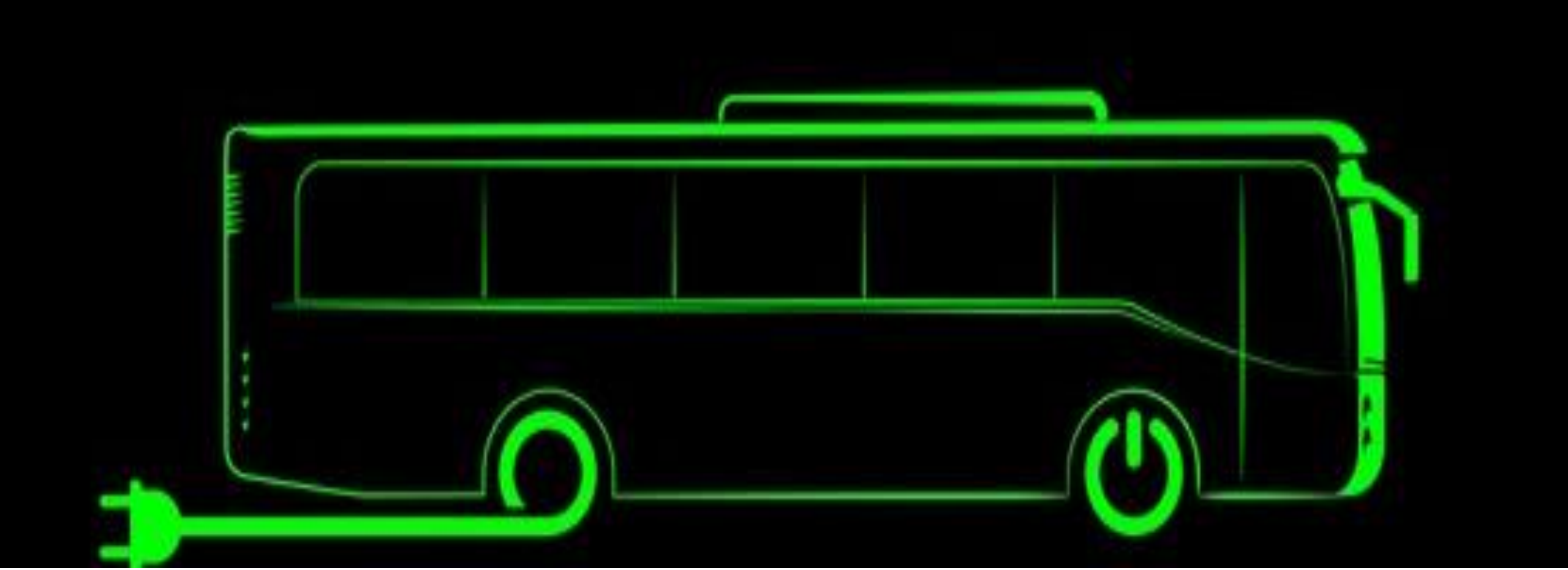
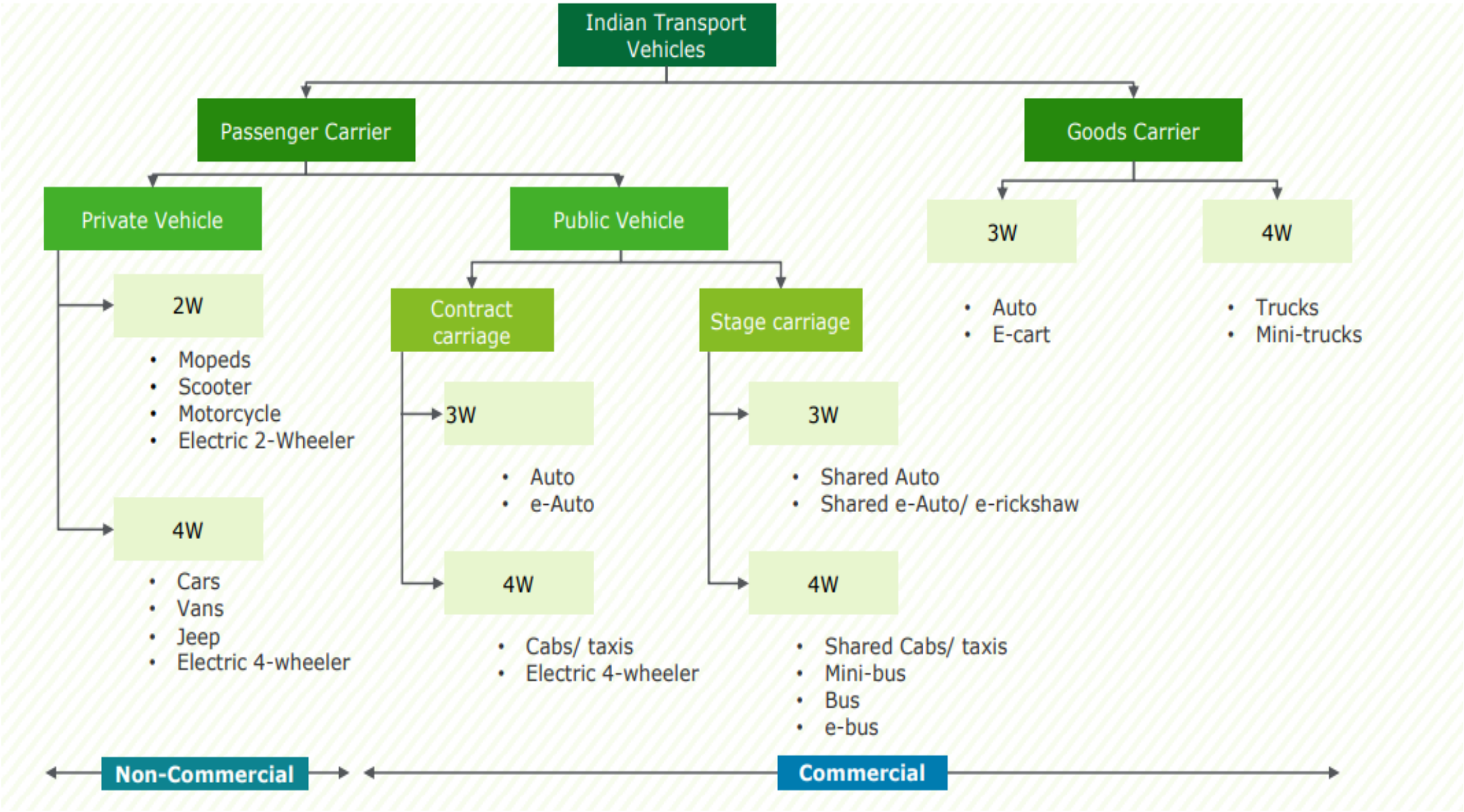


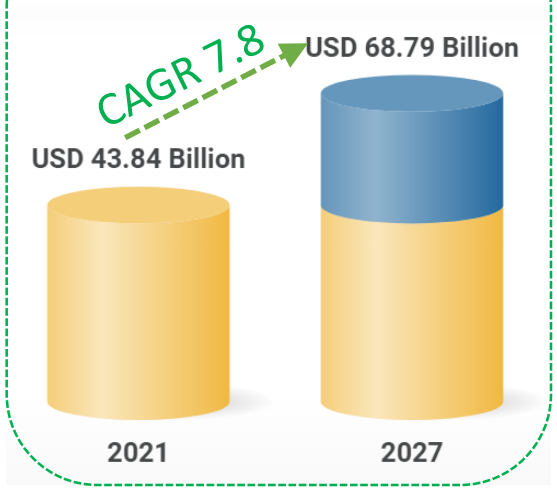
Electric Commercial Vehicle

Automotive Industry



Bus Industry

Global Bus Market

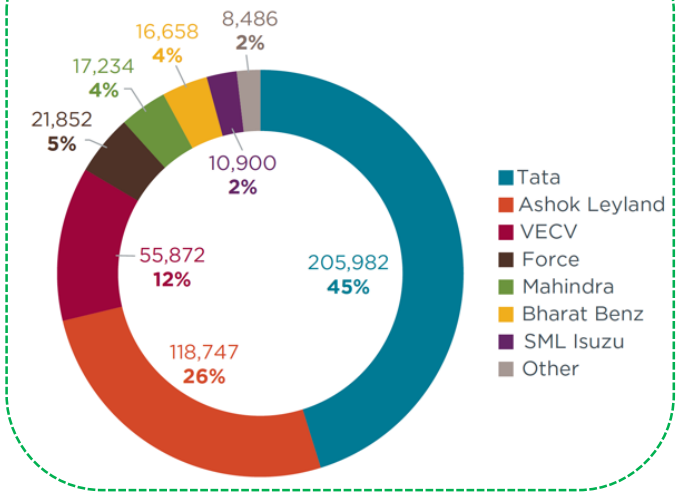


The Market structure

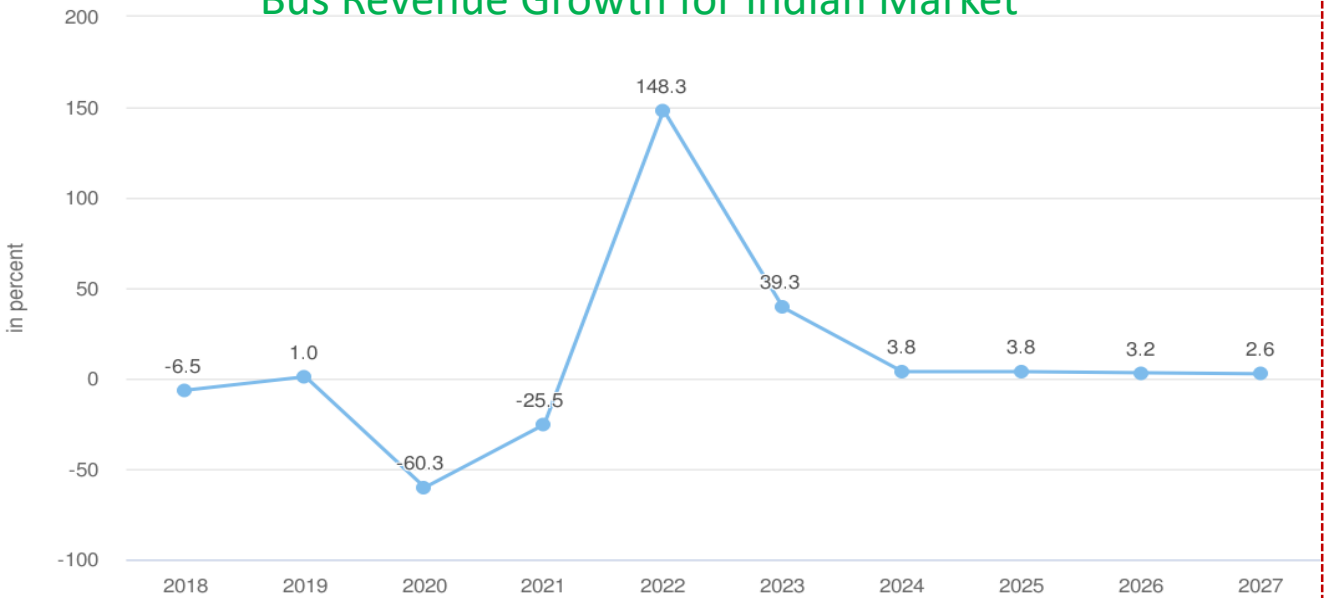
- Based on fuel type: Diesel, electric, and hybrid
- Based on bus type: Double deck, single deck
- Based on seating capacity
- Based on usage: Intercity buses, coaches, transit buses

Market Concentration

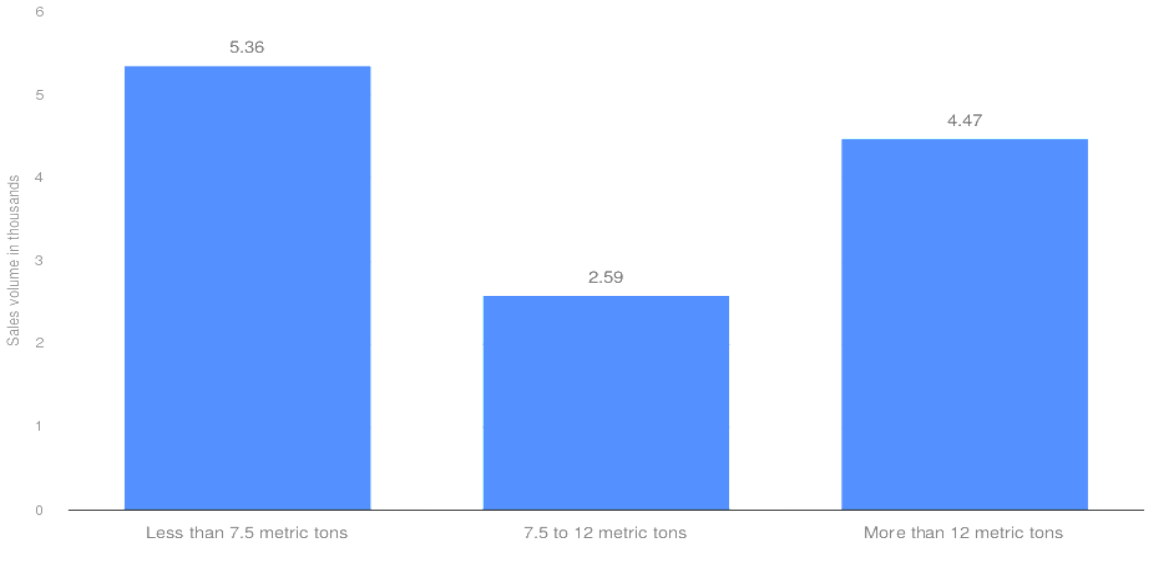
Market Share of Major Players



Bus Revenue Growth for Indian Market

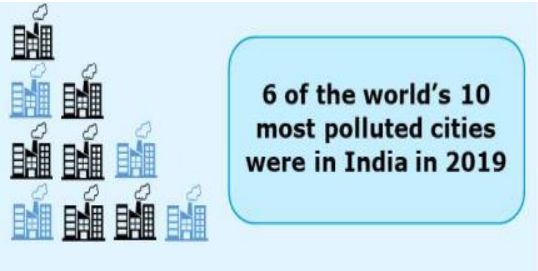


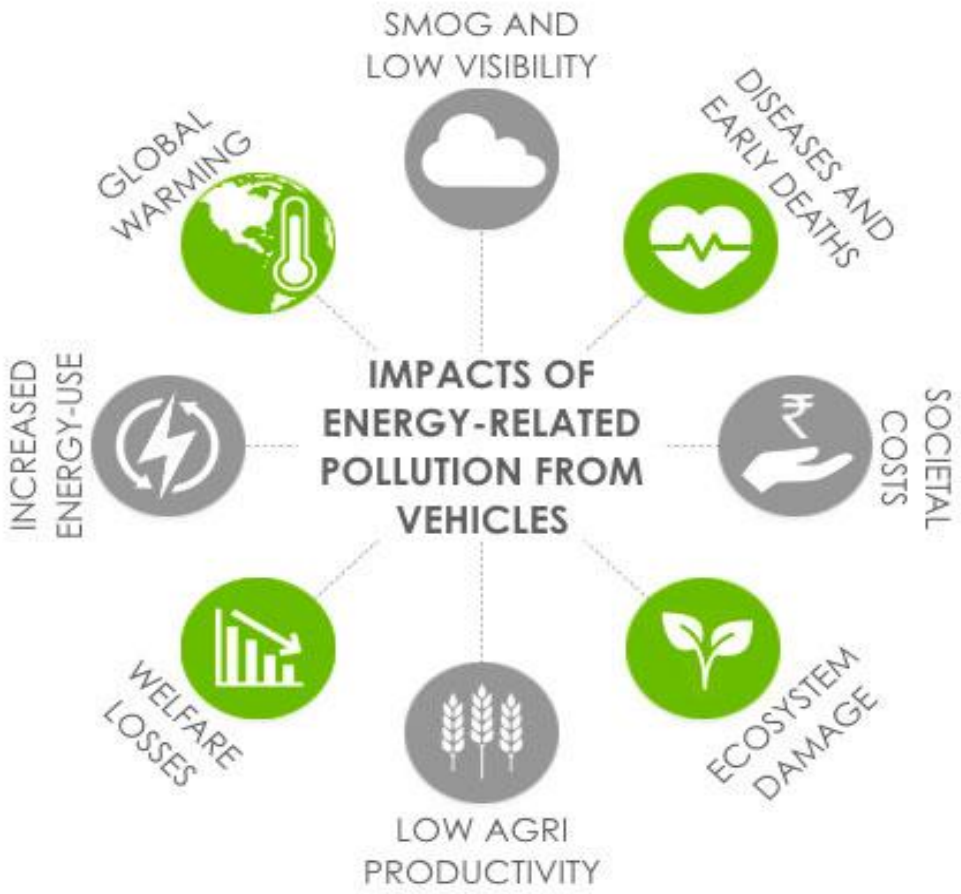
Sales volume of buses in India by weight in 2021



Reason for Shift to Electric Vehicles

Pollution Crisis in India

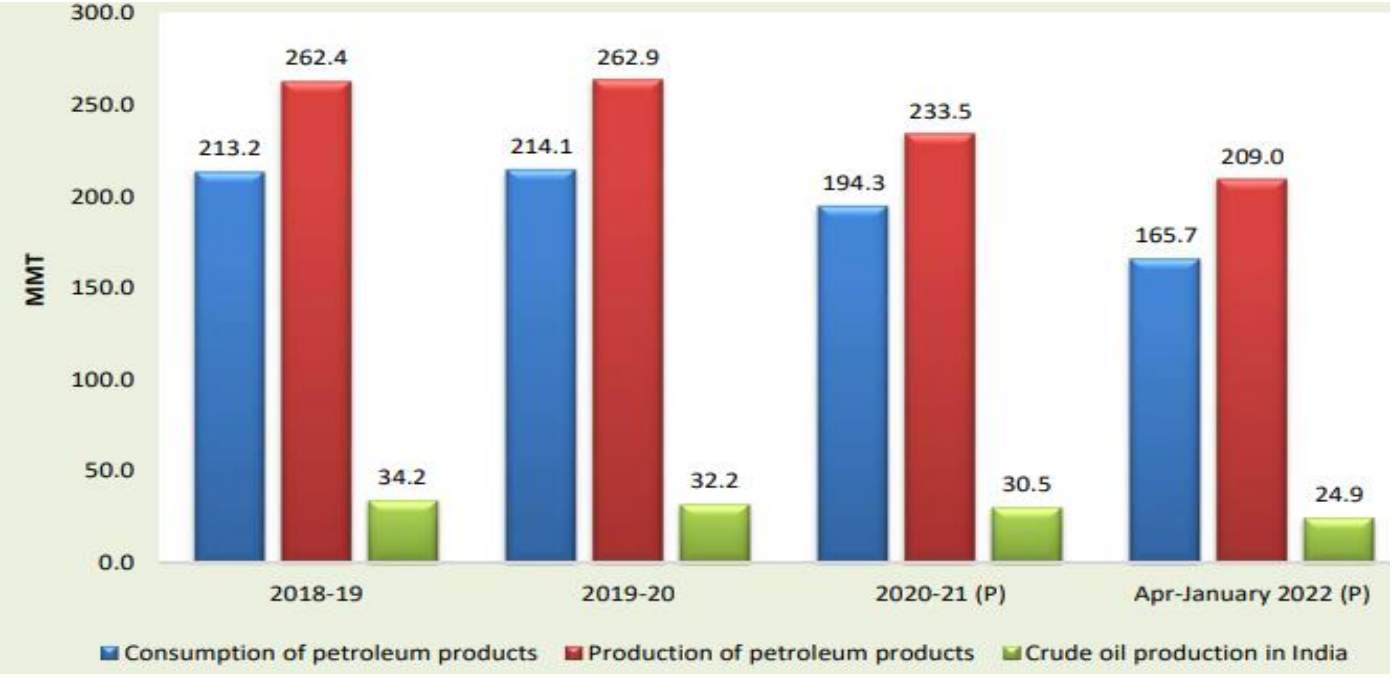




Change of Regulation: Migration to BSVI

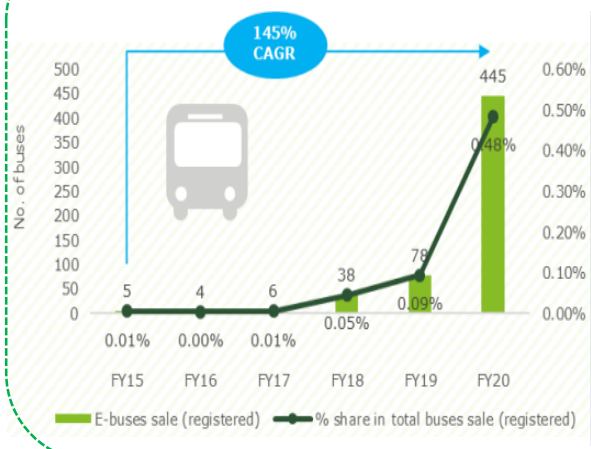
BS VI Emission test	CO (g/kWh)	HC	CH4	NOx	PM	PN
WHSC(CI)	1.5	0.13	–	0.40	0.01	8×10^{11}
WHTC(CI)	4.0	0.16	–	0.46	0.01	6×10^{11}
WHTC(PI)	4.0	0.16[g]	0.5	0.46	0.01	6×10^{11}

Energy Crisis: High Dependence on Oil

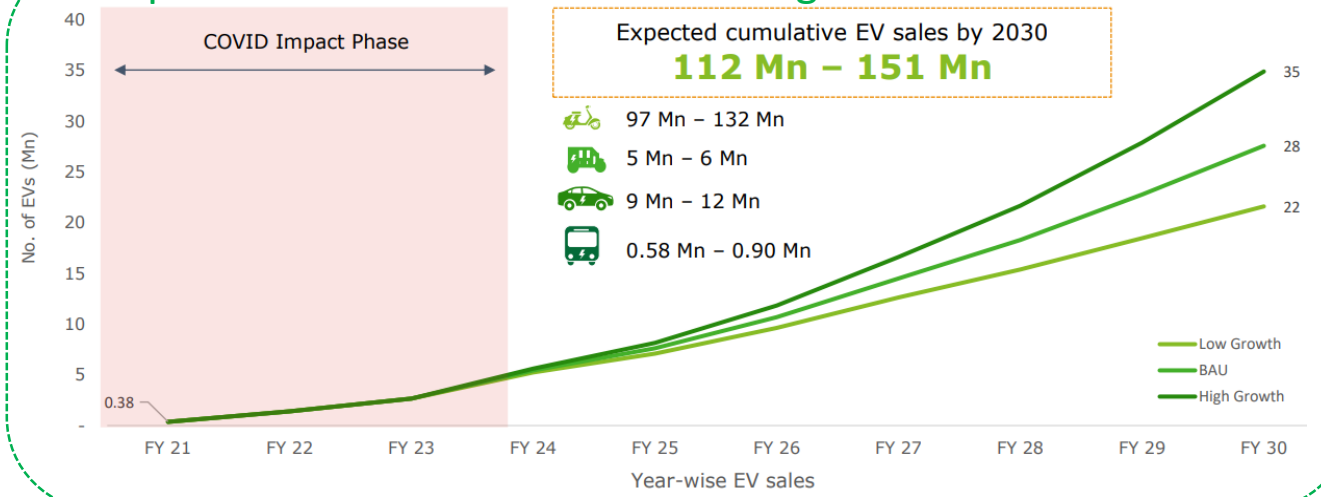


Electric Bus Industry in India

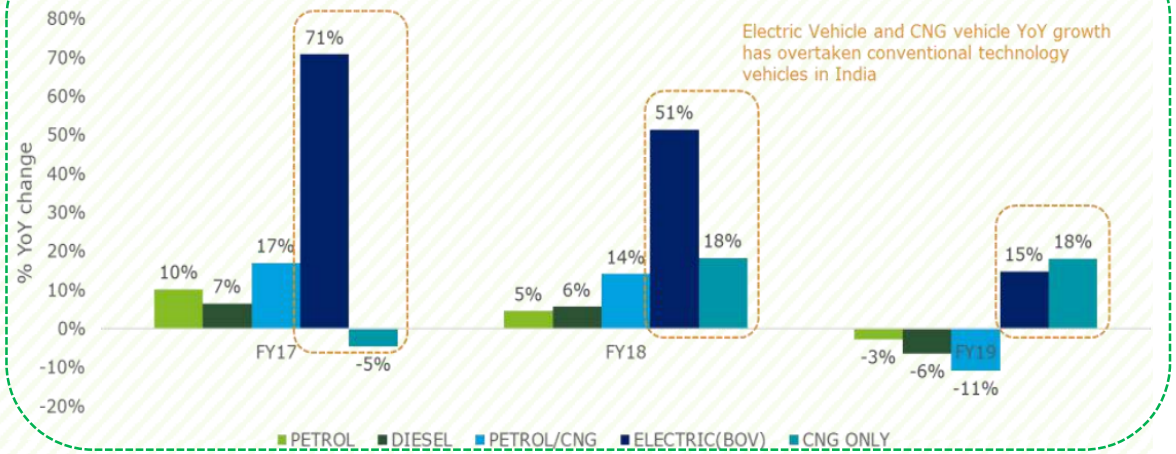
Market Growth (CAGR in recent past and future)



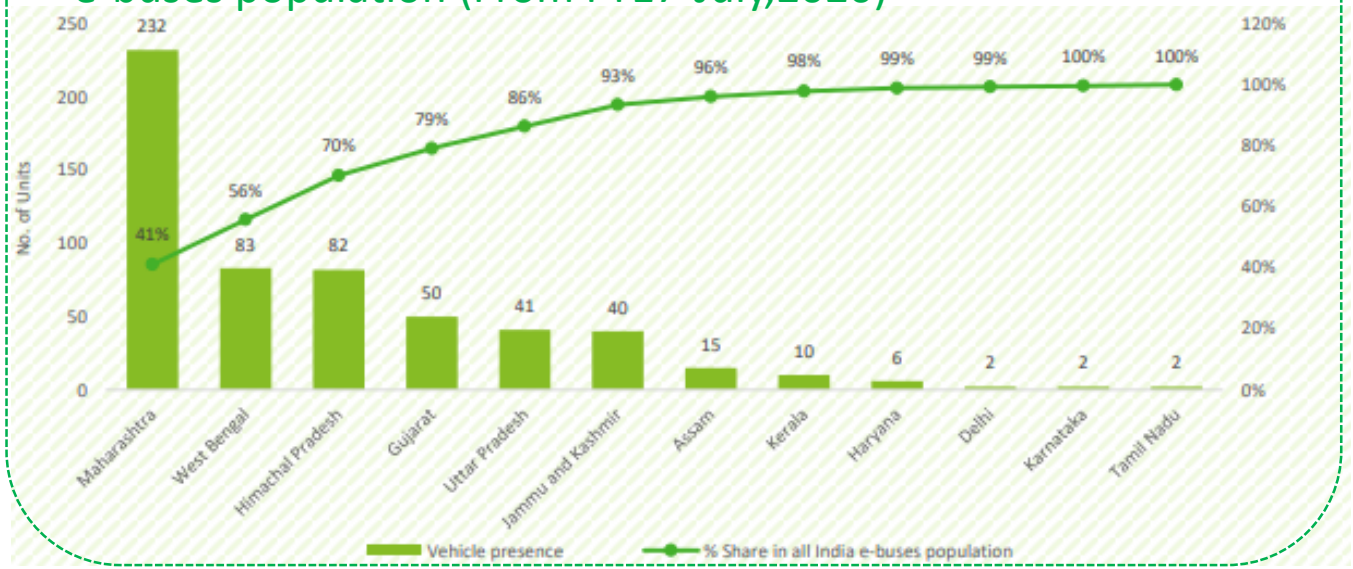
Expected Sales of EV in various categories



YOY Growth for various technological vehicles in India



State-wise cumulative e-buses sales and their share in all Indian e-buses population (From FY17-July,2020)



Growth Drivers

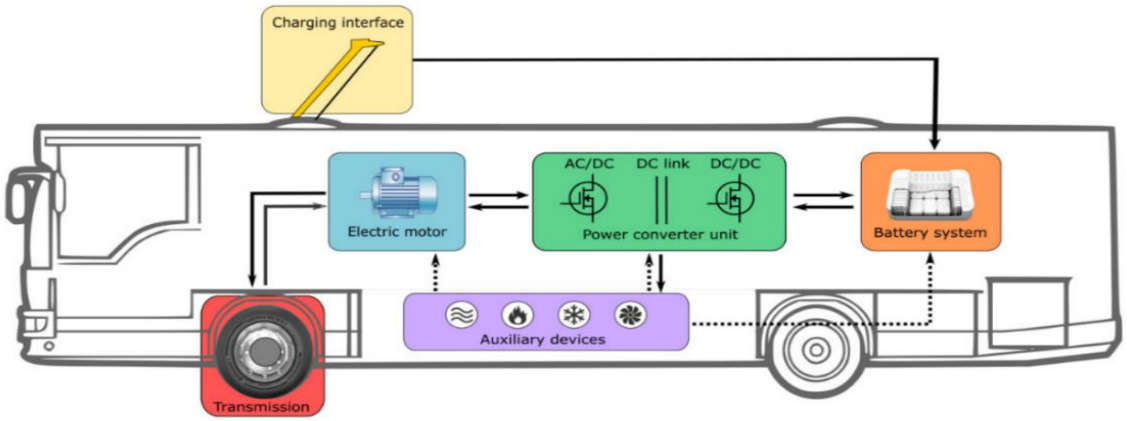
- Rapid Urbanization
- Government Initiatives for green public transportation

Electric Bus Working Methodology

An electric vehicle (EV) is propelled by an electric motor, powered by rechargeable battery packs.

Below are the key components of an EV

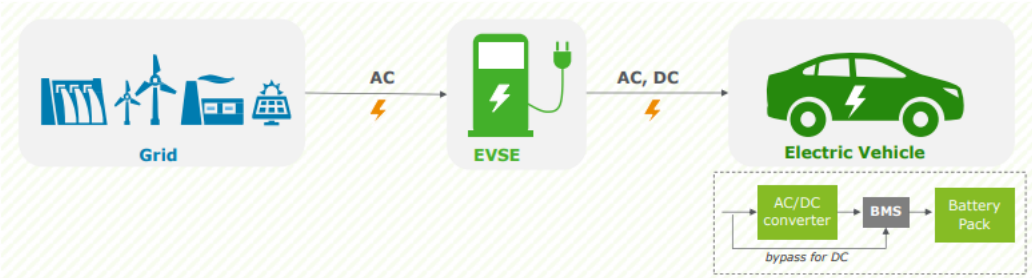
a) Electric motor;
b) Power control unit;
c) Rechargeable battery



Operating principle: The electric vehicle operates on the principle of converting electricity to kinetic energy to drive motor(s) which in turn rotates the wheels of the vehicle. It uses batteries that are charged to store power for running the electric motor(s). Unlike conventional technologies, there are no tail-pipe emissions from electric vehicles.

Electric Vehicle Charging Infrastructure (EVSE)

The electric motor gets its power from a controller which in turn is powered by a rechargeable battery



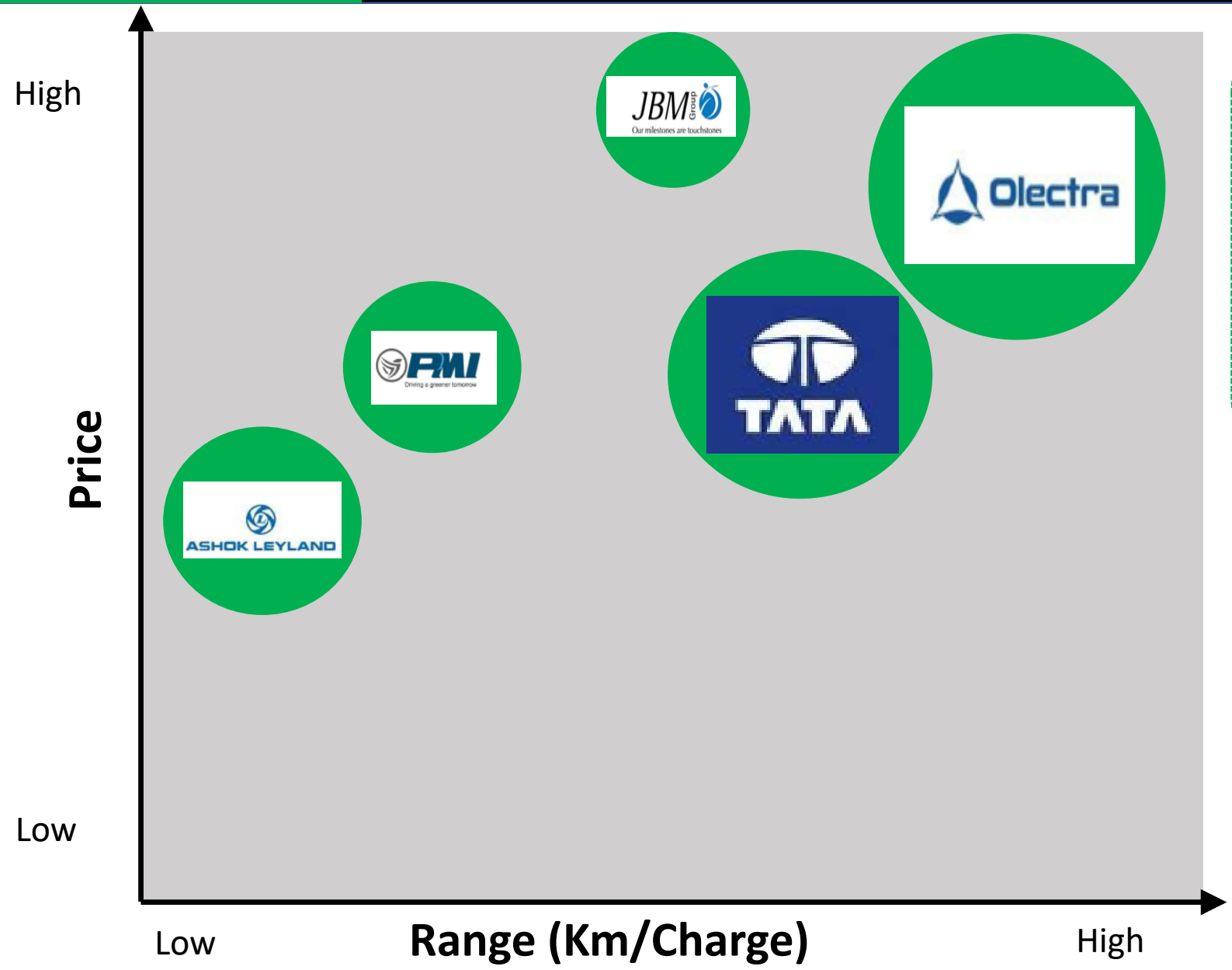
There are different ways to classify an EVSE, depending on

- power supply (AC or DC)
- power rating levels
- speed of charging
- Communication
- connector type

Recent key Initiatives by major players

	Operator	Vehicle category	Key Initiative
	Ashok Leyland	Bus/trucks	a)Ashok Leyland is looking to enter into a partnership with multinationals to start a joint venture in the electric mobility space b)Ashok Leyland setup its electric vehicle (EV)facility in its Ennore plant.
	Volvo Eicher	Buses	VE Commercial Vehicles (VECV), a joint venture of Volvo Group India Pvt. Ltd and Eicher Motors Ltd, is developing a new line of products, including a complete range of electric vehicles for public transportation
	Olectra- BYD	Buses	Olectra – BYD launches electric buses in Hyderabad

Strategic Group Mapping

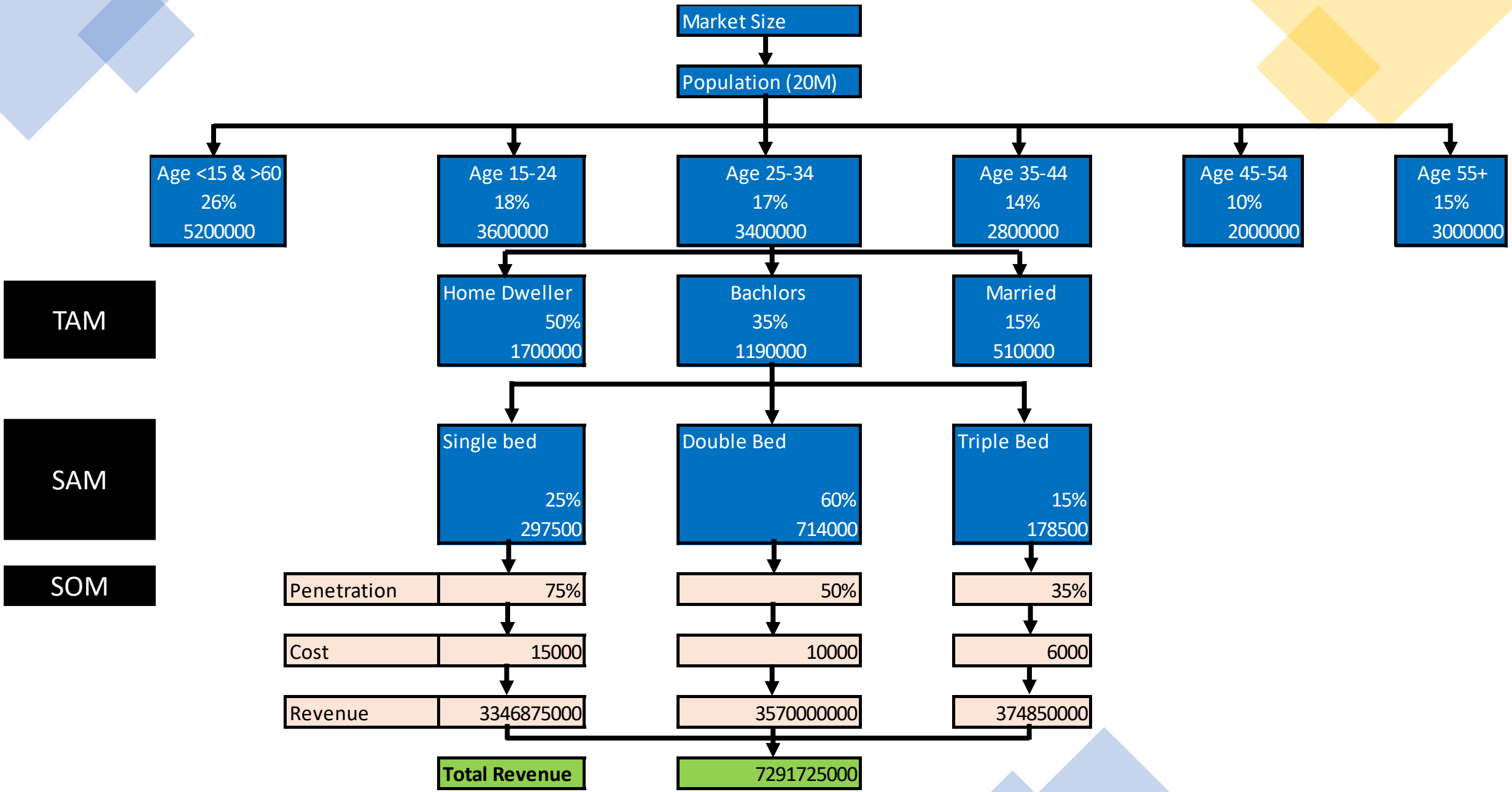


What and Why we have chosen price and Range as parameter

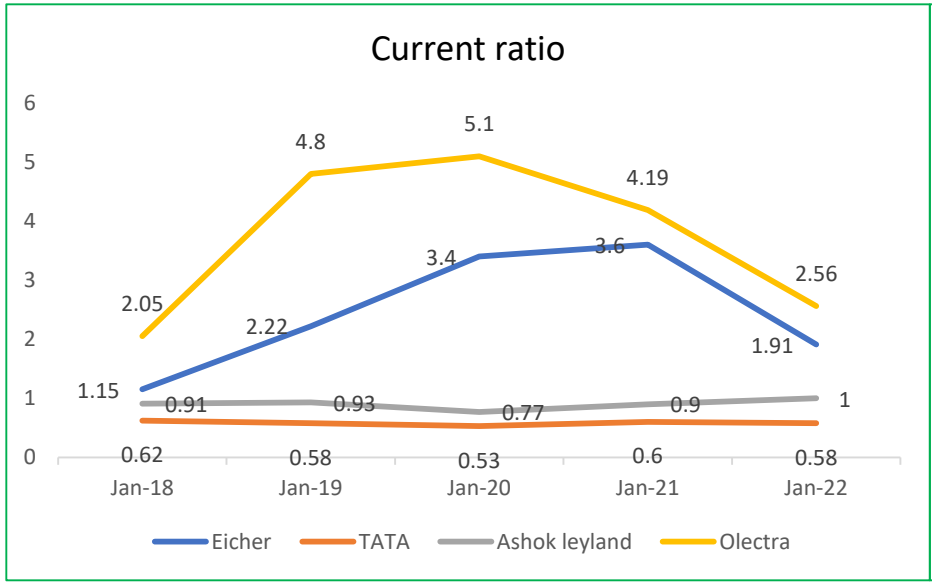
- Price: India is a price-sensitive market and most of the current demand is from government orders. In case of bidding, the lowest bidder wins the order
- Charging infrastructure is still not developed in India therefore range becomes important

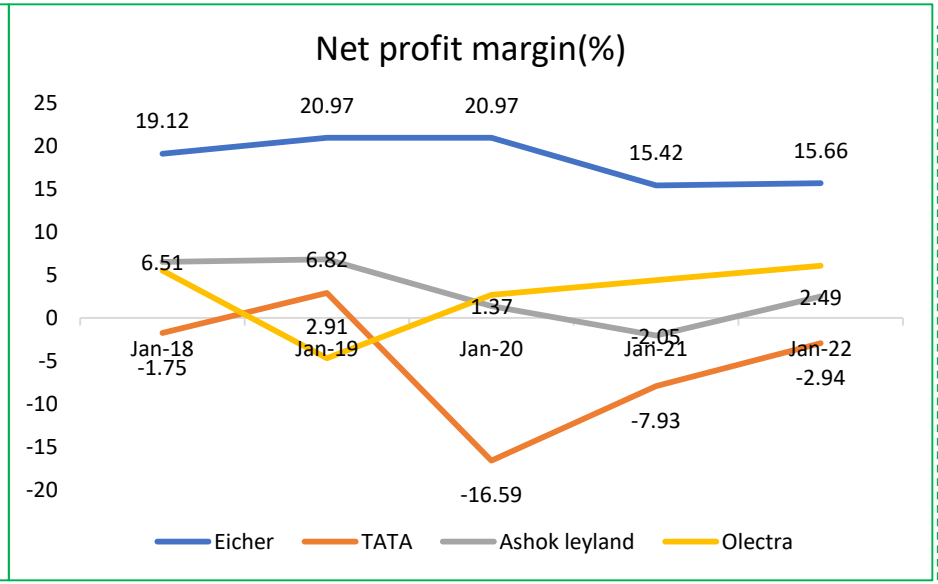
Competitive Advantage

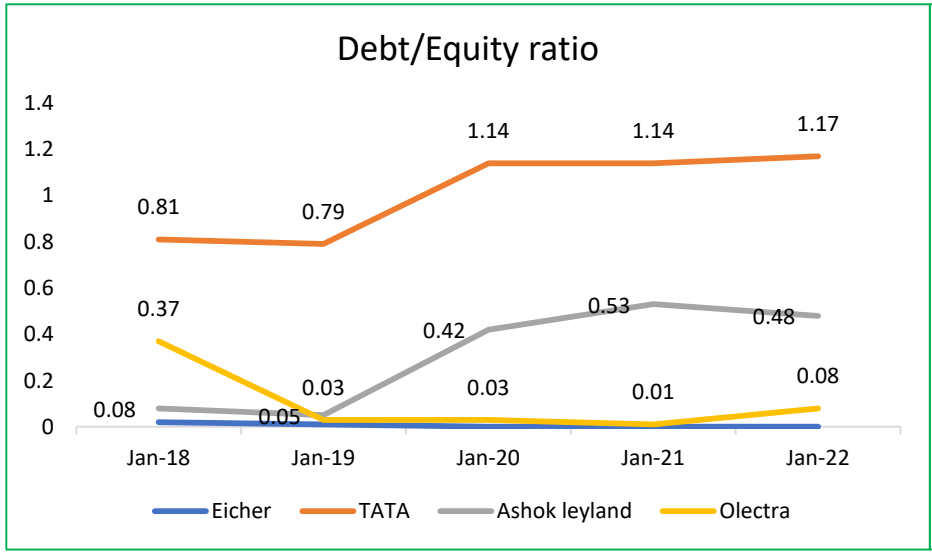
- BYD & Tata have higher market share and range (Km/charge) than the rest of the competitor
- Tata's price is slightly lower than BYD
- BYD range is slightly higher than Tata
- Ashok Leyland has the lowest range
- TATA and BYD are the closet rivals

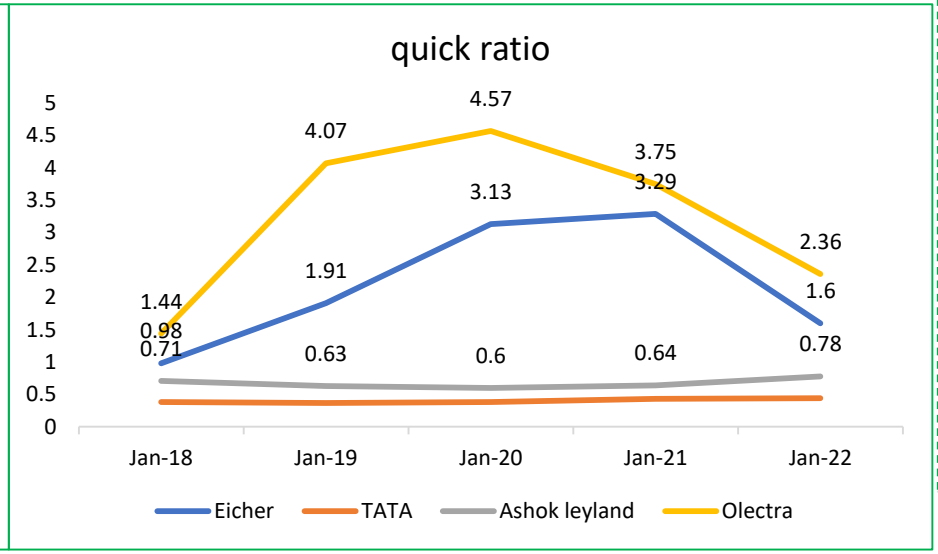

Market Size
Population (20M)
Age <15 & >60
26%
5200000
Age 15-24
18%
3600000
Age 25-34
17%
3400000
Age 35-44
14%
2800000
Age 45-54
10%
2000000
Age 55+
15%
3000000
TAM
Home Dweller
50%
1700000
Bachlors
35%
1190000
Married
15%
510000
SAM
Single bed
25%
297500
Double Bed
60%
714000
Triple Bed
15%
178500
SOM
Penetration
75%
50%
35%
Cost
15000
10000
6000
Revenue
3346875000
3570000000
374850000
Total Revenue
7291725000

Finance Analysis of Major Players In EV









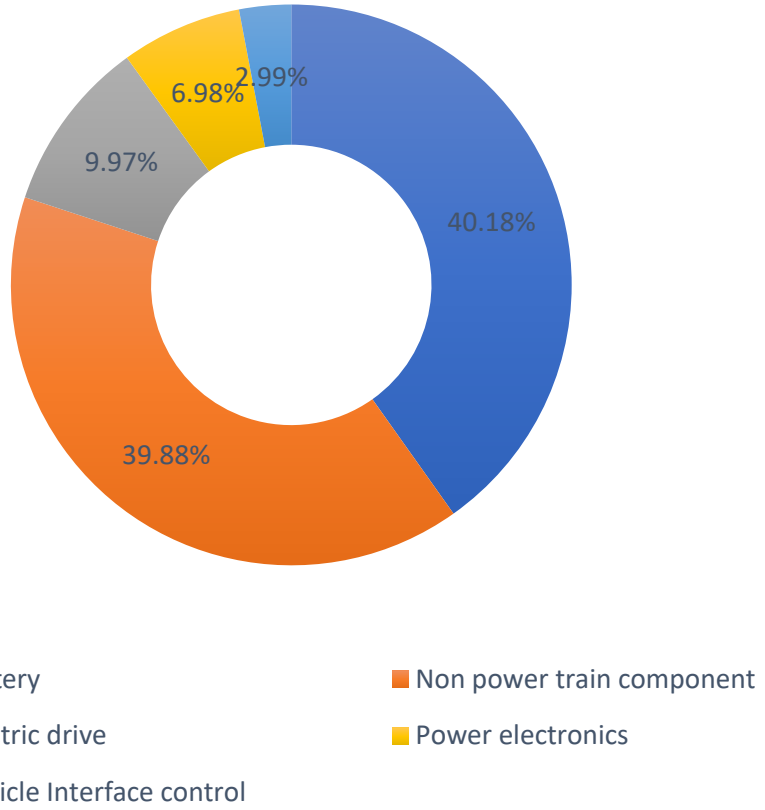
1. From the overall data of last 2 years, it could be seen that Eicher is gaining on the competition, posting a higher operation profit margin and return on capital when compared to Ashok Leyland and TATA motors.

2. Current ratio in FY'22 has decreased owing to increased investment in electric vehicles

3. Olectra has fair quick ratio which shows company agility to pay off the debt and less dependency on long term assets

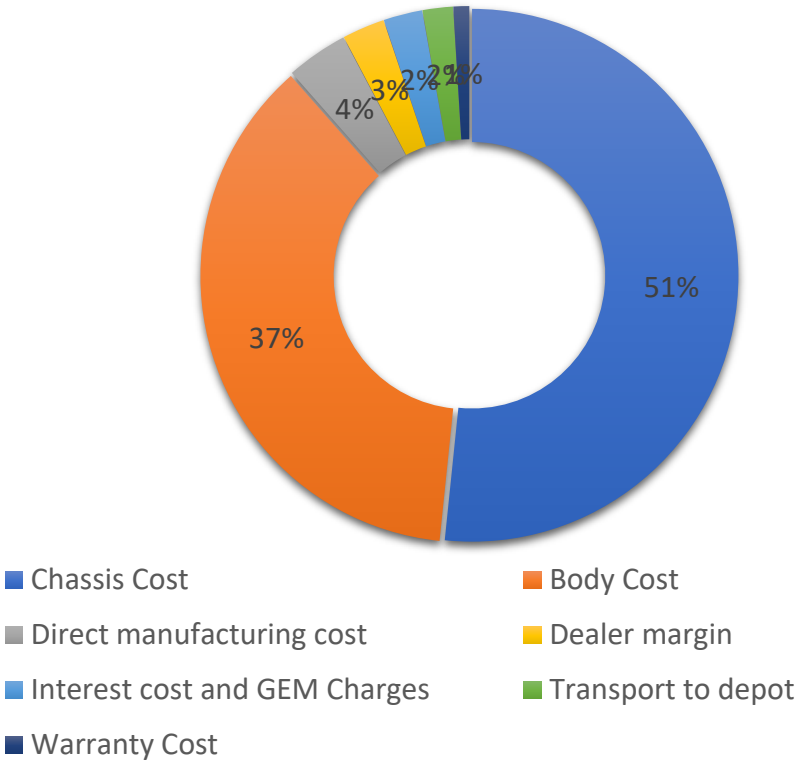
Cost Structure of Electric to Diesel buses

Cost structure for Electric vehicle



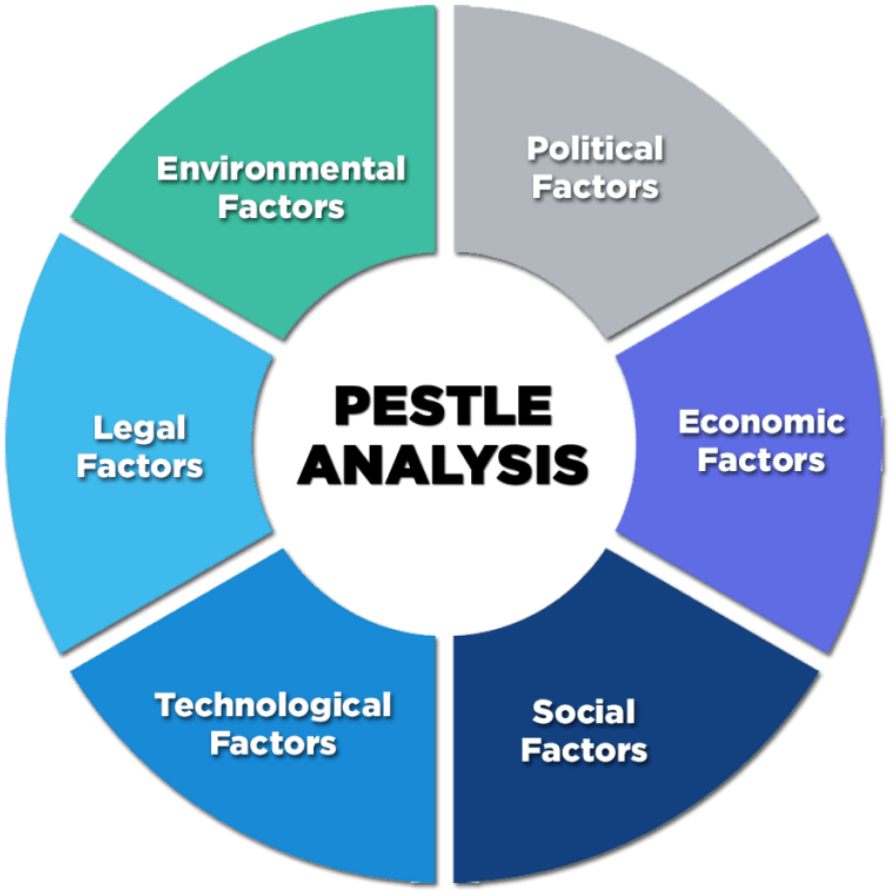
- Major cost is of battery for Electric bus

Cost structure for diesel vehicle



- Major cost is of Chassis and body because of the high vibration in a diesel bus

Strategic Group Mapping



Porter’s Five Forces of EV Buses Industry

Threat of new Entrants

- Large Investment in a production facility, market reach, and service makes it difficult for new entrants
- Easier to design and hence fewer complications
- Growing industry and High ROI

Threat of Substitutes

- The primary substitutes are public, such as metros, trains, and planes are not a major problem because these are used for larger distance and have fixed routes
- Sharp increase in the total cost of ownership of private vehicle

Competitive Rivalry

- Existing four ICEV manufacturers, to their financial strength and pan-Indian market reach, existing production facilities, sales points, and service points will face fierce competition
- New Entrant specific for electric vehicles such as BYD

Bargaining Power of Suppliers

- Localization in EV manufacturing is minimal and hence Key value chain and expensive components have limited availability in India's present EV ecosystem
- Batteries and power electronics are currently imported, making up about 60–70% of an EV's value addition.

Bargaining Power of Customers

- lack of suitable charging infrastructure
- high upfront costs persist
- Lack of nationwide service network
- Lack of Variety since it still an emerging technology

SWOT of EV Bus Industry

Government Policies for EV Industry

National Electric Mobility Mission Plan (NEMMP):

Laid down the vision and roadmap for EV penetration in India. It outlines incentives along four priority areas for EVs:

- ❑ demand incentives
- ❑ manufacturing of Evs
- ❑ charging infrastructure development
- ❑ research and development.

The Mission aims to achieve 6-7 million on-road electric vehicles by 2020.

The total investment requirement envisaged in the mission document for setting up the required infrastructure to achieve the target (both power and charging infrastructure) as the government of India , is summarized in the following table:

Area	4W	2W	3W	Buses	LCV	Total
Additional generation Capacity (MW)	150-225	600	10-15	<5	10-20	775-865
Power Infrastructure (Rs Crore)	1,200-1,300	3,300-3,400	75-85	20-30	90-100	4,685-4,915
Charging Infrastructure (Rs Crore)	950-1000	-	70-80	10-20	115-125	1,145-1,225

The rollout of the EV charging infrastructure was planned in a phased manner as follows:

Phase I (first year)	This will involve detailed and in-depth evaluation of various options, prioritization and putting in place the required frameworks and models for EVSE adoption, enabling policies, charging infrastructure standards, laws and undertaking detailed studies that will facilitate the roll out of the optimum EV infrastructure.
Phase II (Year 1 - 3)	The activities in the medium time frame would build on the initial basic work done and include deeper impact assessment studies and programs, pilot projects in various cities, EV infrastructure consortium building activities, development of possible business models, etc.
Phase III (Year 3 to 2020)	This will include the following activities:- i. Ensuring availability of reliable and regular electricity supply, ii. Making available adequate recharging facilities with convenient access, iii. Development of EV charging as a viable business entity, iv. Well established and synergic linkage between EV charging infrastructure with renewable energy generation infrastructure, v. Development of public recharging infrastructure that includes opportunities for rapid recharging through either setting up of optimal number of fast recharging centres or by use of batteries swapping stations that allows quick replacement of discharged battery packs with charged ones.

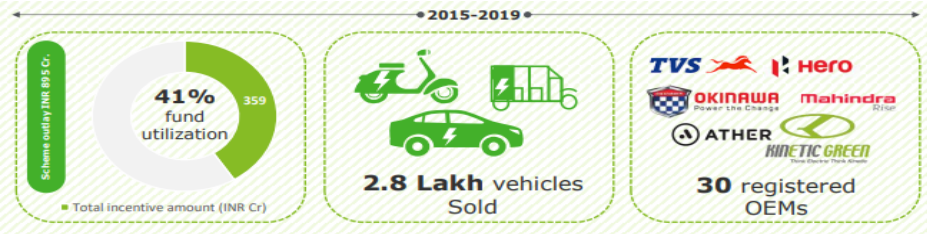
Outcome of NEMMP Policy:

The Government of India has taken considerable measures to keep efforts aligned with the provisions laid down under NEMPP, however, the EV sales penetration stands nowhere near to the planned target level. In all likelihood, the EV penetration target of 14%-16% by 2020 as envisaged under NEMMP is not achieved.

Government Policies for EV Industry

Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME) programme was launched by DHI in 2015. It is the flagship scheme under the NEMMP 2020 mission plan of Central government to enhance hybrid and electric technologies in India.

FAME Phase I scheme

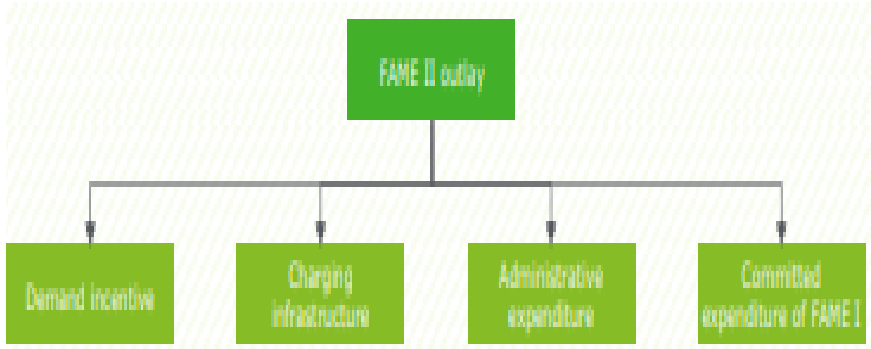


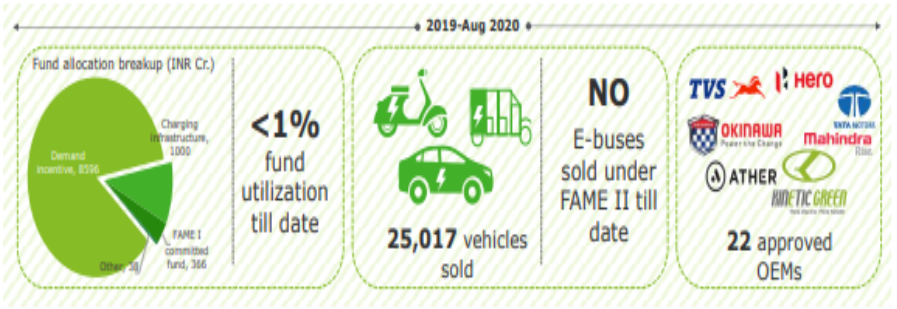
- Launched for over a two-year period starting from FY 2015-16 to FY 2016-17 with an overall outlay of INR 795 Cr.
- Extended four times for six months each witan h additional outlay of INR 100 Cr.
- The funds were used to provide direct subsidies to EV buyers, grants for specific projects under pilot projects were sanctioned, R&D/technology development, and public charging infrastructure components
- 465 buses were sanctioned to various cities/states under this FAME I.
- The FAME I scheme failed in utilizing the complete allocated fund in four years of its period.
- The scheme was successful in creating awareness and momentum for electric mobility in the market.

FAME Phase II scheme

- The increased layout of Rs 10,000/- crores, which includes a spill over from FAME-I of Rs 366 Cr
- Focused on promoting demand as 86% of the scheme outlay is reserved for demand incentives.

The overall outlay is segregated into four categories:





Government Policies for EV Industry

Initial Allocation of Funds under FAME-I			
Component	2015-16 (Rs. cr)	2016-17 (Rs. cr)	Total Fund (Rs. cr)
Technology Platform	70	120	190
Demand Incentives	155	340	495
Charging Infrastructure	10	20	30
Pilot Projects	20	50	70
IEC/Operations	5	5	10
Total	260	535	795

Initial Allocation of Funds under FAME-II				
Component	2019-20 (Rs. cr)	2020-21 (Rs. cr)	2021-22 (Rs. cr)	Total Fund (Rs. cr)
Demand Incentives	822	4587	3187	8596
Charging Infrastructure	300	400	300	1000
Administrative Expenditure	12	13	13	38
Total for FAME-II	1134	5000	3500	9634
Committed from Phase-I	366	0	0	366
Total	1500	5000	3500	10000

State-wise Government Incentives

Parameter	DL	AP	UP	MH	UK	KA	MP	KL	TN	BR*	PB*	TS*
Incentive for Home/Workplace charging	✓		✓					✓				✓
Manufacturing												
Incentive to manufacturer		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Focus on promotion of auto-ancillary manufacturer		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Provision for Industrial Parks and Clusters for EV/Ancillary manufacturing		✓	✓			✓		✓	✓	✓	✓	✓
Battery OEM			✓	✓	✓	✓	✓	✓	✓	✓	✓	
Scrapping and recycling												
Vehicle scrappage incentive	✓						✓				✓	
Battery recycling related provision	✓	✓	✓		✓	✓	✓		✓		✓	
Miscellaneous												
Payment system and information exchange	✓	✓					✓	✓				
Identification of source of funding for various incentives declared in policy	✓						✓					
Skill Development/Job creation	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
R&D	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Public awareness	✓						✓				✓	
Changes in building bye-laws	✓	✓	✓			✓	✓					✓

Note: *Draft; DL: Delhi; AP: Andhra Pradesh; UP: Uttar Pradesh; MH: Maharashtra; UK: Uttarakhand; KA: Karnataka; MP: Madhya Pradesh; KL: Kerala; TN: Tamil Nadu; BR: Bihar; PB: Punjab; TS: Telangana

Government Policies for EV Industry

National Mission on Transformative Mobility and Storage

The aim of the mission is to drive strategies for transformative mobility and Phased Manufacturing Programmes for EVs, EV Components, and Batteries.

Role

- Drive strategies for transformative mobility and Phased Manufacturing Programmes for EVs, EV Components and Batteries
- Creating a **Phased Manufacturing Program (PMP) to localize production across the entire EV value chain**
- Details of localization will be finalized by the Mission with a clear Make in India strategy for the electric vehicle components as well as battery
- The Mission will coordinate with key stakeholders in Ministries/ Departments/states to integrate various initiatives to transform mobility in India

Roadmap

- **Phased battery manufacturing roadmap** with initial focus on large-scale module and pack assembly plants by 2019-20 and Giga-scale integrated cell manufacturing by 2021-22
- Ensuring holistic and comprehensive growth of the battery manufacturing industry in India through PMP
- Preparing roadmap for enabling India to leverage its size and scale to produce innovative, competitive multi-modal mobility solutions that can be deployed globally in diverse contexts
- Roadmap for transformative mobility in "New India" by introducing a sustainable mobility ecosystem and fostering Make-in-India

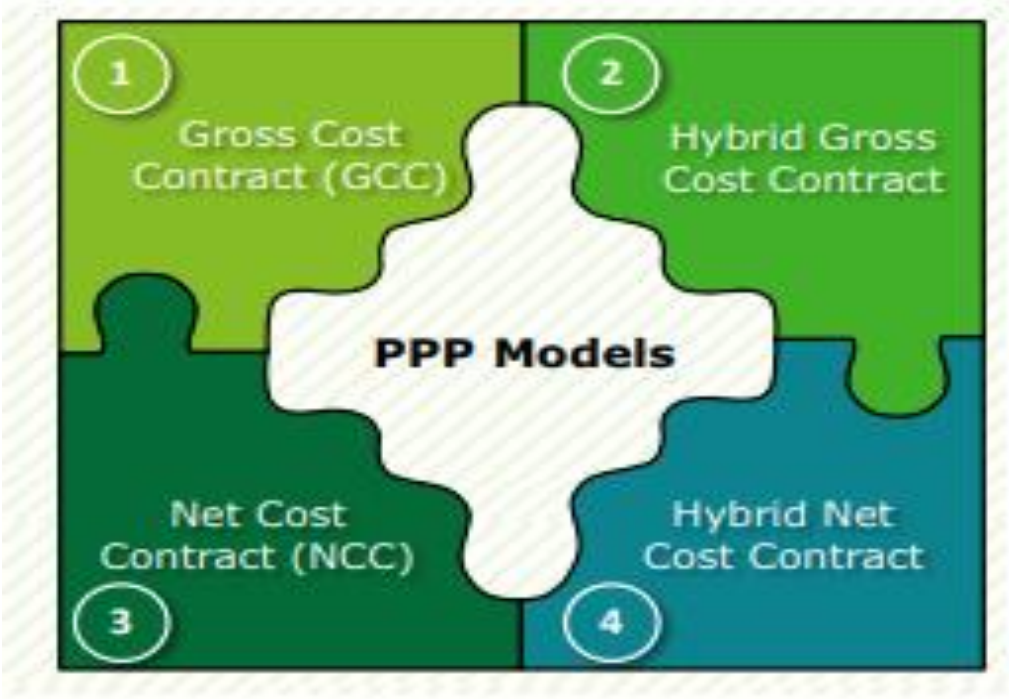
Impact

- Drive mobility solutions to benefits to the industry, economy and country
- Improving air quality in cities along with reducing India's oil import dependence and enhancing the uptake of renewable energy and storage solutions
- The Mission will lay down the strategy and roadmap which will enable India to leverage upon its size and scale to develop a competitive domestic manufacturing ecosystem for electric mobility
- Benefit all citizens as the aim is to promote 'Ease of Living' and enhance the quality of life of our citizens and also provide employment opportunities through 'Make-in-India' across a range of skillsets

Procurement Model for EV Buses

Procurement and operation of buses in India is largely done through PPP (Public Private Partnership) framework. There are multiple models available under PPP framework that differs in terms of

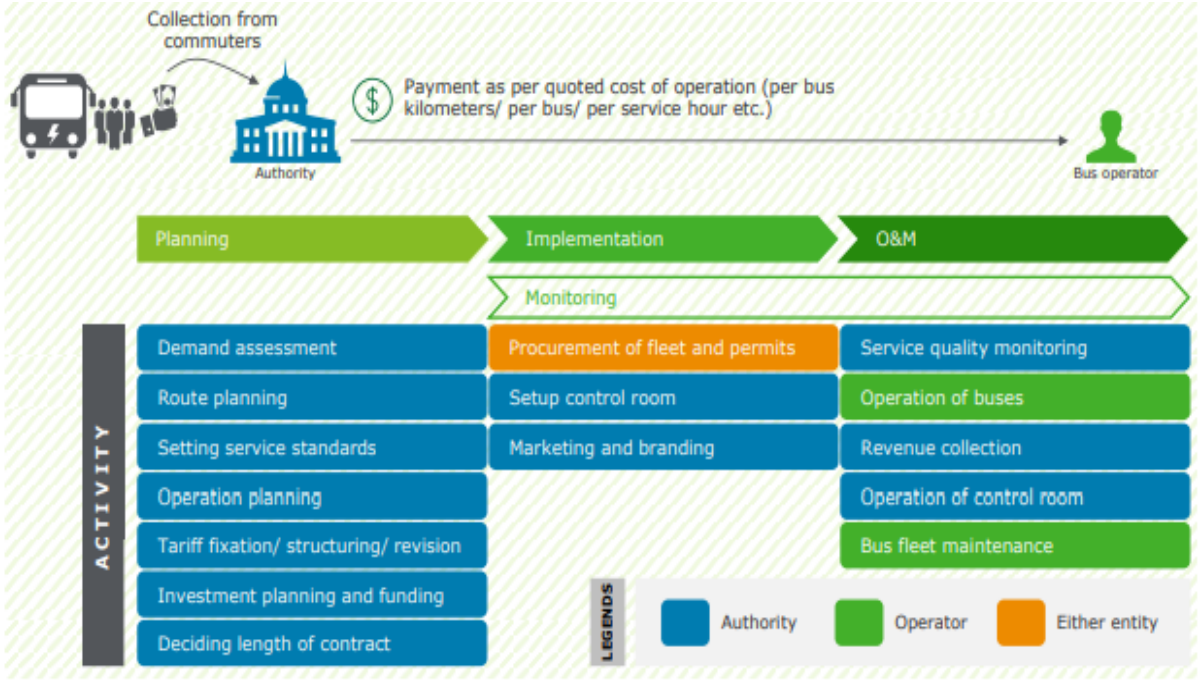
- ❑ Degree of operational control
- ❑ Allocation of risk
- ❑ Investment contribution

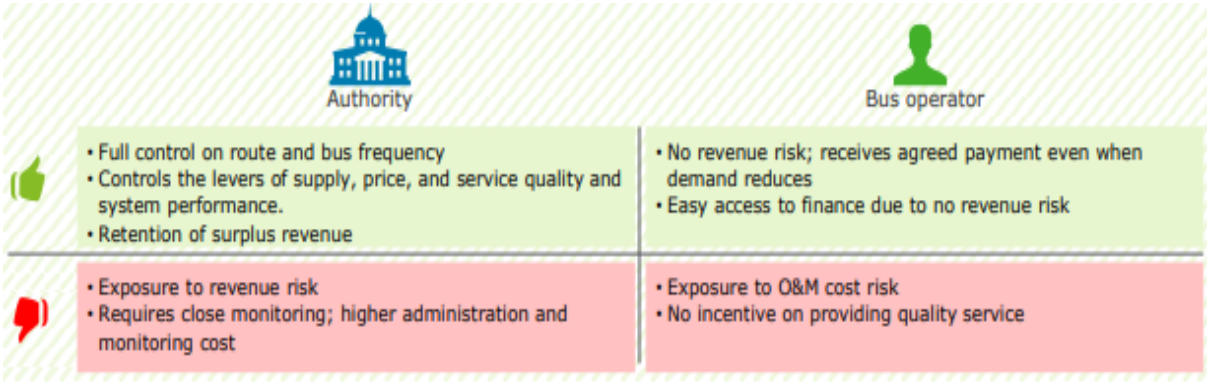


Parameter	GCC	Hybrid GCC	NCC	Hybrid NCC
Suitability	Authority wants to retain control and is financially strong to assume revenue risk, has strong monitoring capacity	Authority wants to retain operational control and intends that operator shares some revenue risk	Competent operators willing to assume revenue risk exist and demand is relatively certain	Authority is willing to reduce control over operations, while financially compensating for unviable routes
Revenue risk	Authority	Shared: *Base cost by authority; Ridership increase by operators*	Operator	Operator: *Subsidy by authority on unviable routes*
Degree of operator's incentive to increase ridership	**Low** *Fixed payment irrespective of ridership*	**High** *Bonus on increase in ridership*	**High** *Revenue directly linked to ridership*	**High** Revenue directly linked to ridership
Monitoring and penalty regime	Requires **strong and consistent monitoring** with penalty for service below benchmark performance	**Higher level of monitoring** than GCC because of greater economic incentive for performance	**Less monitoring** Only service quality parameters monitored	**Level of monitoring is higher than NCC** In addition to service level parameters, monitoring of movement of bus on un-viable routes
Access to finance (Bankability of project)	**High** *Guaranteed income reduces credit risk*	**High** *Part of income assured; decreases risk*	**Low** *Revenue risk borne by operator.* *Increases credit risk especially if no track record or demand is uncertain.*	**Medium** *Since credit worthiness is increased as non-commercial routes are supported.*
Operational efficiency	**Medium** *Since operators are assured of revenue and can focus only on operational efficiency*	**High** *Since operators revenue is guaranteed, while incentives exist for increased ridership*	**Low** *Since operators bear the revenue risk and may skip trips/reduce frequency in case of low ridership*	**High** *Since operators' gets revenue from un-viable routes also*
	High on viability from the bus	High on viability from the bus	High on viability from the authority's perspective	High on viability from the authority's perspective

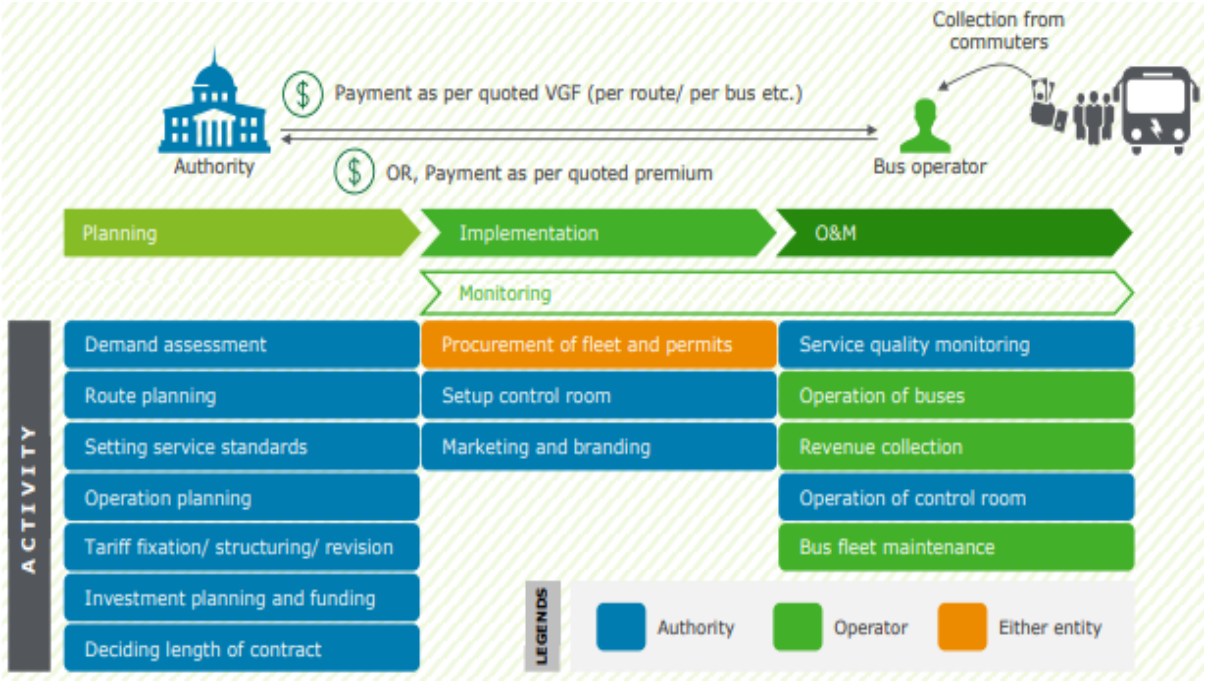
Procurement Model for EV Buses

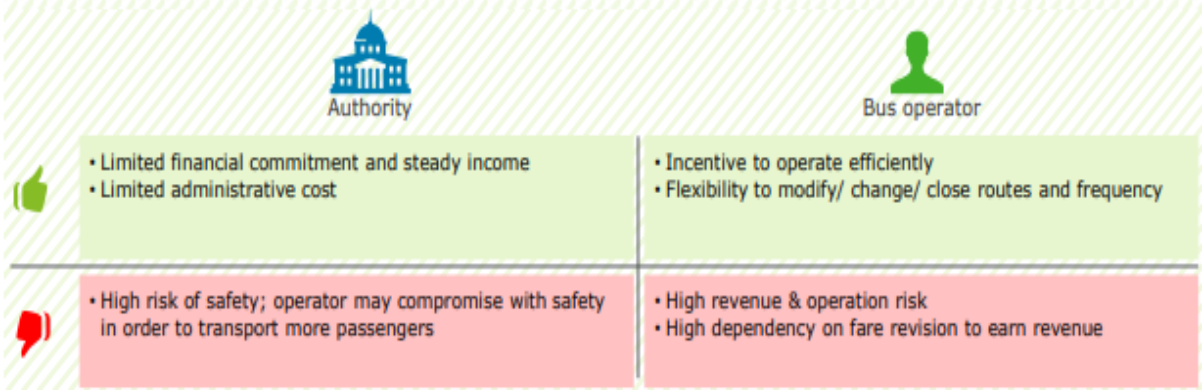
Gross Cost Contract (GCC)





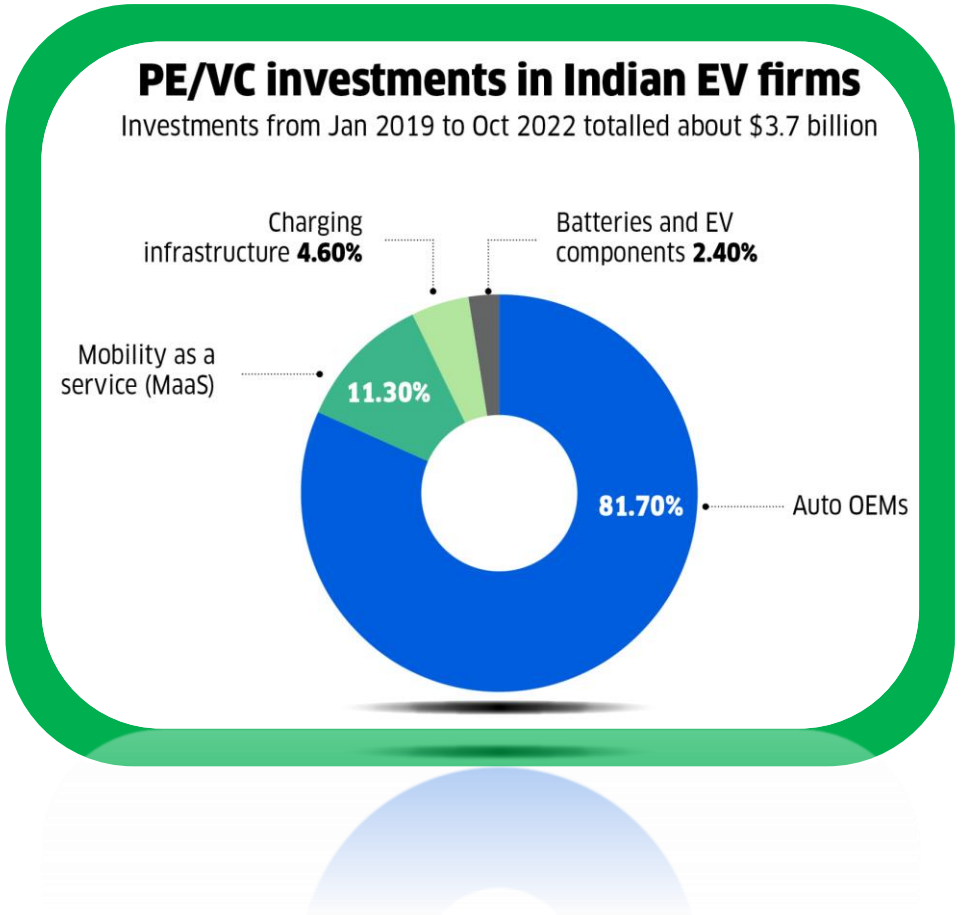
Net Cost Contract (NCC)



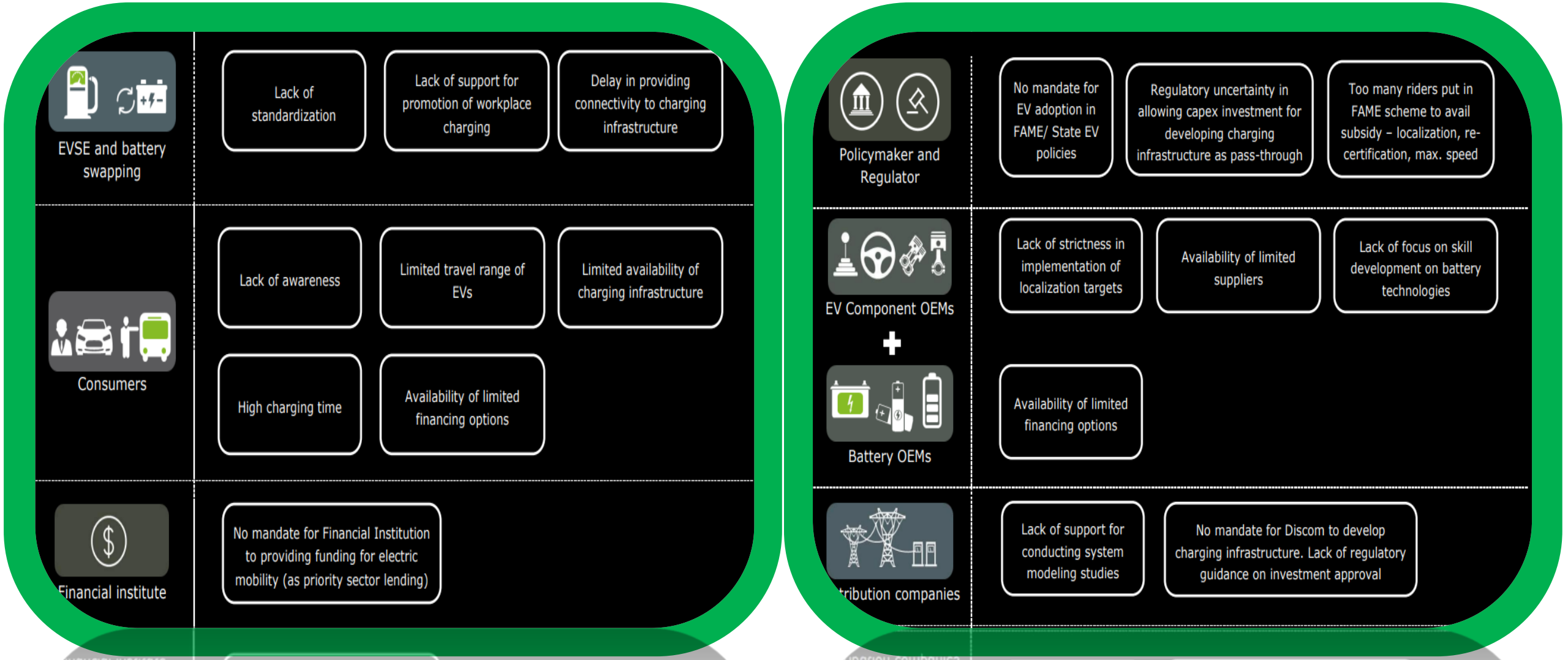


Localization Plan for EV Buses

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

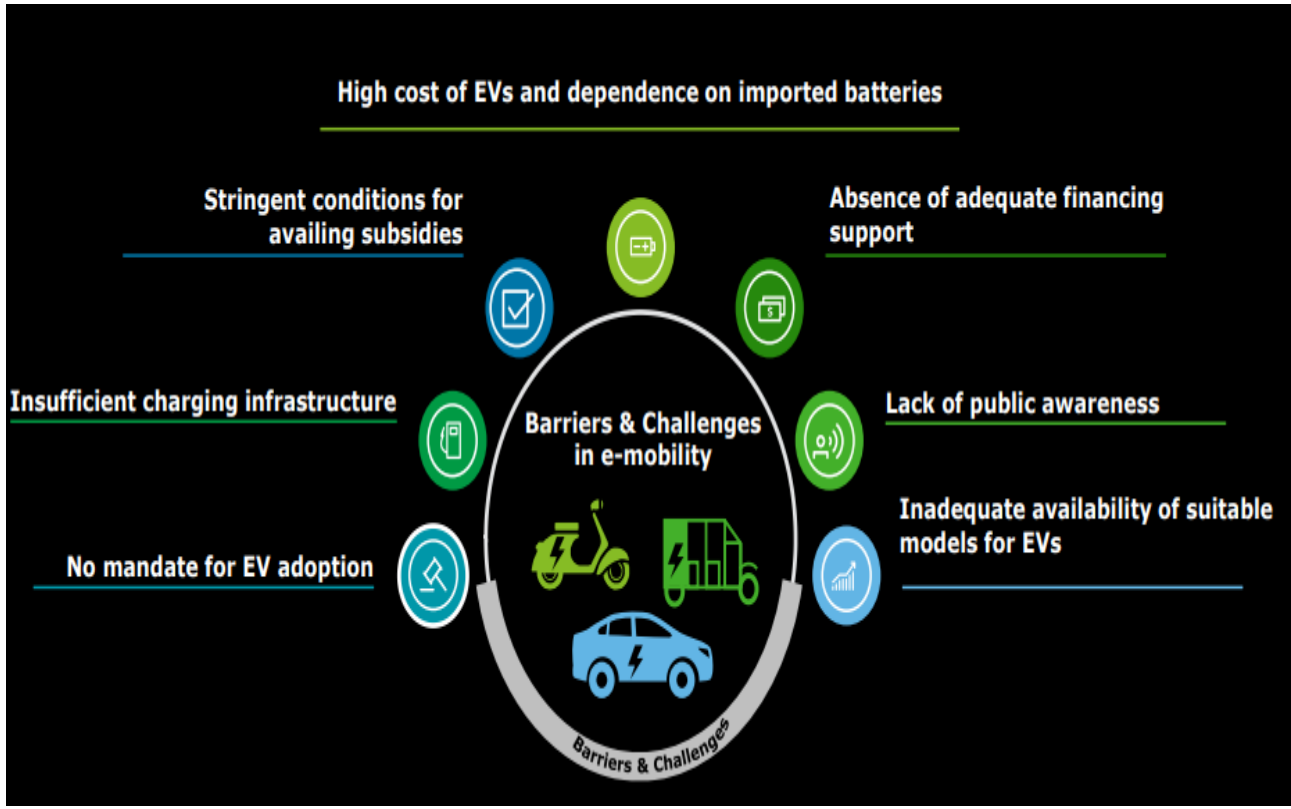


GAPS for EV Buses Industry



Risk for EV Buses Industry

Policy risk	Financial risk	Supply chain risk	Technological risk	Other risks
- Non – implementation of policy measures after announcement - Phasing-out of subsidy support/ posing stiffer norms for availing incentives - Policy risk associated with import-export of automobile component - Introduction of any policy mandating investment in recycling of battery	- High cost of funding due to perceived high technology risk by FIs - Exchange-rate risk due to import dependency for auto components - Investment recovery risk - evolving business models, limited charging infrastructure	- Insufficient access to mineral resources for manufacturing critical components indigenously - Quality of indigenously manufactured auto ancillary component - Demand-supply issue of indigenous auto ancillary component due to limited manufacturing capacity - Geo-political risk -unstable relationship with China (import dependency on China)	- Fast evolution of technology (especially in Battery) – risk of obsolesce - Battery prices may not go down as predicted (may be due to demand-supply mismatch) - Interoperability - Price versus performance - risk of technology preference	- Uncertain consumer preference - High wage rate of skilled manpower/ shortage of skilled manpower Evolving safety standards and their compliance related risk - Environmental concern – battery scrappage or recycling issues



Future Visibility for EV Buses Industry

Present	Future (2025 & beyond)	Business impact
Low EV Penetration	High EV penetration	More charging stations; need for fast charging
Less competition	High competition	Innovative business model to retain customer, cost competitive business model, bundled model – product with services
Focus on urban areas	EV charging expanding to Tier 2 & Tier 3 cities	Suitable business model for price sensitive customers in semi-urban and local areas, high volume and low prices based business models, e-roaming
More focus on product	Service will be key in attracting customer	Need for innovative services, co-located charging, bundled services
Short range vehicle/ less distance travel	Long range vehicle/ long distance capable batteries	Need for fast charging facility; charging zone
Conventional vehicles	Smart, autonomous, connected vehicles	Need for smart charging
"Charging" is the only service	Energy feed back to the grid during from vehicle during unused hours	Need for Vehicle-to-Grid (V2G) facility, participation in demand response, Virtual power plants
No managed charging facility	Active and passive managed charging in place	Increased role of DISCOMs and third party service providers in managing the grid, smart charging
Less cyber threat	High cyber threat	More investment in data security, secure data communication
Single business-led	Partnership-led	Win-win partnership collaboration, co-located charging stations, charging zones with public amenities such as food zone, recreational activities

Key Focus Areas

- R&D Promotion
- Localization implementation
- Strict adherence to governmental policies
- Skill development on new technology
- Developing charging infrastructure

Demand for Charging infrastructure

1 Extensive Demand for charging infrastructure in India under FAME II

DEMAND - Request through 106 proposal for **7,000** EV charging stations

SUPPLY- Sanctioned the **2,636** EV charging stations

GAP - The demand for **4364** EV charging stations is not met

2 States are sensitive for setting charging infrastructure

24 states

62 cities

19 Public entities

19 entities across different states expressed their interest in setting charging stations

3 Promoting fast chargers

Fast Charger	1,633 charging stations	~62%
Slow Charger	1,003 charging stations	~38%

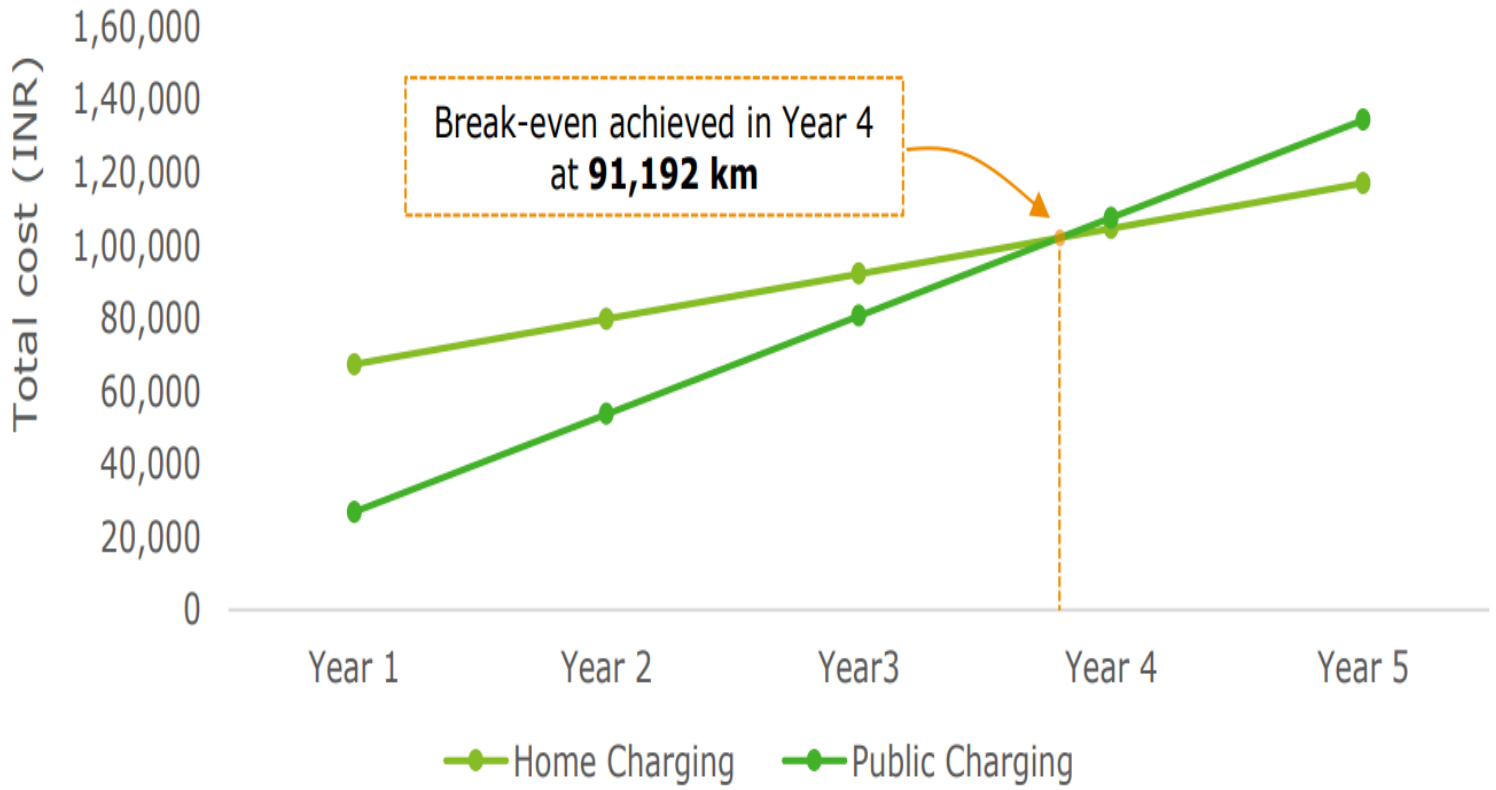
4 Positive Outlook for EV charging industry

The electric vehicle charging infrastructure market in India is anticipated to grow at a **CAGR of over 40%** during the forecast period 2019-2025.

Setting up EV Charging infrastructure

Parameter	Costing
Electricity Connection (250 KVA):	7,50,000 /-
Civil Works:	2,50,000 /-
EVSE Management Software + Integration:	40,000 /-
Technicians, Manpower, Maintenance, etc:	3,50,000 /- yearly
Advertising and Promotion:	50,000 /-
Land Lease (if the land is at lease):	6,00,000 /- yearly
Total Approximate: (First year including setup and if the land is at lease)	Rs. 40,00,000 /-
Annual maintenance from the second year: (Including land lease)	Rs. 10,00,000 /-

Opportunities



- Maintenance cost in home charging is not considered

E-buses

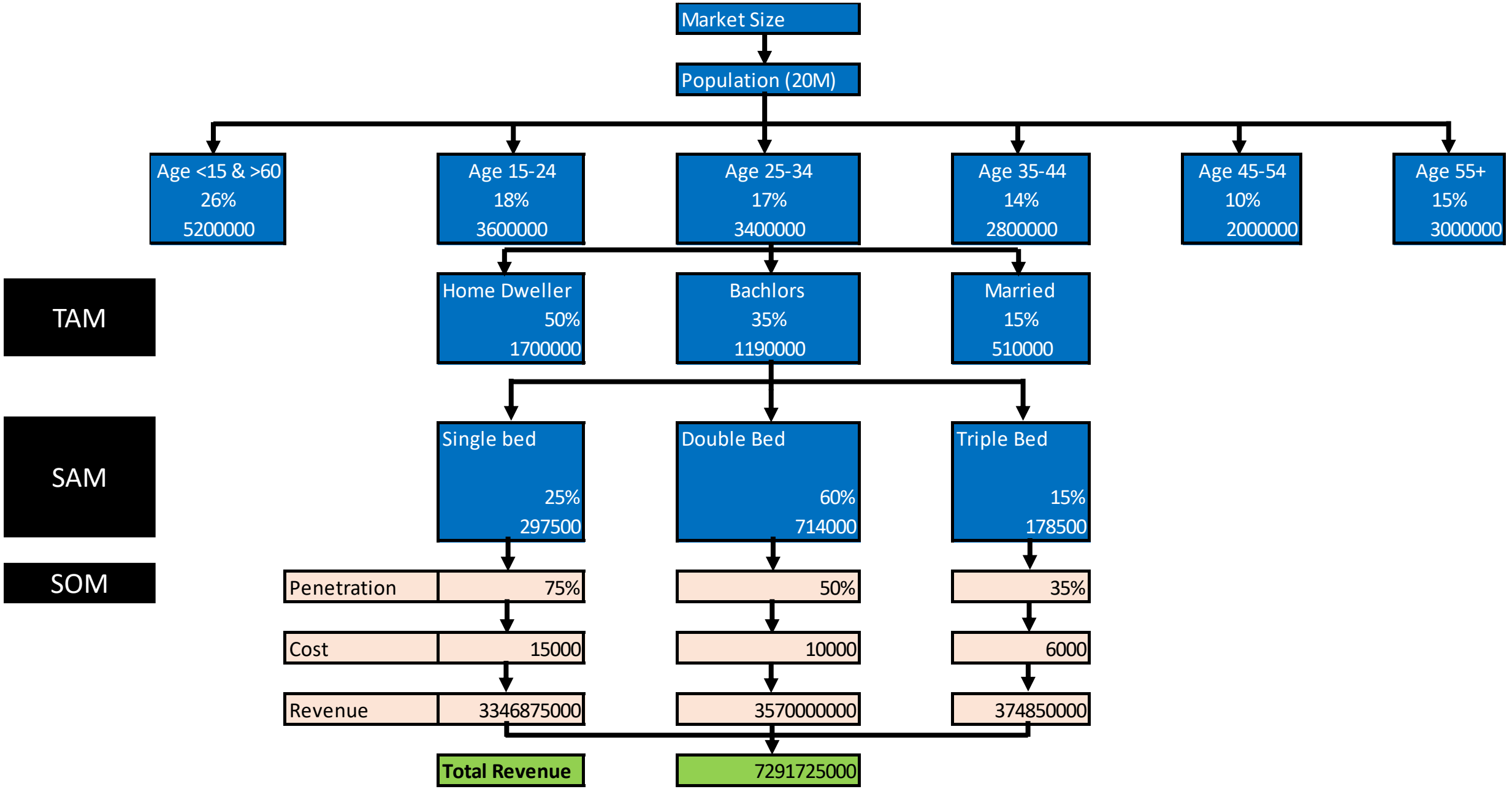
~15,000 – ~24,000

Assuming 1 charger for 50 E buses, hence

Future Visibility for EV Buses Industry

To leverage India's cost advantage and achieve desired level of supply chain localization for EV manufacturing in India, ecosystem stakeholders need to start with the following:

- Facilitate extensive support for Research, Development, and Demonstration of technologies using raw materials abundantly available in India, to find alternatives and reduce dependence on scarce natural resources required for EV manufacturing
- Commitment and investments in technology from incumbent OEMs and auto component companies
- Policymakers will have to strike a balance between promoting localization and making EVs economical. Need to re-think on waiving unrealistic riders of localization requirements for availing subsidy, at least during the demand creation phase.
- Invest in creating charging infrastructure, to build an ecosystem for Evs. Prospects for future demand in Evs would bolster investor sentiments, leading to the development of a local supply chain for EV components.
- Standardization of batteries should be done to enable battery swapping a plausible business model catering primarily to commercial vehicle
- Financial Institutions should be encouraged to extend their lending facility to the electric mobility sector.


Market Size
Population (20M)
Age <15 & >60
26%
5200000
Age 15-24
18%
3600000
Age 25-34
17%
3400000
Age 35-44
14%
2800000
Age 45-54
10%
2000000
Age 55+
15%
3000000
TAM
Home Dweller
50%
1700000
Bachlors
35%
1190000
Married
15%
510000
SAM
Single bed
25%
297500
Double Bed
60%
714000
Triple Bed
15%
178500
SOM
Penetration
75%
50%
35%
Cost
15000
10000
6000
Revenue
3346875000
3570000000
374850000
Total Revenue
7291725000