

# Future of Electric Vehicle

25<sup>th</sup> Sept 2017

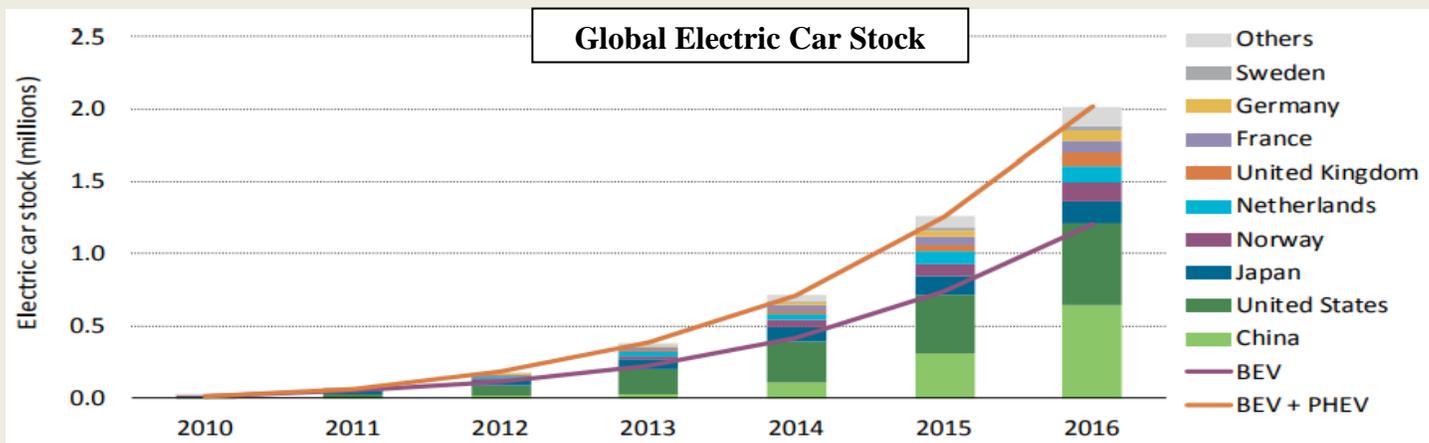


## Why EV?

We already have the technology we need to cure our addiction to oil, stabilize the climate and maintain our standard of living, all at the same time. By transitioning to sustainable technologies, such as solar and wind power, we can achieve energy independence and stabilize human-induced climate change. As we know Delhi is world's polluted city "smoking cigarettes is healthier than breathing Delhi air". This pollution kills 30,000 people in a year in Delhi itself. Over 70% pollution emissions by Vehicles. So here EV comes into picture which contributes clean energy.

## Global Outlook:-

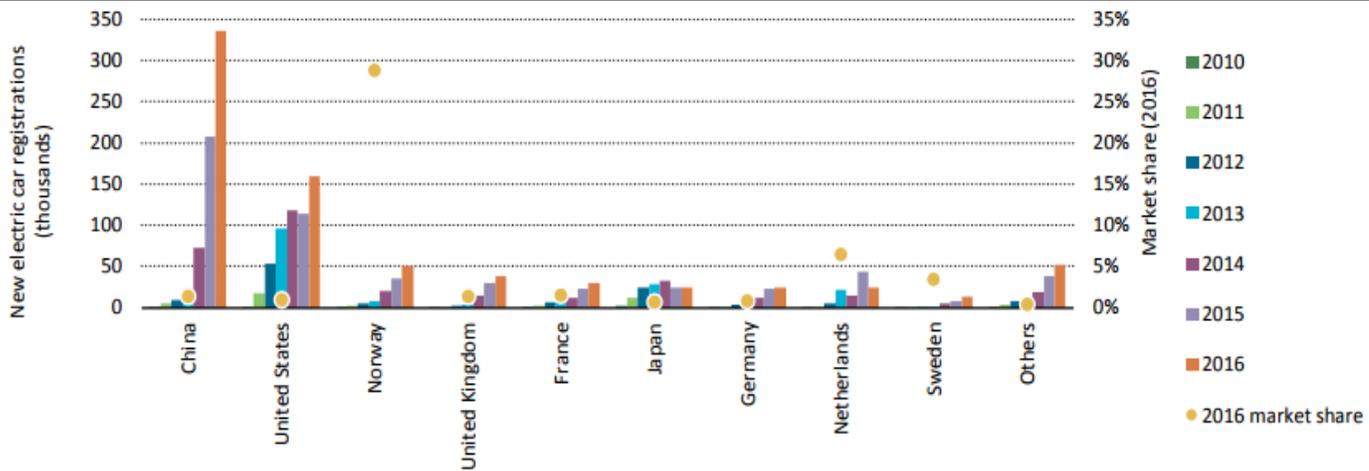
- ❖ New registrations of electric cars hit a new record in 2016, with over 750 thousand sales worldwide. With a 29% market share, Norway has incontestably achieved the most successful deployment of electric cars in terms of market share, globally. It is followed by the Netherlands, with a 6.4% electric car market share, and Sweden with 3.4%. The People's Republic of China (hereafter, "China"), France and the United Kingdom all have electric car market shares close to 1.5%. In 2016, China was by far the largest electric car market, accounting for more than 40% of the electric cars sold in the world and more than double the amount sold in the United States. The global electric car stock surpassed 2 million vehicles in 2016 after crossing the 1 million thresholds in 2015.



- ❖ Until 2015, the United States accounted for the largest portion of the global electric car stock. In 2016, China became the country with the largest electric car stock, with about a third of the global total. With more than 200 million electric two-wheelers, 3 to 4 million low-speed electric vehicles (LSEVs) and more than 300 thousand electric buses, China is also by far the global leader in the electrification of other transport modes. As the number of electric cars on the road has continued to increase, private and publicly accessible charging infrastructure has also continued to grow. In 2016, the annual growth rate of publicly available charging (72%) was higher, but of a similar magnitude, than the electric car stock growth rate in the same year (60%).
- ❖ Despite a continuous and impressive increase in the electric car stock, electric vehicle supply equipment (EVSE) deployment and electric car sales in the past five years, annual growth rates have been declining. In 2016, the electric car stock growth was 60%, down from 77% in 2015 and 85% in 2014. The year 2016 was also the first time year-on-year electric car sales growth had fallen below 50% since 2010.

- ❖ Registrations of electric cars hit a new record in 2016, with over 750 thousand sales worldwide. However, sales for 2016 showed a slowdown in the market growth rate compared with previous years to 40%, making 2016 the first year since 2010 that year-on-year electric car sales growth fell below 50%. Despite the decline, maintaining the 2016 rate of growth over the following years will still allow for meeting the sales and stock objectives of the 2DS for 2025.

**Market Share and trend of EV Sales**



**The two main electric car markets are China and the United States. Six countries reached EV market shares of more than 1% in 2016: Norway, the Netherlands, Sweden, France, the United Kingdom and China.**

- ❖ China was by far the largest electric car market in 2016, with 336 thousand new electric cars registered. Electric car sales in China were more than double the amount in the United States, where 2016 electric car registrations rebounded to 160 thousand units after a slight drop in the previous year. European countries accounted for 215 thousand electric car sales. Both globally and in the European Union, the electric car market is still concentrated in a limited number of countries. In Europe, most of the electric cars sold in 2016 were registered in just six countries: Norway, the United Kingdom, France, Germany, the Netherlands and Sweden. Globally, 95% of electric car sales are taking place in just ten countries: China, the United States, Japan, Canada and the six leading European countries.

## What Leads EV Demand Globally?

### Policy Support:-

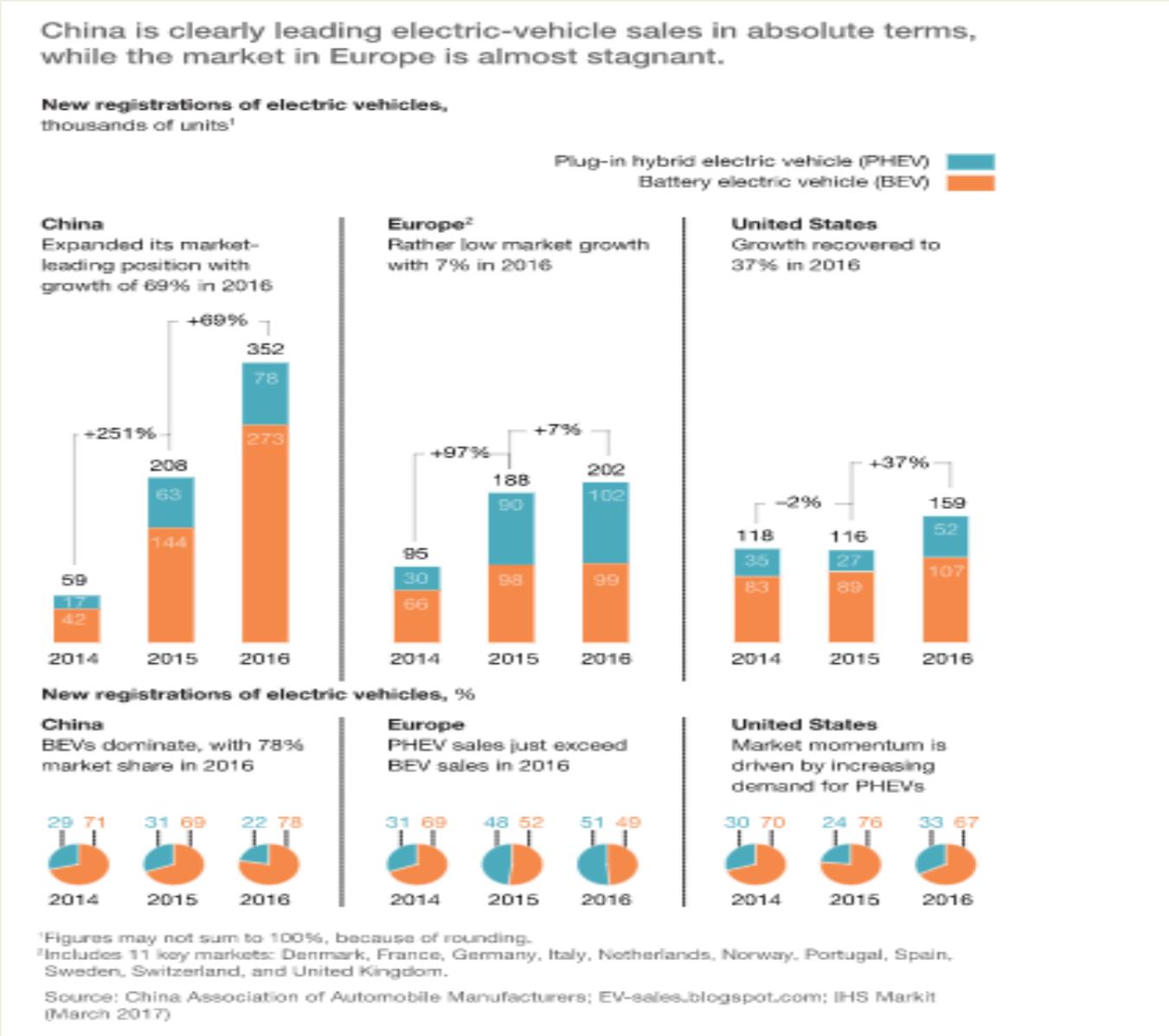
At this stage of electric car market deployment, policy support is still indispensable for lowering barriers to adoption. A supportive policy environment enables market growth by making vehicles appealing for consumers, reducing risks for investors and encouraging manufacturers willing to develop EV business streams on a large scale to start implementing them.

## **Examples of EV Policy Support:-**

1. The German government and the respective OEMs currently offer EV buyers as much as €4,000 for purely battery electric vehicles in an attempt to increase sales. But so far the effect has been limited. South Korea also recently increased EV incentives by around €1,600 to stimulate the market, while several other nations announced plans to reduce or phase out subsidies. China, for example, will slowly switch from direct subsidies to nonmonetary incentives after 2020. Currently, it retains one of the most powerful EV-stimulus mechanisms. Certain cities have made EVs exempt from license-plate lotteries and significant registration fees that apply for cars with internal combustion engines. This is a huge lever to make EVs more attractive, especially among younger first-time car buyers. Other countries that have been reducing or phasing out subsidies include Denmark, France, Portugal, and Norway.
2. In Norway, EV are exempt from acquisition tax, representing around NOK 100 000 (USD11600) (OECD, 2015). BEVs are exempt from the 25% value added tax (VAT) on car purchases. This environment, coupled with a large number of waivers on fees such as road tolls and ferries, continues to provide a highly favourable environment for electric car uptake and for BEVs in particular. BEV taxation should remain unchanged until 2020, while higher purchase rebates and tax waivers were introduced for PHEVs in 2016 compared to 2015. Free parking for electric cars has no longer been applicable nationwide since 2016. BEV sales reached a record high in 2016 but did not grow significantly compared with 2015. On the other hand, PHEV sales registered remarkable growth and more than doubled in just one year. This was consistent with the change in policy support. Other factors that may have influenced sales include changes in BEV and PHEV model availability and an increased interest in electric cars from customers who more frequently cover long-distance trips (in this case potentially favouring PHEV sales).
3. In Japan, a new subsidy scheme was introduced in 2016 that grants progressively higher subsidies as the electric range of the model increases, with the maximum subsidy set at JPY 850000 (USD 7700).
4. Chinese policies continued to provide strong financial and non-financial incentives to EV adoption in 2016. Exemptions from acquisition and excise taxes ranged between CNY 35 000 and CNY 60 000 (USD 5 000 to USD 8 500). Local and regional authorities can complement these within the limit of 50% of the central subsidies. Large Chinese cities also allow total or partial waivers from licence plate availability restrictions (EVI, 2016a). The combination of imposing licence plate restrictions, encouraging consumers to buy electric cars, and offering financial incentives – making electric cars financially accessible – explains the strong sales volumes (336 000 cars) and growth rate (40%) in 2016 compared to 2015. In its 2016-20 plan, Subsidy Schemes and Product Technology Requirements for the Promotion of New Energy Vehicles, the Chinese government announced that subsidies for EVs would be reduced by 20% from 2017 onwards, acknowledging the intention to constantly adjust and improve its policies for an optimised market response (MoF, 2017). Despite these changes, China's electric car market continued to grow in early 2017 (Pontes, 2017).

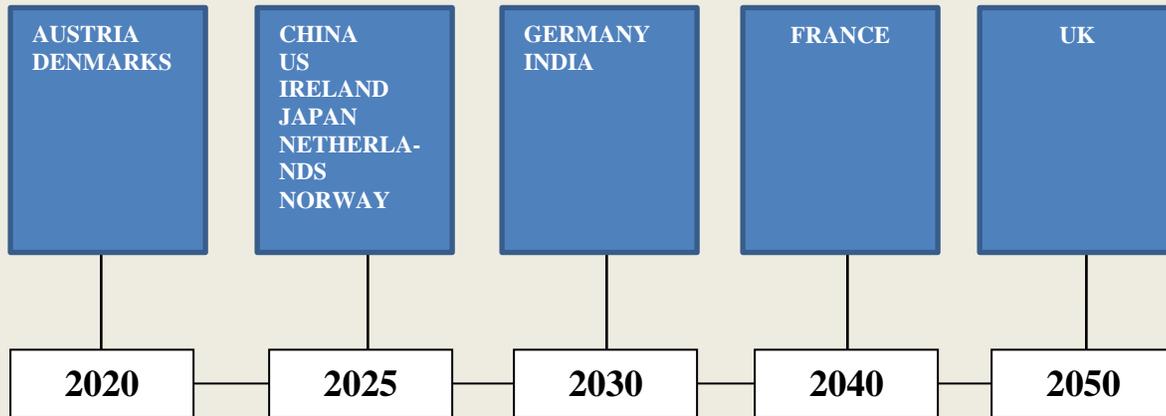
## China Leading the EV Market:-

Approximately 375,000 electric vehicles (EVs) were manufactured by Chinese OEMs in 2016—an impressive 43% of EV production worldwide.



Research says that China is leading in EV sales because Government is supporting manufacturer as well as Consumers hence proved that policy support and Power station (Infra) growth most important to lead EV sales.

## Road Map of EV Target:-



## EV Cars available with top Speed:-

MANUFACTURER	MODEL	TOP SPEED	CHARGING AT HOME(HRS)	PUBLIC CHARGING(HRS)
BMW	i3	150 km/h (93 mph)	4	30min
Citroën	C-Zero	130 km/h (81 mph)	7	30min
COURB	C-ZEN	110 km/h (68 mph)	6	
Hyundai	Ioniq	185 km/h (115 mph)	4	33min
Kyburz	Kyburz eRodRace	140 km/h	4	
Lightning	Lightning GT	200 km/h (124 mph)	1	
Mercedes-Benz	B-Class Electric Drive	160 km/h (99 mph)	9	2.4
Mitsubishi	i-MiEV	130 km/h (81 mph)	10	30min
MW Motors	Luka EV[24]	148 km/h (92 mph)	9	2
Nissan	Leaf	150 km/h (93 mph)	20	30min
Peugeot	iOn	130 km/h (81 mph)	7	30min
Renault	Fluence ZE	135 km/h (84 mph)	Battery swap in 5 min	
Renault	Zoe	135 km/h (84 mph)	8	30min
Tesla	Model S	209 km/h (130 mph)	8	20min
Tesla	Model X	210 km/h (130 mph)	8	20min
Volkswagen	e-Golf	145 km/h (90 mph)		
Volkswagen	e-Up	130 km/h (81 mph)		

## Indian Electric Vehicle Market:-

### Future of EV in India:-

- ❖ Electric vehicles (EVs) are growing in popularity and certainly in mind space. They are cleaner and more efficient. Their growth, however, is still considered just a market problem: The end user should choose on the basis of what it costs to buy and run, or how it performs, etc. Markets matter, but there is also a need for government and policy inputs.
- ❖ Indians are famously value conscious. This is why consumers love diesel cars, despite their higher MRP and pollution relative to petrol counterparts. Even at today's low oil prices, running a diesel sedan can cost about Rs3.8 per kilometer versus petrol's Rs5.5. In contrast, CNG costs roughly Rs1.9/km, but it's not widely available. The cost of EVs depends on electricity price, which varies significantly. At Rs7/kWh (kilowatt hour) of power, they cost only about Rs1.1/km This saves consumers driving 5,000km per year over Rs20,000 annually, and taxis much more as they drive 10-15 times as much.
- ❖ The catch is the upfront cost. EVs are expensive, primarily because of the battery. A single kWh of electricity is enough to go about 6km, so a 200km "full tank" range requires about 35 kWh of battery. Today's prices for lithium ion batteries are about \$250/kWh globally, which comes to Rs5.7 lakh in battery costs, excluding import duties. Even with an eight-year lifespan and a 12% interest rate, justifying the battery costs on per kilometer savings alone means one would have to drive over 25,000km per year. Doable, but not for everyone. However, when battery prices fall to \$100/kWh, as projected a few years out, EVs can become a game changer.
- ❖ 5,000km per year is only about 15km per day on average, while an urban taxi may do 300km daily. Higher range means not only more battery cost but weight as well. In an ideal world, we would have a smaller battery pack and simply recharge periodically. In practice, taxi and fleet vehicles can only charge overnight, and even private users may have limits on charging options. Without fast-charging infrastructure—fast-charging an EV requires much more power than household 15 amp sockets, which can only offer about 3 kW of power, so 35 kWh takes almost 12 hours to charge—one inevitably has "range anxiety". Unlike the US, most Indians don't have a personal garage. Hence, widespread and company-agnostic public charging infrastructure becomes a key policy choice.

### Government Initiatives:-

**The power minister Piyush Goyal's announcement in April, that the country would stop selling petrol and diesel cars by 2030. The move is particularly promising for the electric vehicle (EV) sector that is estimated to be worth \$731 billion globally by 2027, according to a report from research firm IDTechEx.**

- 1) In November 2010, the Government of India, through the Ministry of New and Renewable Energy (MNRE), announced a subsidy of Rs. 950 million for electric vehicles. The subsidy provided benefits up to 20% on the ex-factory price, with a maximum benefit of Rs. 100,000 on electric cars, 4,000 on two-wheelers, 5,000 on high speed two-wheelers, 400,000 rupees for electric minibuses, and 60,000 for three wheelers. To claim the subsidy, manufacturers need to certify that 30% of the components were made in India. The scheme ended on 31 March 2012.
- 2) In April 2014, the Indian government announced a new plan to provide subsidies for hybrid and electric vehicles. The plan will have subsidies up to Rs. 150,000 for cars and Rs. 30,000 on two wheelers. India aims to have seven million electric vehicles on the road by 2020.
- 3) Government also giving benefit on tax for EV buyers which is 12% from normal cars buyers which is 28%.

Vehicle Segment	Min Incentive	Max Incentive
2 wheeler Scooter	1,800	22,000
Motorcycle	3,500	29,000
3 Wheeler Auto-rickshaw	3,300	61,000
4 wheeler cars	11,000	1,38,000
LCVs	17,000	1,87,000
Bus	30,00,000	66,00,000

### Indian Auto companies on EV:-

- 1) The country's top PSU led by NTPC will invest over Rs. 10,000 crore to set up the infrastructure for charging and battery swap stations. PSUs like IOC and PGCL are set to study the feasibility of investing in the infrastructure.
- 2) Mahindra & Mahindra, India's pioneer in the electric car segment recently committed Rs 600 crore to its electric vehicle arm and plans to strengthen its portfolio, starting from the E20 to a Pininfarina-designed auto.
- 3) As part of the initiative, Suzuki is also looking to infuse \$600 Mn (INR 3,900 Cr) for the construction of a new plant at Hansalpur. The proposed factory will boast a manufacturing capacity of over 250K units. Additionally, Suzuki has announced plans to set up another factory that would be manufacturing lithium-ion batteries for electric as well as hybrid cars. For the project, the company has partnered with Denso to build the core technology. It will also be working with Toshiba to create the fuel cells and cell modules.
- 4) JSW Energy announced that it would invest up to Rs 4,000 crore to manufacture EVs by taking help of China's Zhejiang Geely.

### Electric 4 Wheelers in Indian Market

Company	Brand	Type	Battery Type	Availability
Mahindra	e20	BEV	Li-Ion	Since 2013
Mahindra	Scorpio Hybrid	HEV	Li-Ion	Announced
Mahindra	e-Verito	BEV	Li-Ion	Launched 2016
Toyota	Prius	PHEV	NiMH	Since 2012
Toyota	Camry Hybrid	HEV	NiMH	Since 2013
Honda	Civic Hybrid	HEV	NiMH	For past 6 years
BMW	BMW i8	HEV	Li-Ion	Launched 2014
BMW	BMW i3	HEV	Li-Ion	Oct-16
Maruti Suzuki	Ciaz	HEV	Li-Ion	Launched 2015
TATA	Megapixel	HEV	Li-Ion	2016
TATA	Indica Vista Electric	BEV	Li-Ion	Jul-16
Nissan	Leaf	BEV	Li-Ion	2016
Hyundai	i10 Electric	BEV	Li-Polymer	2016
KPIT	Rivolo	HEV	NA	R&D Stage

## Charging Infrastructure in India:-

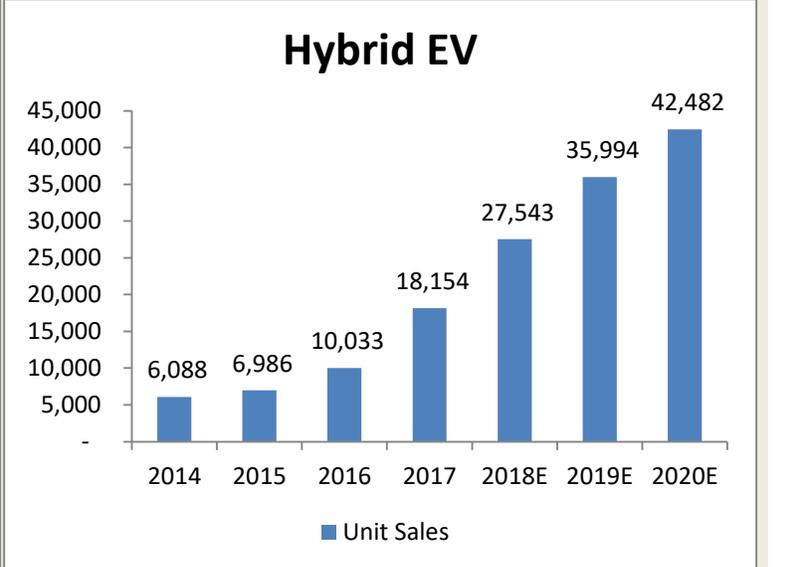
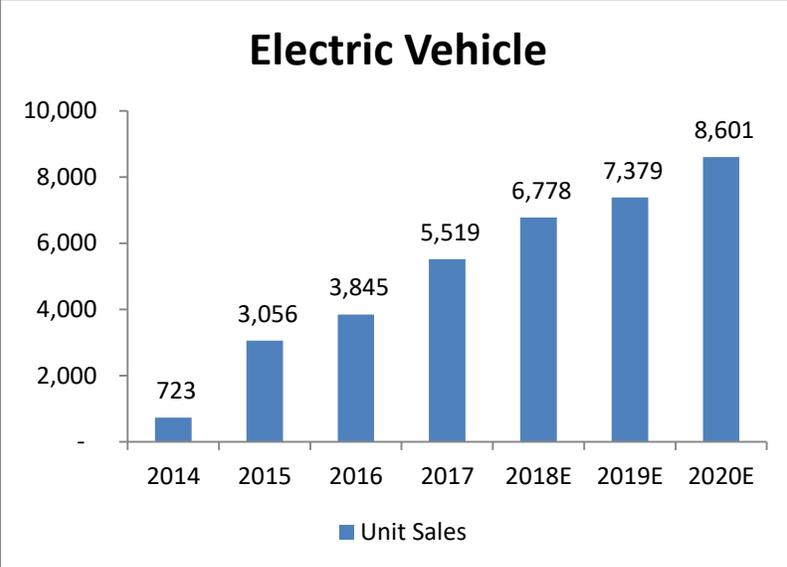
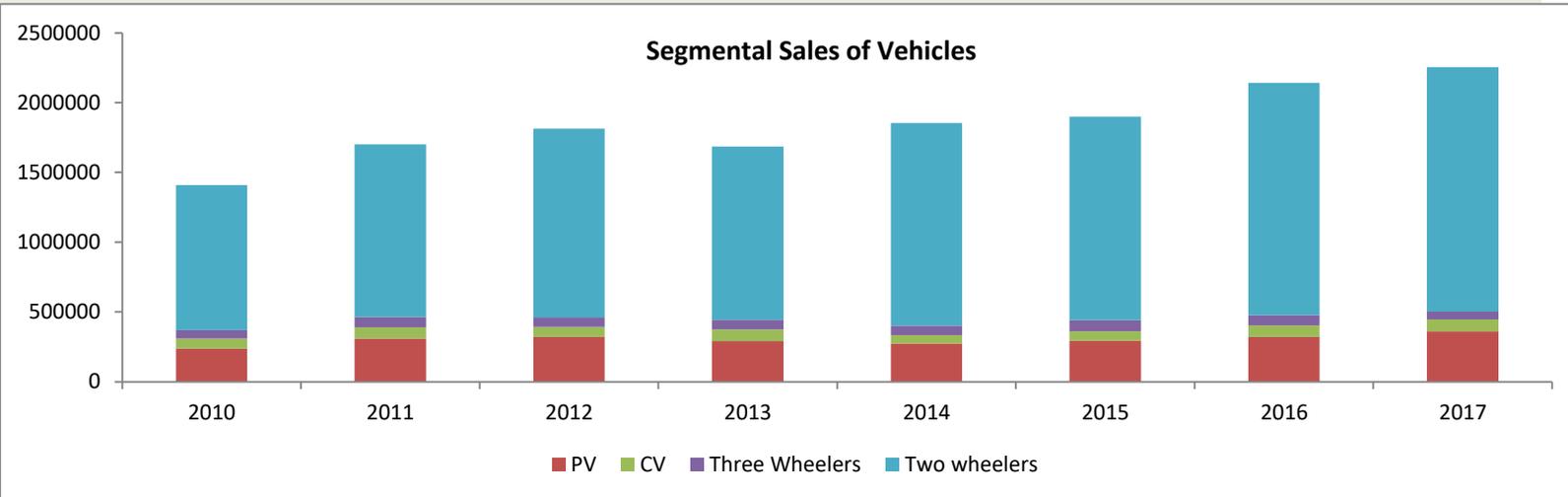
- ❖ For mass adoption of EV's in India, One of the major hurdles is Charging Infrastructure. It is not feasible to take an EV for a long distance journey due to lack of charging infrastructure.
- ❖ To fulfill government's aim of 6-7 million (60-70 lakh) electric and hybrid vehicles on road by 2020, estimated fund of INR 14,000 crore is required. Out of which government only allocated INR 795 Crore (6% of the estimation) for initial 2 years (2015-17).
- ❖ Out of INR 795 Crore, central government only allocated INR 10 Crore and INR 20 crore for the year 2015-16 and 2016-17 for charging infrastructure set up, which is very low as per the requirement.
- ❖ Low Investment in Charging Infra and also due to the lack of the Standards/Regulations required for charging EV's are creating Questions on the ambitious target of the government.
- ❖ Government need to involve private players to set up charging stations on a PPP mode.
- ❖ Smart Charging Company, New Motion announced to Invest INR 1,000 crore in India on charging infrastructure development which is a positive sign for the future of Ev's in India.
- ❖ As the Tesla also announced to launch its model 3 electric sedan in India, which is creating a curiosity in the rich Indian class and tesla also signalled that they will start the groundwork for a launch by setting up its 'super charger' network of charging stations across India.

Location	Type of Charger
Residential colonies	Normal Charger
Railway, Bus and Metro stations	Normal and Fast Chargers
Mall and Market place	Normal and Fast Chargers
Commercial centers, Hospitals, Hotels etc.	Normal and Fast Chargers
Campus and Industrial Parks	Normal Charger
Petrol Pumps	Fats Chargers
Highways	Normal and Fast Chargers

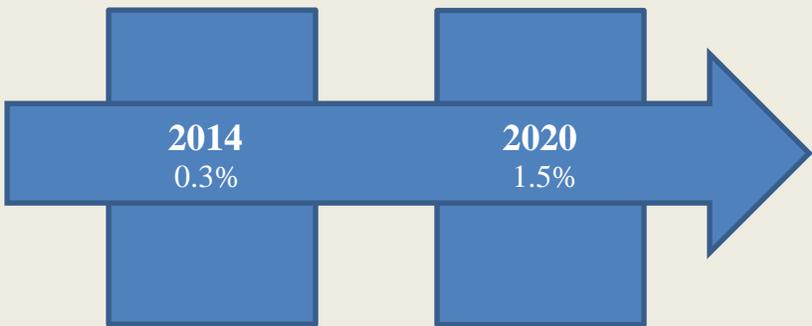
ISGF under the aegis of SUG (Smart Utilities Group) formed a subcommittee of SUG members to work on recommendations related to appropriate EV charging Infrastructure and business models that are sustainable and to submit them to NAB and Ministry of Heavy Industry for incorporating in the( NEMMP2020) framework and policies

**Market Potential:-**

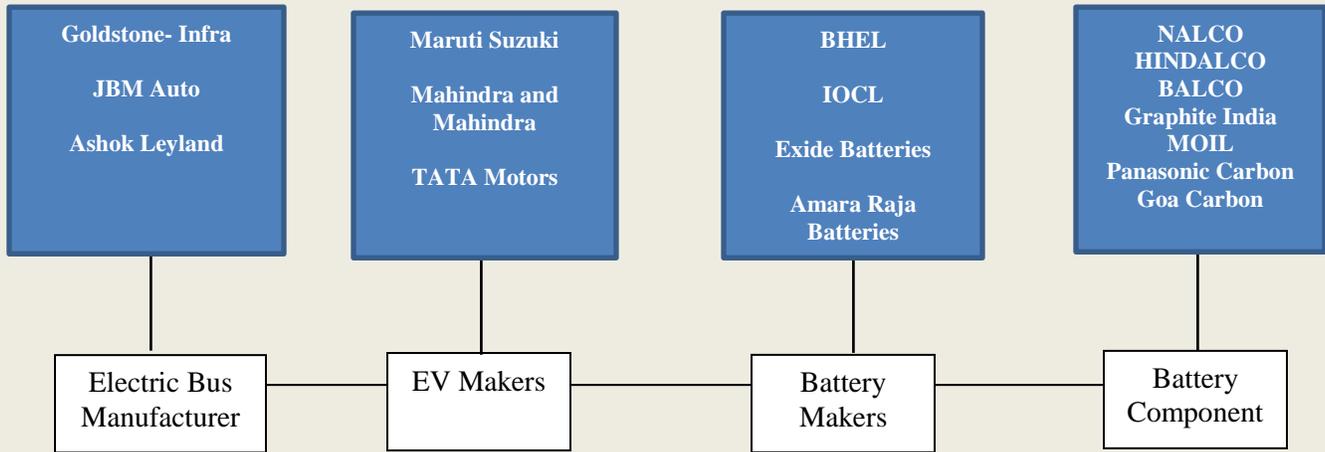
Electric vehicles (EV) industry is at a nascent stage in India, comprising less than 1% of the total vehicle sales, however it has the potential to grow significantly in the coming years. Electric vehicle sales are expected to grow at high double digit growth rates annually till 2020



**Share of EV to total light weight vehicle**



## Auto and Auto-ancillaries Makers:-



## Conclusion:-

- ❖ **India is the 4th largest emitter of greenhouse gases (GHG) globally. Strong International pressure is coming to reduce the global greenhouse gas emissions. And also there is an internal pressure coming from the Supreme Court and national Green Tribunal (NGT) of India. Moreover, India imported 202.1 million tons of crude oil in the last fiscal year i.e. (2015-16) in comparison to the crude oil import of 189.4 million tons in 2014-15 which cost India more and it contribute about 50% to India's import. The initial cost of Electric Vehicles is very high in comparison to Conventional Vehicles even after VAT exemption by various states and subsidy by the government under FAME India Scheme but the Cost of Maintenance is also very low for EV's as compared to Conventional vehicles. Price for fuel/charging will reduce by one third compared to conventional vehicle. History tells that India is the country which never minds the cost of cars if its fuel cost is low. Hence, Future of Electrical Vehicle Market in India will grow gradually.**

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