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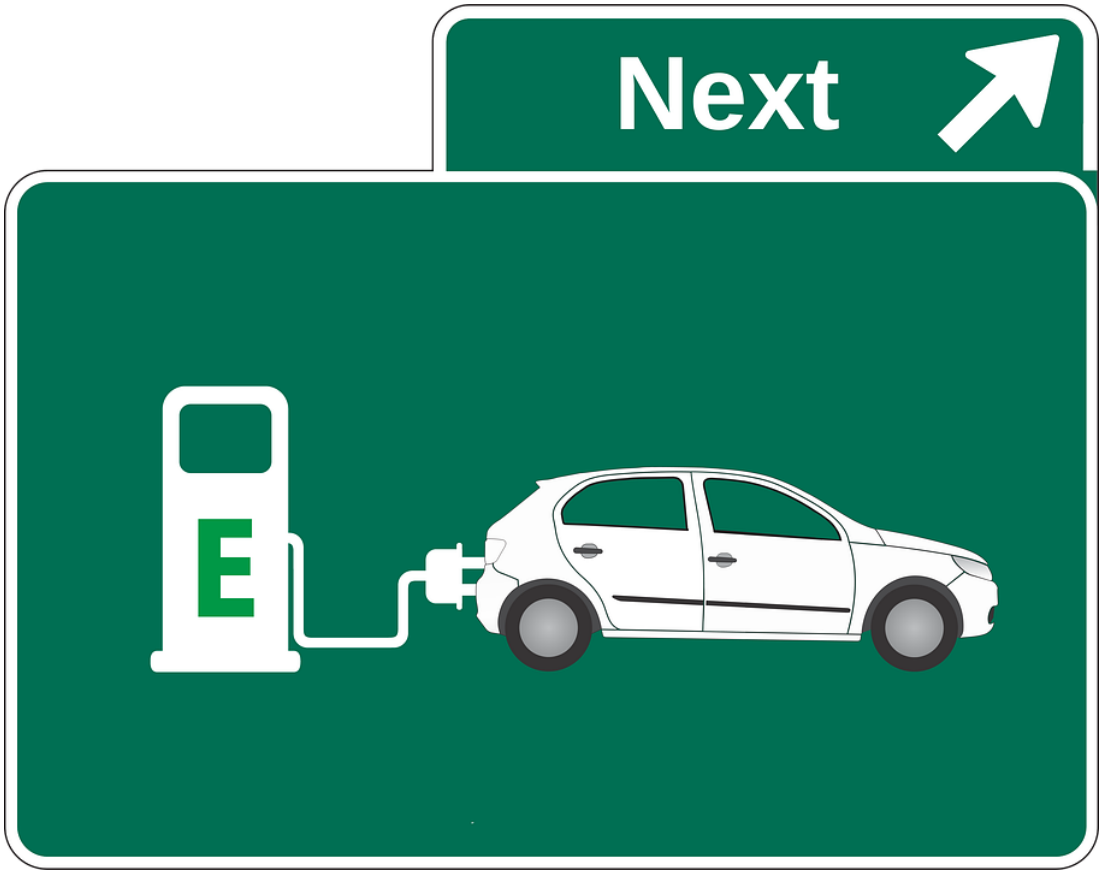

INDIAN PASSENGER VEHICLE INDUSTRY

EV penetration in Indian PV market will remain below 5% in the next five years

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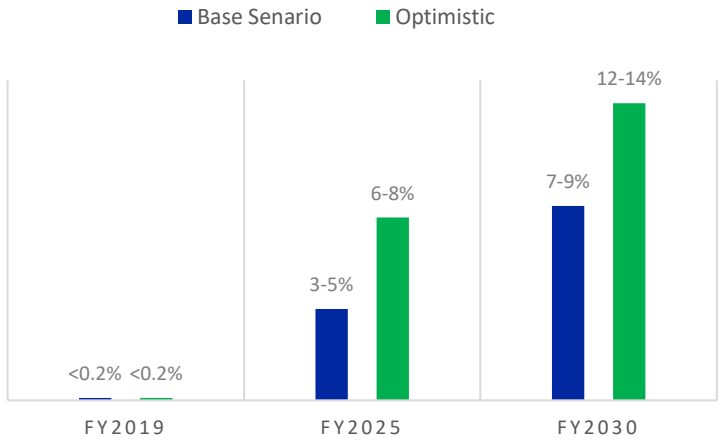
Term	Description
2W	Two-Wheelers, like motor-cycles, scooters
3W	Three-Wheelers including both passenger & goods carrier
BEV	Battery Electric Vehicle (vehicle which runs only on battery)
BYD	BYD Auto Co., Ltd., China
CAFÉ	Corporate Average Fuel Efficiency
CATL	Contemporary Amperex Technology Co. Limited, China
CV	Commercial Vehicle like trucks, buses and tippers
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of (Hybrid and) Electric (FAME) scheme
GoI	Government of India
GST	Goods and Service Tax
ICE	Internal Combustion Engine (conventional engine that runs on petrol/diesel)
JV	Joint Venture
KwH	Kilo Watt Hour
LCV	Light Commercial Vehicle (less than 7.5T gross vehicle weight)
M&HCV	Medium & Heavy Commercial Vehicles (above 7.5T gross vehicle weight)
OEM	Original Equipment Manufacturer
OI	Operating income indicating net sales excluding non-operating income like interest income, dividends and others
OPM	Operating margin i.e. operating profit before interest, depreciation & amoritization and taxes/net sales
PV	Passenger vehicle like cars, utility vehicle and vans
R&D	Research and development
RM	Raw material
US	United State of America (USA)

Conventional vehicle will continue to dominate; EVs will account for 3%-5% of domestic new vehicle sales by 2025

Exhibit 1: ICRA outlook for EV sales in passenger car segment



Source: ICRA research

Indian market is a price sensitive market and "economies of scale" is crucial for a passenger vehicle OEM to price its model competitively. At present, prices of electric vehicle (EV) remains significantly higher than their ICE counterparts which along with limited range and lack of public charging infrastructure resulted in minimal EV penetration in the country. Earlier, we had anticipated that hybrid vehicle to gain stronger traction in domestic market, thanks to lower taxes and additional FAME subsidy. However, with revised taxation structure under GST where EV attracts 5% duty as compared to 43% for hybrid counterparts, along with substantial reduction in subsidy under FAME for hybrids - hybrid vehicle has lost their attractiveness. Average car realization is much lower in India as compared to markets like USA and China. Consequently, price parity for EVs and ICE in India will take longer time as compared to markets like China and USA. Due to high upfront cost as well as limited charging infrastructure, ICRA expects electric vehicle penetration to remain low (3-5%) till 2025. However, over the longer-term horizon, once BEV achieves price parity with ICE counterparts, EV may experience exponential growth.

Electric vehicle penetration in India is likely to remain low over the medium term (next 5 years), due to concerns related with high price tag and lack of charging infrastructure

To support growth of EVs in the medium to long term, government support remains critical. Assuming subsidy of Rs 150,000/vehicle, 1% of total domestic PV sales in FY2020 will require about Rs 450 crore of subsidy support annually, translating into about Rs 1,300+ crore support for PV sales itself over next three years. Recent announcement of FAME 2.0 scheme provides limited visibility, as overall subsidy amount remains much lower (total Rs 525 crore over the next three year) to provide any meaningful impetus to EV growth in passenger car segment. Government has prioritized commercial fleet/taxi operators initially for EV subsidies. However, due to high upfront cost, cost of car ownership will continue to favour ICE vehicles in the medium term even in the commercial taxi segment.

There is lack of clarity regarding long term road-map for charging infrastructure as well as incentive structure for EV and Li-ion battery manufacturing facilities in India. Currently, global Li-ion battery market is dominated by international majors like Panasonic (Japan), LG-Chem (Korea), CATL (China) and BYD (China). Consequently, in case of import dependence for battery and other electronic components, the benefits of lower crude import bill due to shift towards EVs (from conventional vehicle based on petrol/diesel) may get diluted.

In a conventional ICE vehicle, engine and transmission components account for about 30%-35% of material cost whereas battery and associated components (motors, drives) cost ~40-45% of material cost in an electric vehicle. With technological advancements and benefits of scale economies, lower battery prices may result in EV price parity with ICE counterparts over the longer term (10-12 years), altering the Indian PV landscape significantly.

EVs to remain economically unattractive over medium term; government support/subsidy remain crucial

In India, government support remains crucial for EV to gain meaningful acceptance; under FAME 2.0, subsidy is linked with battery size as well as final retail price

Battery prices must drop below USD 80/KWH to become independent on any subsidy mechanism, to achieve price parity with conventional vehicles

Initial traction in EV adoption will come from higher price segment (Rs 10 lakh+)

Indian market is highly price sensitive with average vehicle realization below Rs 6,50,000. To incentivize electric car maker, government has provided preferential GST rate of 5% for electric vehicle as compared to 31%+ for small cars (which could be as high as 50% for SUVs). A gearbox & engine system (including exhaust) currently accounted for about 30%-35% of ICE based vehicle's raw material cost. In electric vehicle, conventional gearbox and engine as well as exhaust system will be replaced by battery pack, motor & drives and cooling system.

Exhibit 2: Cost competitiveness of EV vs conventional ICE vehicle

	ICE	EV	
		Case 1	Case 2
Invoiced Price (ex showroom) – (Currently)	6,50,000	6,50,000	6,50,000
Invoiced Price (ex showroom) in 2025 – (a)**	8,29,583	8,29,583	8,29,583
GST – (b)	31%	5%	5%
Ex Factory (c) = (a) – (b)	6,33,269	7,90,079	7,90,079
Subsidy (d)	-	1,00,000	1,00,000
Effective Pricing for OEM (c) + (d)	6,33,269	8,90,079	8,90,079
Battery Size (KWH)		30	30
USD - INR Conversion		70	70
Battery price (USD/KwH)		120-130	80-90
Battery price (USD/KwH) – (without subsidy to become competitive)		75-80	40-50

Source: ICRA research; Case 1 assumes RM cost at 80% resulting in just breakeven level for OEMs; In Case 2, current cost structure is expected to generate current OPM; USD INR conversion assumed at 1 USD = 70 INR; ** assuming 5% annual inflation in prices

As per FAME 2.0, subsidy is linked with battery size and overall incentive is capped at 20% of vehicle price. We expect subsidy to reduce from current level to Rs 100,000 per vehicle over the medium term, which translates into subsidy of USD 48/KWH for a 30 KWH battery at USD INR conversion of 70. Moreover, unlike sub 20KWH battery currently in place for small EVs (e.g. Tigor EV by TML), we have assumed 30 KWH battery which gives range of over 200 Km addressing range related concerns of most Indian buyers without compromising on power output.

In today's cost structure, EV vehicle are uncompetitive (as compared to similar ICE counterparts); however, if we analyze competitiveness of EV vs ICE after five years, EVs may become viable alternative with battery pack prices in the range of USD 120-130/KwH (with subsidy). In the absence of subsidy (currently assumed at USD 60/KwH), the trigger point could be much lower at USD 75-80/KWH which is still sometime away. Hence, we do not foresee any material improvement in acceptability of EVs in India over the medium term, especially in the mass market segment. ICRA analysis suggests that EVs penetration in sub 10 lakh price bracket is likely to remain limited, and its initial traction will come from the higher price segment.

OEMs bracing for long term industry disruption

As per Niti Ayog's study, shift from conventional vehicles to electric vehicle as well as shared mobility (vehicle pooling) could result in saving of USD 60 billion

Why there is push towards EVs, if they are unviable at present? GoI is keen on EV penetration due to possible reduction in import bill as petroleum products (automotive industry being primary consumer) accounts for bulk of current account deficit. Moreover, India being a signatory of Paris Climate Accord has committed to reduce intensity of fossil fuel emission by 33% from 2005 level by 2030. To reduce carbon footprint and improve fuel consumption, government has notified with Corporate Average Fuel Efficiency (CAFÉ) norms in January 2015, which became applicable from April 2017 onwards. CAFÉ norms not only prompt OEMs to downsize engine without compromising on power output by using turbochargers, but also encourage usage of alternate power source (electric vehicles) to improve overall fuel efficiency.

All major OEMs planning to add electric vehicle in their portfolio over next 3-5 years

Notwithstanding current scenario with high price tag and lack of public infrastructure, OEMs are still pushing for electric vehicle revolution as battery prices (which alone accounts for almost 50% of EV raw material cost) are on sharp declining trend. Cost of Li-ion battery has reduced by almost 80% in the last decade to USD 156/Kwh. If battery prices continue to decline on steady pace, electric vehicle will achieve parity with conventional vehicle over next 10-12 years, thereby accelerating acceptance of BEVs. Moderation in electric vehicle prices along with improvement in public accessible charging infrastructure will trigger mass market acceptance of EVs in Indian market over 10-12 years.

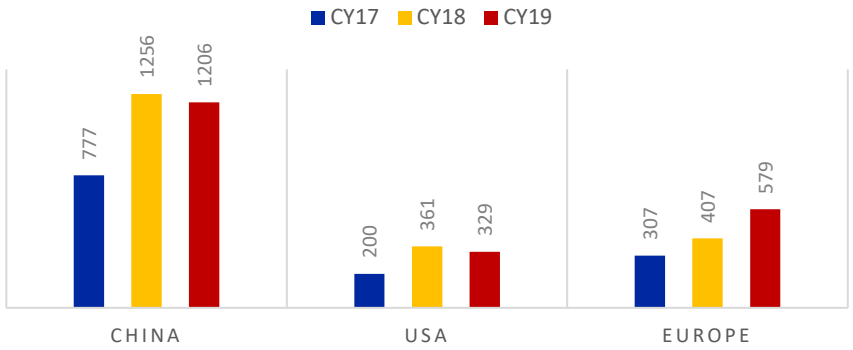
OEMs are investing in technology and product development to brace themselves with long term disruption, once BEVs achieve price parity with ICE

OEMs are already bracing themselves with possible disruption in mobility segment with advent of EVs. Suzuki Motor Corporation (50% stake in Li-ion battery unit) is already taking the lead with plans of setting up dedicated Li-ion manufacturing unit in Gujarat in collaboration with Toshiba (40%) and Denso (10%). Suzuki JV will be investing about Rs 1,200 crore and the unit is expected to become operational by 2020. Similarly, Exide Industries, which is currently India's largest lead acid battery manufacturer, has entered in 75:25 JV with Switzerland based Leclanche SA for setting up Lithium-ion based battery unit. Almost every PV OEM present in India has committed themselves to bring EV models in India, with market leader MSIL, Hyundai, M&M and Tata Motors have either launched a product already or will soon enter in EV space in the next 12-18 months.

Considering stranglehold of top 2 players in the current PV market, evolution of EVs provide opportunity for global OEMs to start afresh instead of competing with incumbents (in ICE technology) who already have competitive edge due to vast dealership & service network for their ICE platforms. Electric vehicles are not 100% emission free, as major portion of grid electricity in India today is still generated using fossil fuel. But, they are amongst the best alternative available - considering overall emission in EV is much lower as compared to ICE based vehicles. Earlier, few OEMs have also worked on fuel cell technology which is also emission free, but due to prohibitive cost as well as safety issues, focus has shifted to electric vehicle technology.

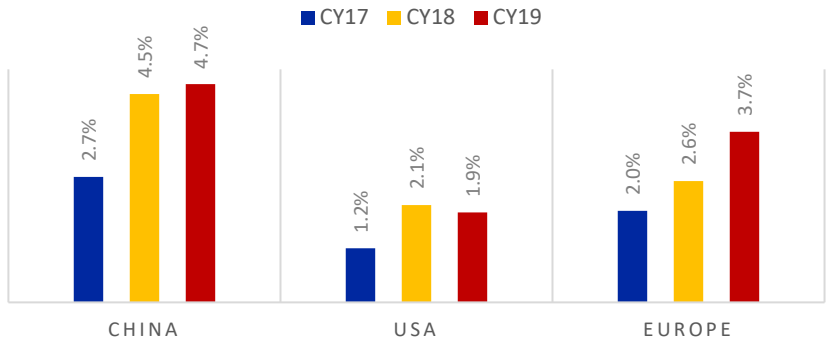
Globally, regulatory support and charging infrastructure aid EV penetration; China accounts for 50% of global EV sales

Exhibit 3: New Energy Vehicle (NEV) sales across key region (in 000's)



Source: Cleantechnica/MaxHolland; units in thousands

Exhibit 4: New Energy Vehicle (NEV) sales as % of total new vehicle sales



Source: Cleantechnica/MaxHolland, ICRA research

Direct & indirect financial support from government remain crucial for EV penetration

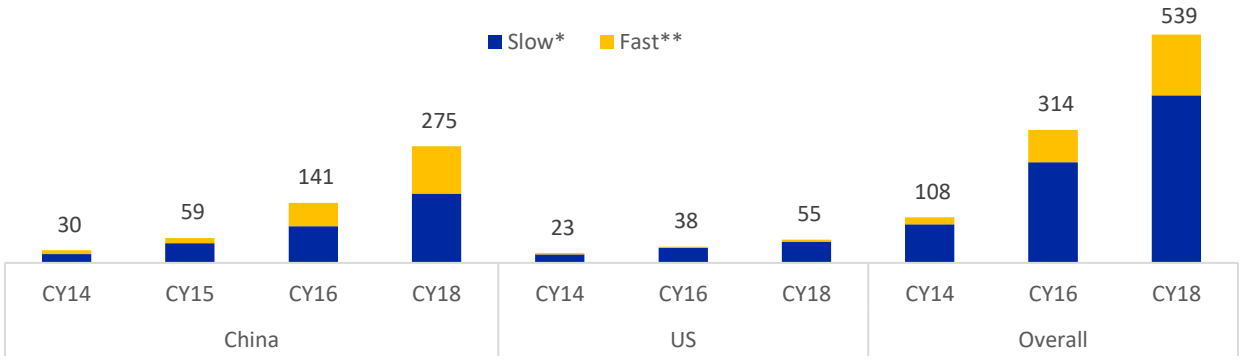
What is driving growth for EVs in international market?

- ***Regulatory intervention***: CAFE norms and mandatory Zero Emission Vehicle (ZEV) in US as well as restricted licensing for new vehicles in China is propelling demand for cleaner fuel. Moreover, countries who are signatory to Paris climate accord are bound to cut down carbon emission, by pushing for cleaner fuel technology.
- ***Energy security***: USA, China, European countries as well as India are amongst the largest importers of crude oil which puts heavy burden on their exchequers. Dependence on alternate source of energy will alleviate energy security concerns of these countries.
- With advancement in technology, declining battery prices and improvement in charging infrastructure, electric vehicles are increasingly becoming a viable option for fuel guzzling and polluting conventional vehicles

During last decade, battery electric vehicle registration has grown by 15x primarily driven by China, United State of America (USA) and European market. However, EV share in overall new vehicle sales remains modest even in those regions. Financial support from government, both directly and indirectly, is crucial for EV adoption in any region. Almost half of the EV sales in USA comes from California, where incentives and a Zero Emission Vehicle (ZEV) mandate requires that EVs be a certain percentage of sale. Even markets like US, China and Norway, which are flagbearer of global EV growth engine witnessed decline in EV sales post withdrawal/reduction in subsidies. In China, electric vehicles reported sharp decline during H2 CY2019 post reduction/withdrawal of subsidies by government reflecting importance of government subsidies/support for EV penetration. In US, pent-up demand for Tesla Model 3 resulted in strong NEV volume during CY2018 which subsequently cooled down in CY2019. Notwithstanding short-term headwinds, EVs are expected to significantly outperform ICE growth rate in PV segment over the medium to long term, thanks to increasingly stringent emission norms and declining battery prices.

Public charging infrastructure is another key area that will plague growth in India

Exhibit 5: Public charging infrastructure is crucial for EV penetration in passenger vehicles



Source: International Energy Agency (IEA), ICRA research; units in thousands
** Fast chargers include AC 43 kW chargers, DC chargers, Tesla Superchargers and inductive chargers;
*Slow chargers include AC Level 2 chargers (> 3.7 kW and ≤ 22 kW)

Apart from financial support, charging infrastructure is one of the key drivers for global BEV penetration

Amongst all automotive segment, EV penetration in PV and CVs (goods carrier and inter-city movement) industry will be most vulnerable to bottlenecks in charging infrastructure; whereas, segments like 2W, 3W and intra-city buses will be relatively less dependent on external charging stations. In India, public charging infrastructure remain minuscule currently; however, GoI has recently sanctioned 2,636 charging stations under FAME 2.0 to incentivize investments (in charging infrastructure) which if fructify will provide boost to EV acceptance over medium to long term. Out of these 2,636 charging stations across 62 cities in 24 states & UTs, 1,633 will be fast charging stations. Maharashtra will have 317 charging stations followed by AP (266), TN (256), UP (207) and Gujarat (205).

Given most Indian families own a single car, range anxiety related concern will continue to be a key deterrent for several customers. ICRA expects that overall rollout of charging infrastructure to remain slow, which will constrain any meaningful expansion of EV in the passenger vehicle segment in the near to medium term.

Summary

A clear roadmap from government is required to make EV adoption viable in Indian PV market without disrupting current automotive ecosystem

Summary

China, USA, Norway are amongst the largest market for electric vehicle globally, and the EV growth story in these markets are largely driven by government incentives and regulatory support. Apart from direct subsidy, indirect support like lower registration fees, toll-free access, lower parking fees and licensing requirement for new vehicle registration have also incentivized customers for adopting EVs. Even developed markets have witnessed sharp moderation in EV registration upon expiry of government incentives, which indicates that EV growth is still on artificial life support in the form of government incentives.

Indian market is unlikely to witness any meaningful penetration of EVs in PV segment, unless the prices of EV reduce drastically or there is strong direct and indirect financial stimulus from government to incentivize EV adoption. Demand incentive for electric PVs is restricted to commercial taxi segment, highlighting that GoI is aware that attractiveness of EVs for personal car buyers will remain distant in the near to medium term. Moreover, substantial investments are required in EV vendor ecosystem to keep cost under check and reduce dependence on imported electronic systems. Given PV industry accounts for half of OE demand from auto component industry; the stakeholders (OEMs, suppliers as well as GoI) will also follow cautious approach towards transition from ICE to EV space in Indian market owing to potential impact on Indian auto component industry.

Annexure: Overview of Hybrid & Electric Vehicles

Hybrid runs on combination of ICE and battery whereas electric vehicle runs purely on batteries

A vehicle can run on conventional fuel like diesel/petrol using internal combustion engine (ICE) or it can run solely on battery power using rechargeable batteries. A vehicle driven by two or more distinct power sources can be termed as hybrid vehicle, e.g. a vehicle running on diesel engine and electric motor. A hybrid vehicle can be broadly classified under three categories, i.e. 1) Micro Hybrid, 2) Mild Hybrid and 3) Full Hybrid.

In a hybrid vehicle, depending upon power requirement, the control system in vehicle derives power from electric motor/battery and ICE to improve fuel efficiency and reduce emission. For e.g., at low speed, when energy requirement is relatively low, vehicle can be driven by electric motor only, whereas during overtaking, electric motor may provide extra power assist to ICE to improve overall power output for short duration. There are other sub-categories like plug-in hybrid wherein external power source can be used to charge battery rather than relying solely on vehicle's ICE to recharge battery.

Exhibit 6: Pros & Cons of various vehicle technologies

	ICE	Hybrid	Full Electric
Fuel	Petrol/Diesel	Petrol/Diesel + Electricity	Electricity
Initial Cost	Low	Moderate	High
Charging/Refill Infrastructure	Best	Best	Weak
Maintenance Cost	Moderate	High	Low
Emission	High	Low	Minimal
Range per refill/recharge*	600Km	600Km	200+Km for Tata Tigor EV >400 Km for Tesla

Source: ICRA research; *assuming mileage of 15/Km x Fuel tank of 40 Litre

Fuel cell is not considered, as its initial cost is prohibitive and most OEMs have shifted their R&D focus towards battery EVs

Annexure 2: FAME II Scheme focuses primary on taxi segment; incentives linked with battery capacity

Exhibit 7: Fund allocation under FAME II

Amount in Rs Crore	FY2020	FY2021	FY2022	Total
Demand Incentive	822	4,587	3,187	8,596
Charging Infrastructure	300	400	300	1,000
Other	12	13	13	38
Total of Fame II	**1,134**	**5,000**	**3,500**	**9,634**
Committed Expenditure of Phase I	366	-	-	366
Grand Total	**1,500**	**5,000**	**3,500**	**10,000**

Source: ICRA research, Department of Heavy Industries – Government of India

Exhibit 8: Demand Incentive Breakup

Vehicle Segment	Target Vehicles (in 000s)	Max Ex Factory Price (in Rs Lakh)*	Total Support (in Rs Crore)
2W	1,000	1.5	2,000
3W	500	5.0	2,500
4W - EV	35	15.0	525
4W - Strong Hybrids	20	15.0	26
E-Bus	7	200.0	3,545
Total			**8,596**

Source: ICRA research, Department of Heavy Industries – Government of India
*to avail incentive

In March 2019, department of Heavy Industries came out with notification providing road map for electric vehicle mobility for next three years. Government has proposed outlay of Rs 10,000 crore under FAME II scheme, out of which 86% is towards demand incentives and rest will be towards charging infrastructure development and other marketing/publicity related activity. Government has kept private car buyers out of the incentive scheme which was disappointing. However, linkage of subsidy with battery capacity and performance of vehicle is a positive, which will incentivise improved operating efficiency of vehicles.

Demand Incentives

- Only vehicles (other than 2Ws) used for public transport are eligible for incentives; hence, demand incentives are not applicable for personal car buyers.
- Demand Incentive linked with battery capacity; Rs 20,000/Kwh for buses and Rs 10,000/Kwh for rest of the vehicle segment.
- Demand incentive amount is capped at 40% of ex-factory price for buses and 20% for the rest of the categories. It will not be eligible if ex-factory price cross maximum price threshold for that vehicle segment.
- Apart from EVs, hybrid vehicles (in PV) are also eligible for subsidy. However, there are no hybrid PVs with price below Rs 15 lakhs available in India; hence, none of the hybrid cars currently on road in India are eligible for demand incentive.
- Government focus is on localization and domestic manufacturing. OEMs will require 40% localization for buses and 50% localization for other automotive segments to become eligible for demand incentive.

Charging Infrastructure

- One slow charger for every e-bus and one fast charger for every 10 e-bus will be funded by the government
- Up-to 100% of the cost, depending on project proposal can be funded

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