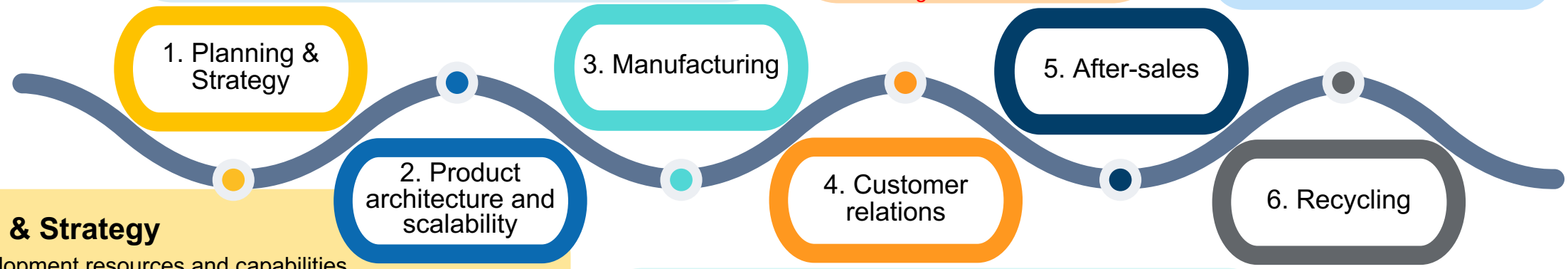


6

How to invest in India?

This section explores the attention points for investors in various roles along the ZE-Bus value chain while entering the Indian market. It provides the key considerations for the investors and the status of India for the ZE-Bus transition

Key Investment Considerations for e-Bus Manufacturing



1. Planning & Strategy

- Product development resources and capabilities
  - Meeting e-Bus operator demands is still a hurdle due to factors such as higher cost, shorter driving range, low battery charging capacity, and lengthy charging times
  - Managing Product, land, safety and Environmental Compliance
- Mobilising investment to finance e-Bus OEM
  - Owing to the nascent stage of the industry and the absence of prior experience in financing have higher risk. For example, financing for long term contract for 10-15 years isn't available
  - International partnership with OEMs governments
- Roadmap
  - Lack of clear Roadmap and proceeding with technology demonstrator pilots and deployment

2. Product architecture and scalability

- Dependence on Imports
  - Phased Manufacturing Program for Electric Mobility & Production Linked Incentive (PLI) Scheme acts as a roadmap to localize e-Bus component production and enable the country to manufacture batteries at large-scale
- Suppliers identified and approved
- Modularity of e-Bus architecture
  - Leveraging existing ICE truck manufacturing with e-Powertrain assembly glide paths
  - Other standardization opportunities for demand aggregation

3. Manufacturing

- Assembly In-house/ Outsourced
  - lack of maturity in e-Bus supply base as well as a desire to retain the intellectual knowledge within the firms
  - lack the capital and production capability to provide volume production on an automotive scale.
  - Government of India encourages foreign investment in the automobile sector and allows 100% FDI under the automatic route
- Supply chain built-up
  - Building supply chains for on-time, on-cost
- Quality control
  - Engineering teams for adapting and integrating e-Bus powertrains

4. Sales & Marketing

- Sales Staff training for e-Bus Products
  - Marketing teams for effective communication of e-Bus benefits
- Electrification focused communication strategy / campaign
  - e-Bus awareness program for supply side, demand side and financing stakeholder

5. After-sales

- Warranty
  - Aftermarket teams for infield support to ZET
- Annual Maintenance contract
- Insurance Service

6. Recycling

- Life-cycle Assessment (LCA) Study
- Recycling initiatives by OEM

Legend
Green – Mitigations measures
Red - Risks and challenges

Key Investment Considerations for Mobility as a Service

1. Tendering and Contracting

Contracting Risk

- Low understanding of routes and schedules to be served with e-Buses
- Flaws in price escalation formulae
- Biased penalty clauses
- Low confidence on receipt of regular monthly payment under GCC model

Contracting Mitigation measures

- Due to unfavorable terms & conditions, many tenders/projects were cancelled and passed. This can be avoided by defining clear guidelines such as specify route & time schedules, lost kms, force majeure kms, fleet availability, spare buses norms, etc.
- Cost escalation scenarios needs to be properly documented as part of tender document to minimize project risk. The increase in input cost may overrun budgeted expense, thereby decreasing EBITDA* which may further impact project funding
- All possibilities of contract termination need to be addressed.
- Concession agreements needs to avoid discretionary powers with the STUs which increases the risk to the bidder

2. Financing

- Private operators need fair and equitable concessions with payment security to convince the financial institutions to fund the e-Bus projects
- With growing understanding of the benefits of a system-wide solutions approach, the present single-party PPP engagement model is likely to be split into multi-player models, where each private player will bring in specialised services. This may make better business sense in future, when scale of Electric bus operations expands to larger network and services. However, this will require more commitment and understanding from the STUs as compared to the present hands-off approach
- A project finance-based approach will be more effective than pitching for vehicle-based funding support for enabling funding support from investors/banks
- Cost rationalisation through appropriate project sizing and technology selection will present better funding opportunities and lower costs to the operator
- MCA conditions must be modified in order to attract banks and financial institutions to the e-Bus funding space. Discretions with STUs and penalties need to be capped to reduce the risk to the operators

Operator could be vehicle manufacturer, private bus operator, service provider or a financial institution

3. Procurement

Execution Challenges

- Power disruptions and low-quality power
- Depot space non-availability
- Inadequate support for power infrastructure and operations
- Lack of skilled manpower to maintain electric buses
- More range and variety of EVs will be available in the market in the coming years, but unless there is a foreseeable market for e-buses, OEMs will struggle to make the necessary investments.

Execution Mitigation Measures

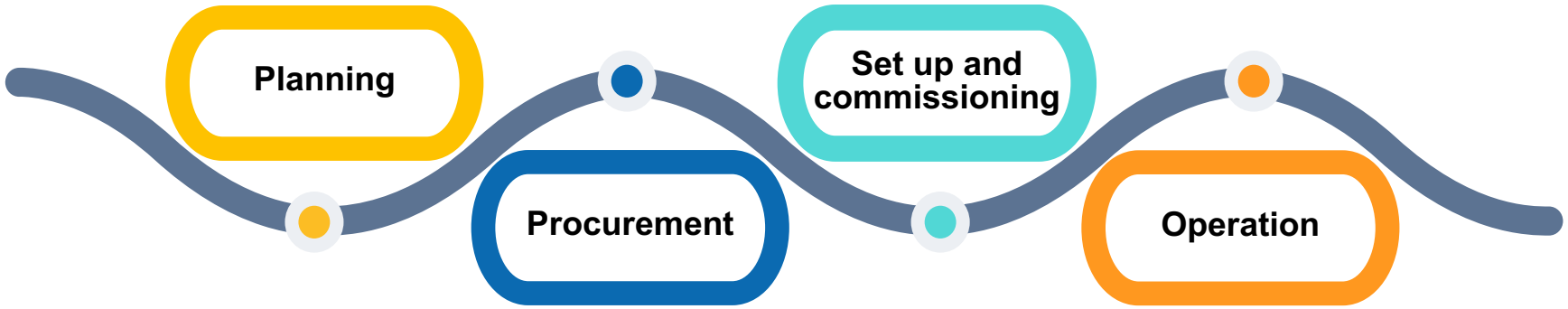
- Standardization of the e-Bus is necessary, but at the same time interoperability is more important than standardization for matching up with the sector's technological mix and upgrade requirements.
- e-Bus contracts should not worry about technology but should provide comprehensive route and operational requirements, based on which OEMs/concessionaire can provide a cost-effective and optimized technology solution

**EBITDA: Earning before interest, tax, depreciation, amortisation*

Key Investment Considerations for Charging as a Service

2. Procurement and Set-up & commissioning

- Procurement could be carried out via open tendering. Tender document should have specific technical specifications for bidders to submit their bid.



1. Planning

- Charging Demand Assessment
  - Charger sizing needs to be done after knowing the e-Bus operations requirements (energy, battery, bus and charging scheduling).
  - Estimating the demand for required peak power
- Spatial Planning
  - Charging Location and integration with Urban land-use planning
  - Accessibility to grid
  - Area selection
  - Area Requirement
- Grid Infrastructure requirements
  - Electricity tariff
  - Grid interconnection and safety
  - Integration with renewable energy (generation and storage)
- Charging Technology Selection
  - Charging Technology used in electricity transfer
  - Charging Types and Power output of the charger
  - Charging strategy
  - Communication and protection protocols
  - Interoperability
  - Charging standards

3. Operation

- Operation Planning
  - Route Coverage
  - Charging optimisation
- Charging Infrastructure Safety
  - Disaster resiliency
  - External Safety considerations
- Business Model Selection
  - Cost of charger and charging infrastructure
  - Charging infrastructure investment and ownership model
  - Business synergies with EV charging
  - Pricing Model

With learnings, the right procurement contracting, and financing strategies will need to be adopted to ensure the success of e-Bus fleet growth over the next 3-5 years

Key Investment Considerations for Financing

Presently most e-Bus financing is taking place through corporate financing model, based on relationship with OEMs…

RISKS and CHALLENGES

There are three main risks associated with e-Buses (i) **technology risk (ii) cash flow risk, and (iii) operations risk**

Difficulty in assessing the bankability of Electric bus systems as there is **low understanding of technology**

Electric bus project is more about **cash flow rather than asset funding transaction**

Few STUs have **financial credibility** which **does not give cashflow certainty**

Financiers require **cash flow assurance** in form of **government sovereign guarantee and credit enhancement**

MITIGATION MEASURES

If the STUs provided **credit enhancement** like revolving letter of credits, government guarantee/letter of comfort etc., the counterparty risk can be reduced to a great extent)

Alternatively, if a **central nodal agency** bided for the GCC contracts on behalf of STUs, there would be a **diversified pool of cash flows** from different STUs to **bridge cash flow gap** if any particular STU did not pay on time

Insurance tools to cater contract performance **uncertainties** will help Financiers

Summary of enabling entities required for Transition to e-Bus

Category	Illustrative Indicators	Status (e-Bus ecosystem)
Government Entities		
Policy	Central policy	☺
	State policy	17 notified state policies / 28 states
Regulatory	Regulations & standards governing ICE Bus emissions	☺
	Regulations & standards specific to e-Buses	☺
Willingness for Budget Provision	Incentive schemes - e.g., FAME 2	☺
Pilots	Implemented / in-pipeline e.g., e-Intracity Buses, etc.	☺
Industry Association		
Demand Aggregation	Focus groups within association and between associations	☺
Technological Advancements and Standardization	Requirement harmonization, modular batteries, etc.	😐
Advisory and R&D		
Policy Advocacy	Policy recommendations with substantive analysis	☺
Skillset availability & Supportive ecosystem	Product engineering, marketing & service	☺
Awareness Campaigns	Communication for EV awareness and use guidelines	😐
Overall		☺

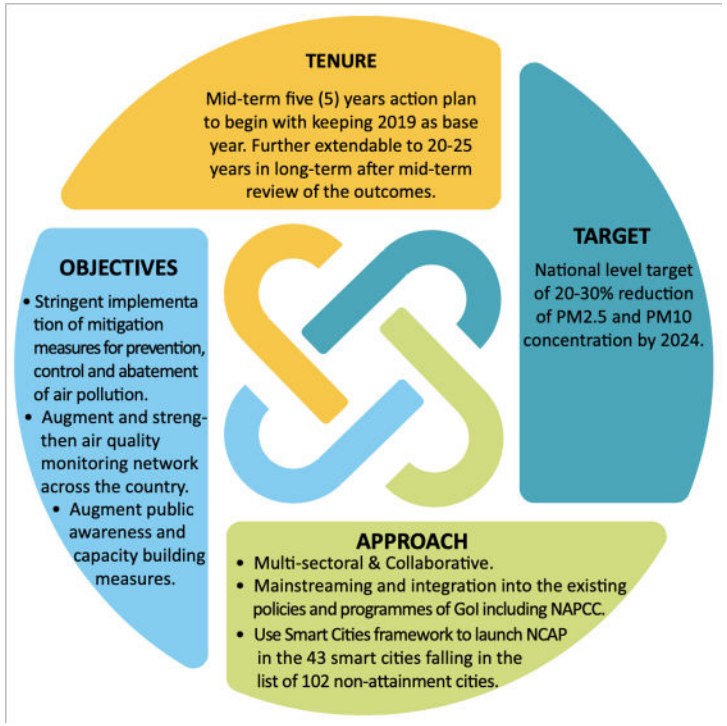
Category	Illustrative Indicators	Status (e-Bus ecosystem)
OEM and EVSE Provider		
Manufacturing Base & Capacity Building	Product engineering, marketing & service	☺
Skillset availability & Supportive ecosystem	Product development resources and capabilities	😐
Operators		
Alternative Financing	Alternative models such as financing leasing emerged to convert upfront capital costs into manageable annual lease payment	☺
Cooperative Approach	OEMs offer lifetime warranties for e-Buses & key components to offset technological risk, and training for operator staff	☺
Subsidies & Charging infra Support	Offers significant National & Local subsidies (up to 40% - 50% of procurement costs), both to reduce capital costs as well as to improve operator profitability	☺
Funding Institution		
Willingness for Funding	Pilots and initiatives financed	☺
Capacity Building initiatives	Product engineering, marketing & service	😐
Overall		☺

India is Gearing up Towards establishing Strong Electric Bus Ecosystem…

THANK YOU

National Clean Air Programme (NCAP)

- The Central Government launched **National Clean Air Programme (NCAP)** as a long-term, time-bound, national level strategy to tackle the air pollution problem across the country in a comprehensive manner with targets to **achieve 20% to 30% reduction in Particulate Matter concentrations** by 2024 keeping 2017 as the base year for the comparison of concentration.



Overview of National Clean Air Program

Reduction of Transport Sector Emission

Green Mobility

- National Biofuel Policy
- Review the extension of MRT in cities/towns.
- Inspection and maintenance system for vehicles – I&C centres.
- PUC certificate
- Fleet modernization and retro-fitment programmes
- Congestion management.
- Green Corridor Project & of its extension
- Introducing CNG in 2-wheelers
- R&D on use of Hydrogen as transport fuel.

E-Mobility

- Formulation of a national-, state-, and city-specific action plan for e-mobility.
- Charging infrastructure.
- Central government offices fleets older than 15 years to be shifted to electric vehicles.
- Government-run buses for public transport, private buses, and 3-w to be converted to EVs.
- Electric 2-wheeler sector
- Venture capital fund.
- Investment in R&D

Under **Maharashtra Pollution Control Board**, the funds have been allocated for NCAP for **procurement of e-buses. INR 2981 Cr allocated** for NCAP, **80% of funds will be utilized for e-components.**

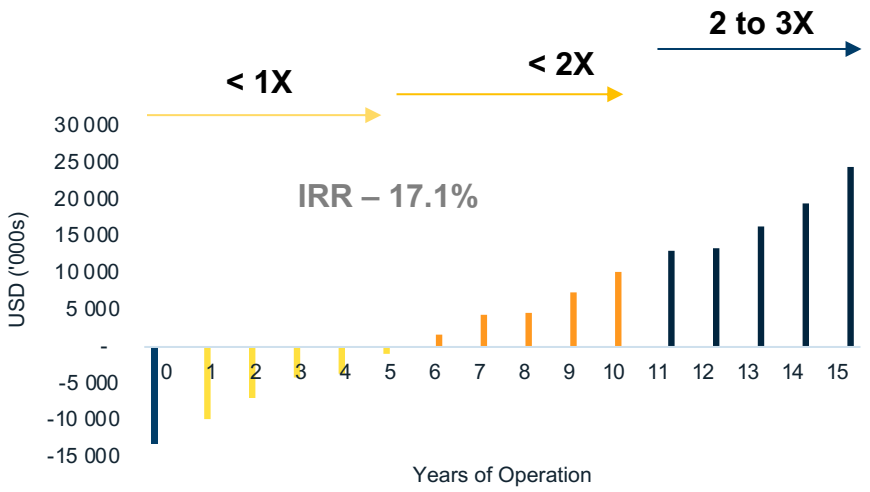
Source: NCAP Report, 2019

Source: MOMs of AQMC/SLMIC held on 18.01.2022 under MPCB

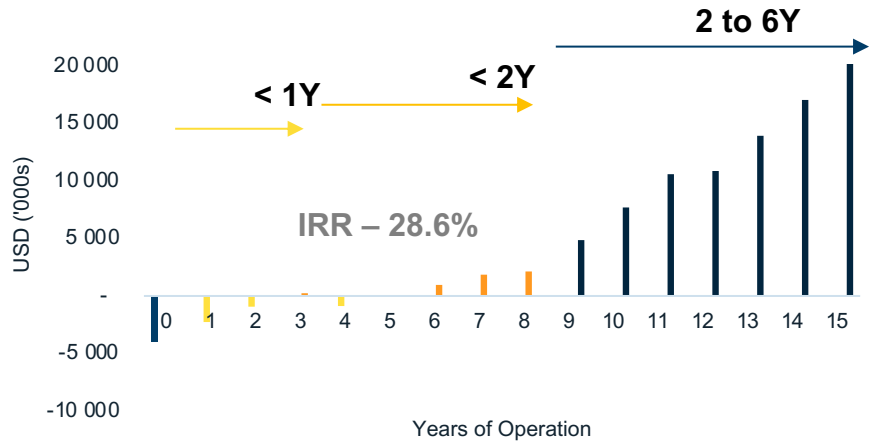
Appendix- Cumulative Cash-flow projections for e-Buses over 15 years of operation

Base Case

Project Cash Flow- Cumulative



Equity Cash Flow- Cumulative



X= Project Initial Investment ; Y- Equity Investment

Key Assumptions

Min. Annual Vehicle Kms Travelled (VKT)- 75,600 kms

Vehicle Efficiency – 1.2 km/kWh

GCC Rate – 0.55 USD/km @ 3% annual escalation

Fleet Size – 100 Nos (9m length) @ USD122,500 per vehicle

Charger- 25 Nos (120 kW) @ USD 34,500 per charger including civil work, grid infra cost, I&C and others.

Charging Strategy – Self-owned

Project Lifecycle – 15 years

EV Tariff- 0.08 USD/kWh with 2% annual escalation

Project Acceptable Rate – 11%

NPV > 0

Loan Tenure – 7 years @ 9%

Insurance, man-power, vehicle and charger maintenance, electricity, replacement and other costs included