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4TH INTERNATIONAL CONFERENCE & EXHIBITION ON ENERGY STORAGE & MICROGRIDS IN INDIA

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Energy Storage & Charging Infra for EV

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Mahindra ELECTRIC

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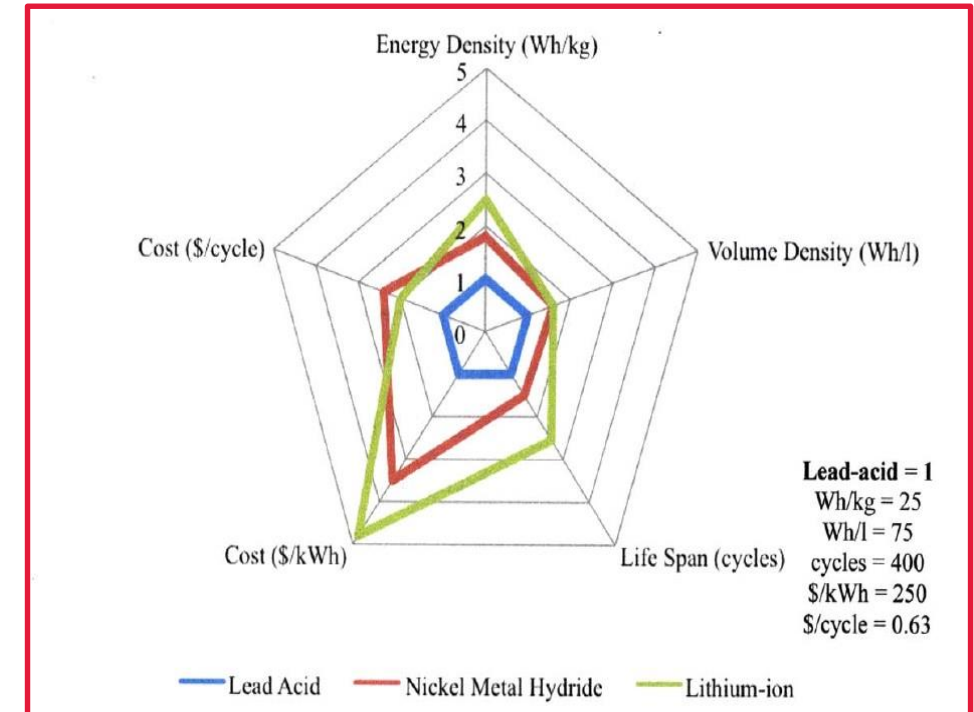
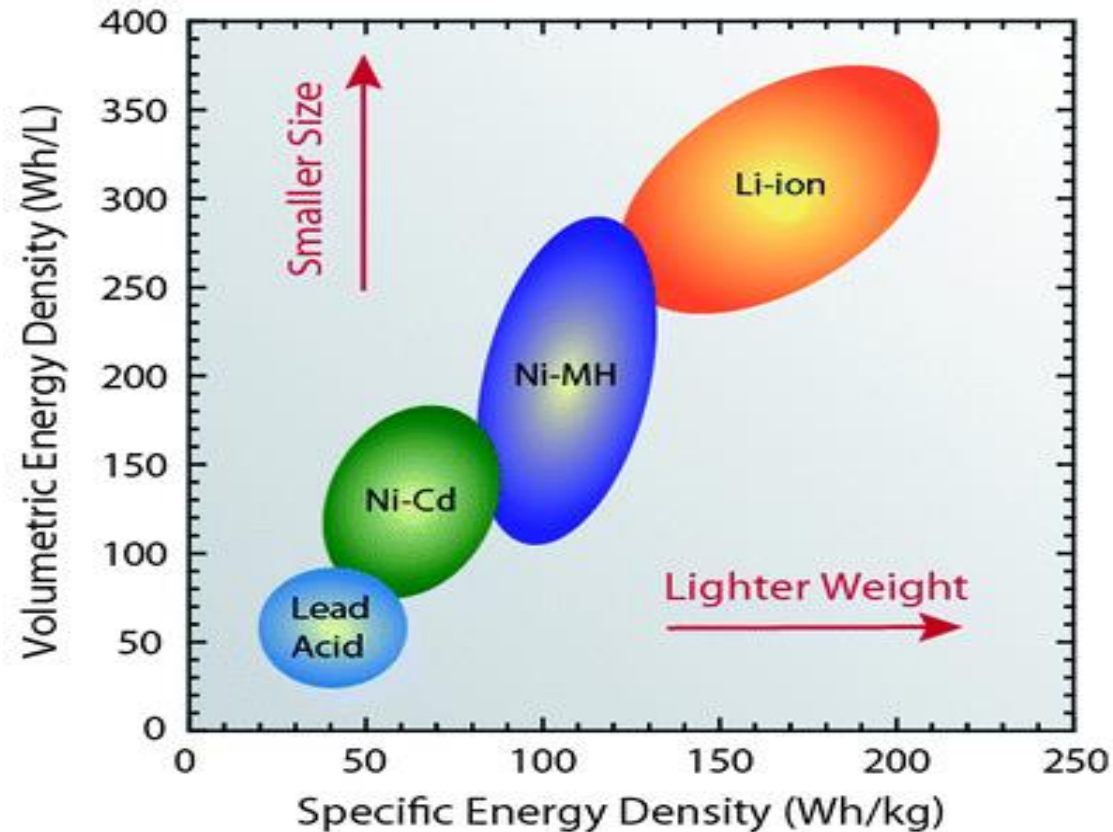


- Energy Storage in EV
- EV Charging Eco-System
- Charging Infrastructure- India & World

Energy Storage in EV



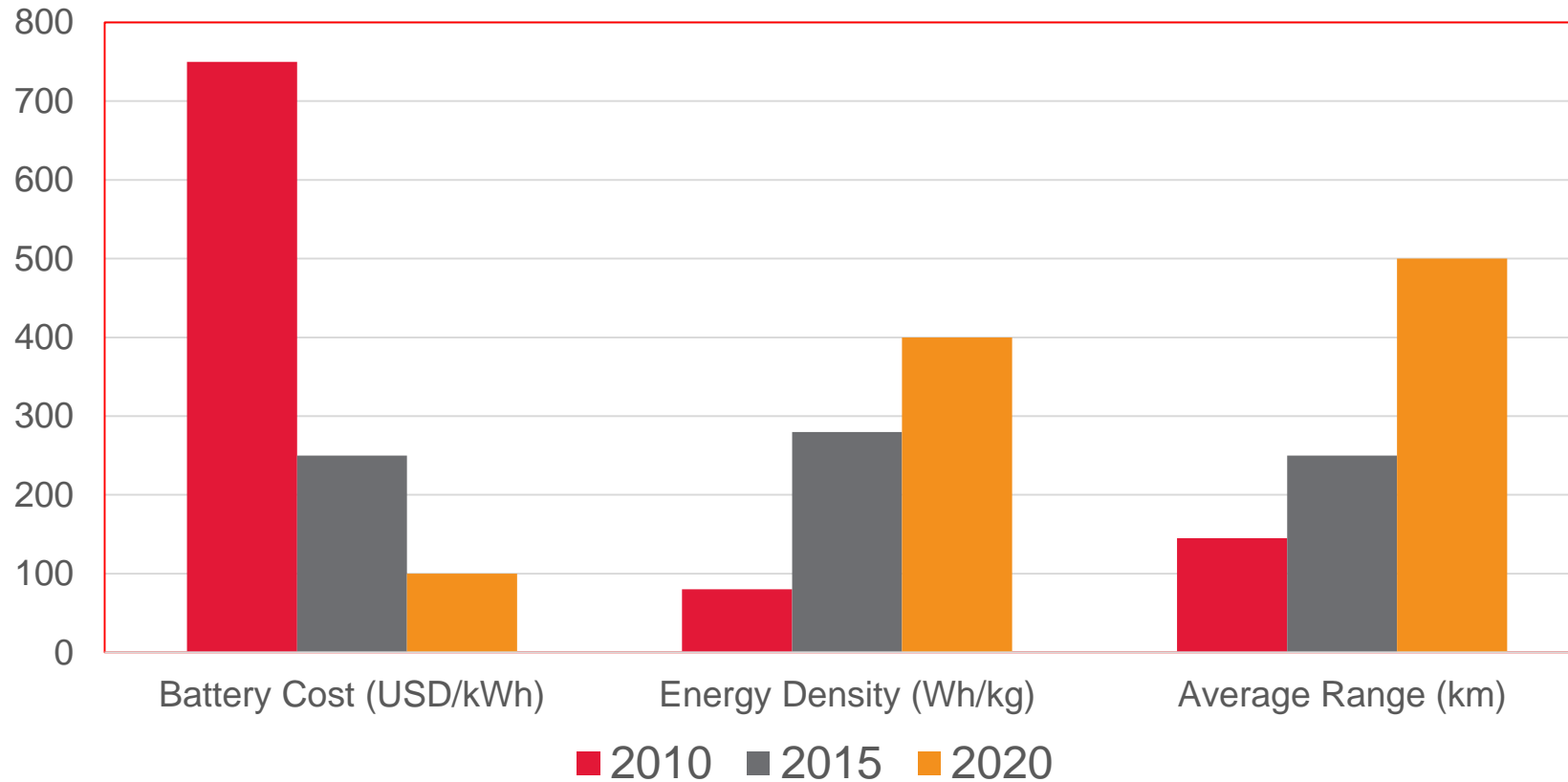
Basic Comparison of Batteries for EVs



- Li Ion batteries with small size and light weight are best suited for EVs but requires efficient battery management controls and cell balancing
- VRLA batteries are too heavy with low life; emerging technologies like Lithium Metal are not yet safe to use.



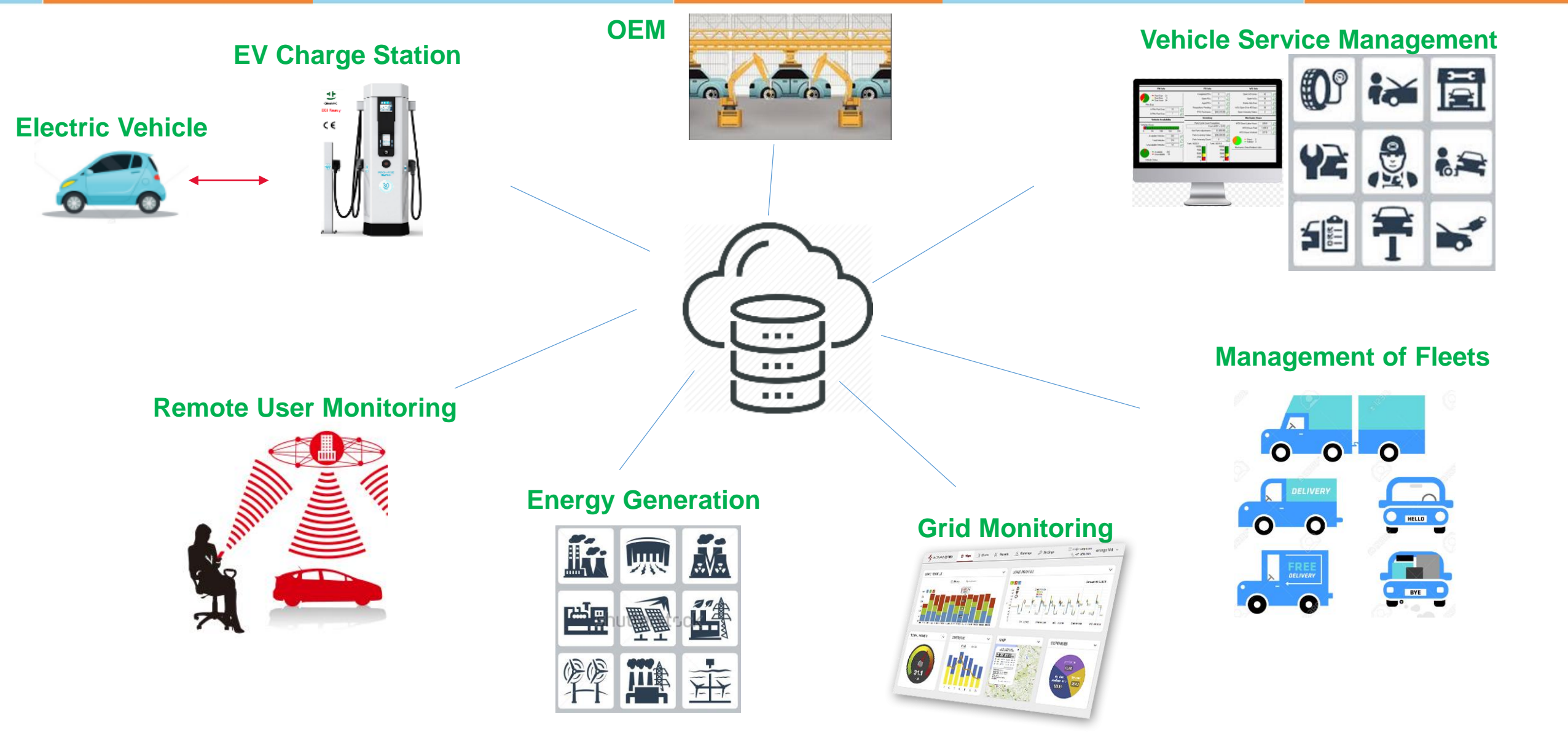
Longer Range with low cost, high density batteries



- ▶ Clear trend for higher range using large storage capacity batteries (22kWh in 2010 to over 60kWh in 2020), thus increasing demand for battery
- ▶ Drastic increase in battery energy density resulting in higher range with same foot print

EV Charging Eco-System

EV Charging Eco-System



EV Charging Framework

CONSUMERS

EVSE

EVSE MANAGEMENT

POWER GENERATION

SMART GRID



NORMAL CHARGING (AC)

1-Ø
In-LINE RCD



230Vac, 16Amp, 3.3kW
Mode-2 Case 'C'
IEC 61851-1

1-Ø TYPE-2
WM & ICCB

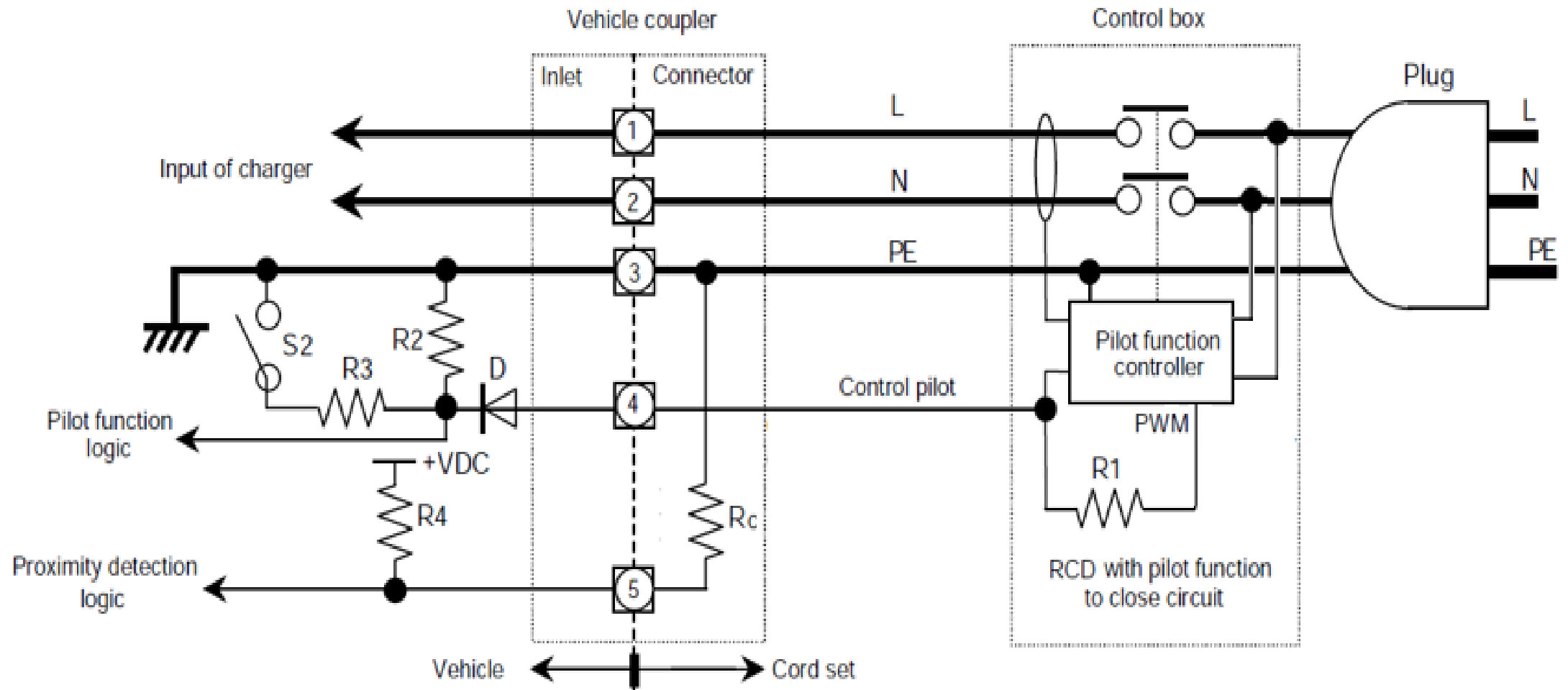


250Vac, 16 /32 Amp, 3.3/6.6 kW
Mode-2 Case 'B & C'
IEC 61851-1
IEC 62196-2

3-Ø TYPE-2
WALL MOUNT



480Vac, up to 63Amp,
43kW, Mode-3 Case 'C'
IEC 61851-1
IEC 62196-2



- › Type-2 is a physical interface with the vehicle, without any communication or cyber connectivity with grid

Off-Board DC Fast Charging

FAST CHARGING (DC)

GB/T DC FAST CHARGE



Up to 750/1000 Vdc,
Up to 250Amp

CHAdeMO DC FAST CHARGE

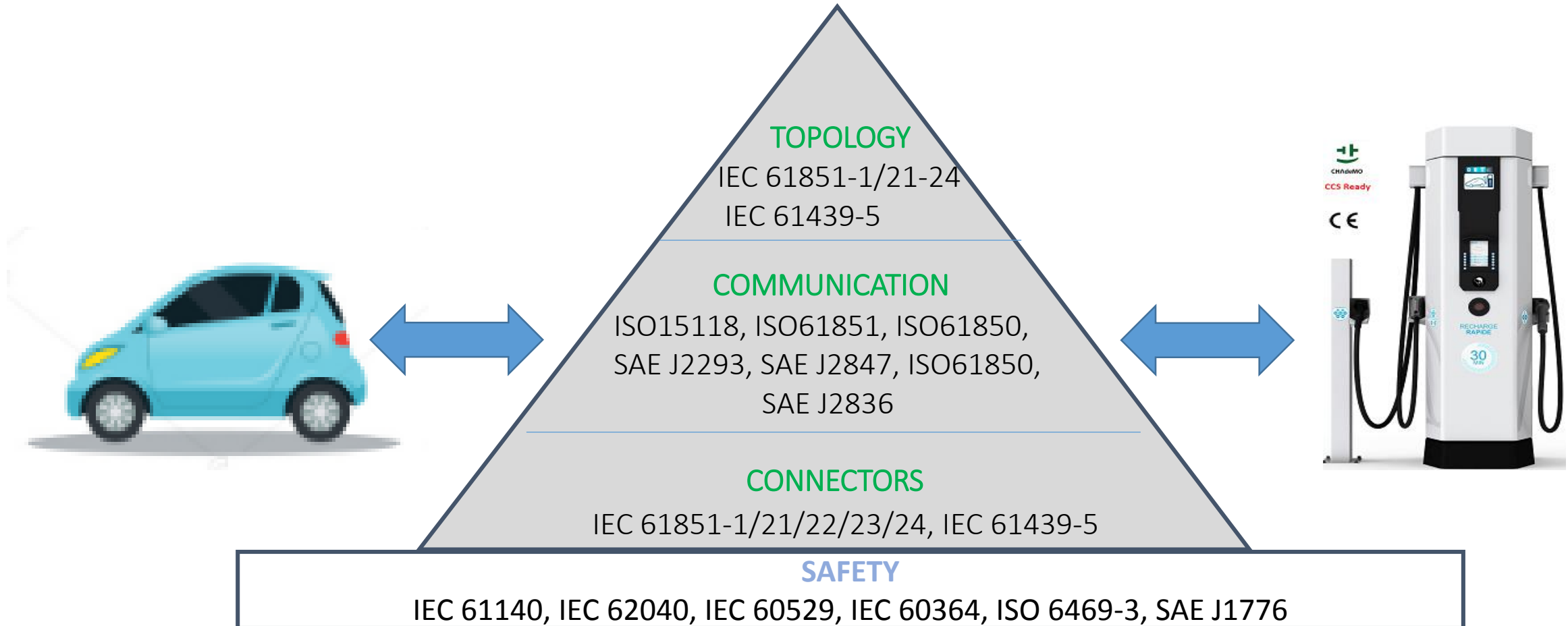


50Vdc - 500Vdc,
125Amp, 50kW

TYPE-2 COMBO DC/AC FAST CHARGE



Up to 750Vdc,
125Amp, 100kW



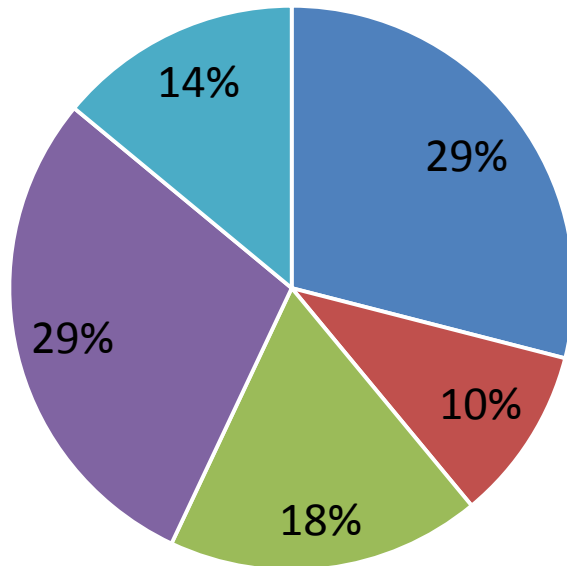
- ▶ All three Fast Charging protocols needs communication with the vehicle, thus has cyber connectivity with grid

Charging Infrastructure – India & World



Slow Chargers - Global Distribution

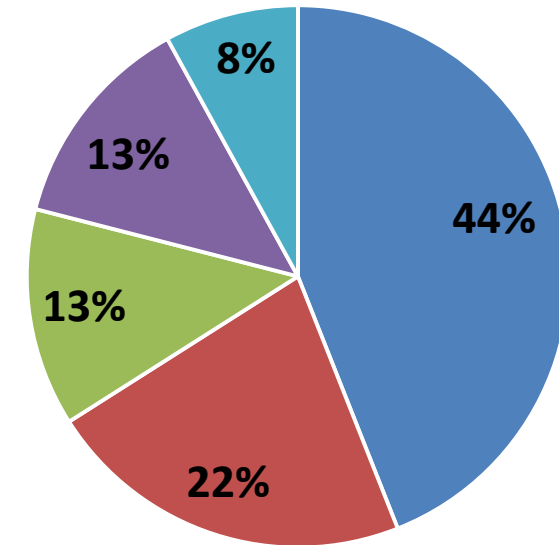
162,000 OUTLETS



■ China ■ Japan ■ USA ■ Europe ■ Others

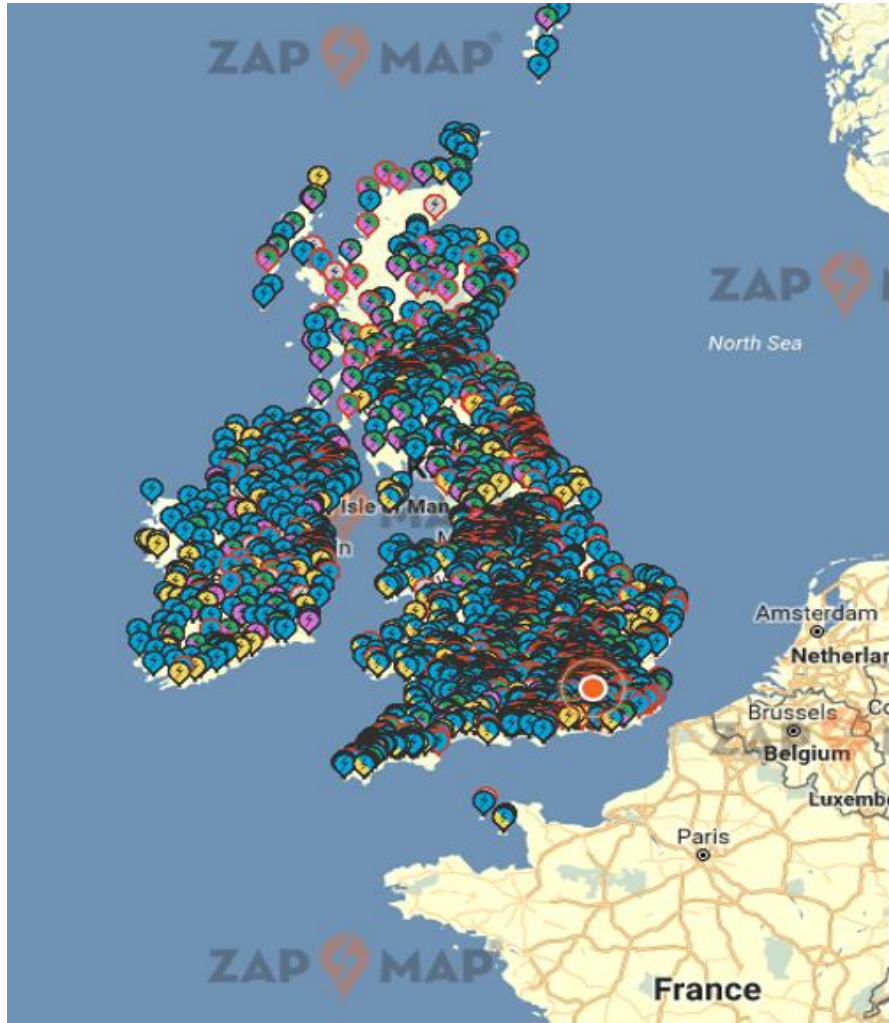
Fast Chargers - Global Distribution

28,000 OUTLETS



■ China ■ Japan ■ USA ■ Europe ■ Others

Like Japan, UK has relatively large EVSE installations – over 10,000.

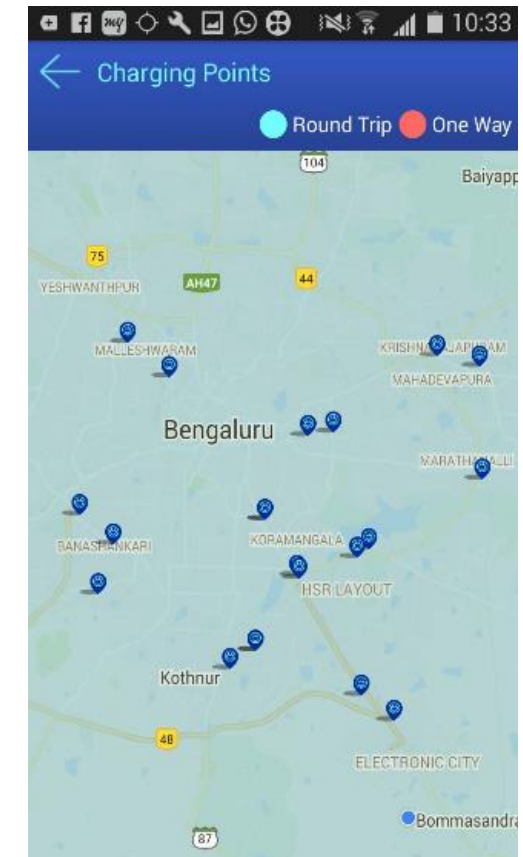


Source: ZAP MAP

India Lags in EV Charging infrastructure with only around 300 Installations



EVSE in Bangalore

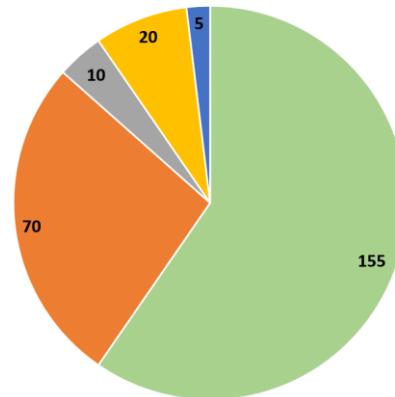


FAME: **F**aster **A**doption and **M**anufacture of **E**lectric Vehicles in India

Focus Areas:

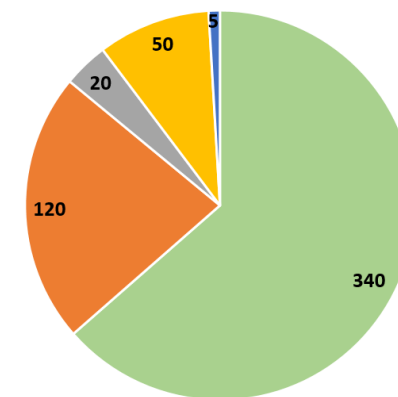
- Demand Incentives
- Technology Platform
- Charging Infrastructure
- Pilot Projects
- Operations

2015-2016



260Cr

2016-2017

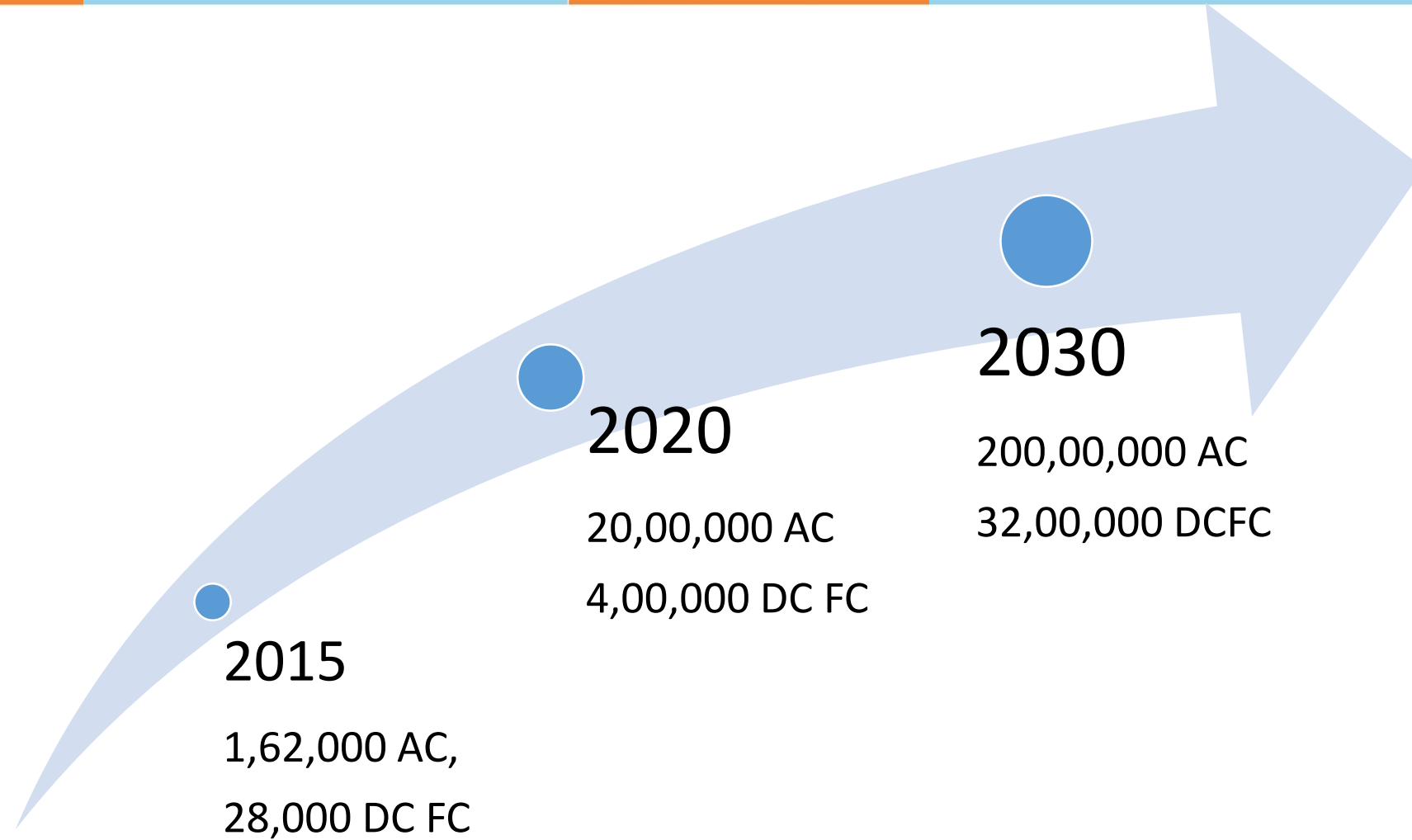


535Cr

Vehicle Segment	Minimum incentive (INR)	Maximum incentive (INR)
2 wheeler scooter	1800	22,000
Motorcycle	3500	29,000
3 wheeler Autorikshaw	3300	61,000
4 wheeler cars	11,000	1,38,000
LCVs	17,000	1,87,000
Bus	30,00,000	66,00,000

- ▶ FAME is an Initiative under the National Mission for Electric Mobility (NMEM) aiming to put Millions of EVs and HEVs on Indian Roads by 2020

EVSE Global Deployment Targets



- As per Paris declaration; Over 100 times increase in EV charging infrastructure all over the globe in next 15 years

- EV market continues to grow at a rapid pace with over 5M vehicles by 2025
- Steady increase in energy capacity and decline of battery cost resulting in EVs with longer range
- Emergence of EV charging eco-system globally
- Phenomenal growth of charging infrastructure over 100 times in next 15 years
- India lags much behind in comparison with global surge; needs to do a lot to catch-up

Thank You

Mahindra ELECTRIC