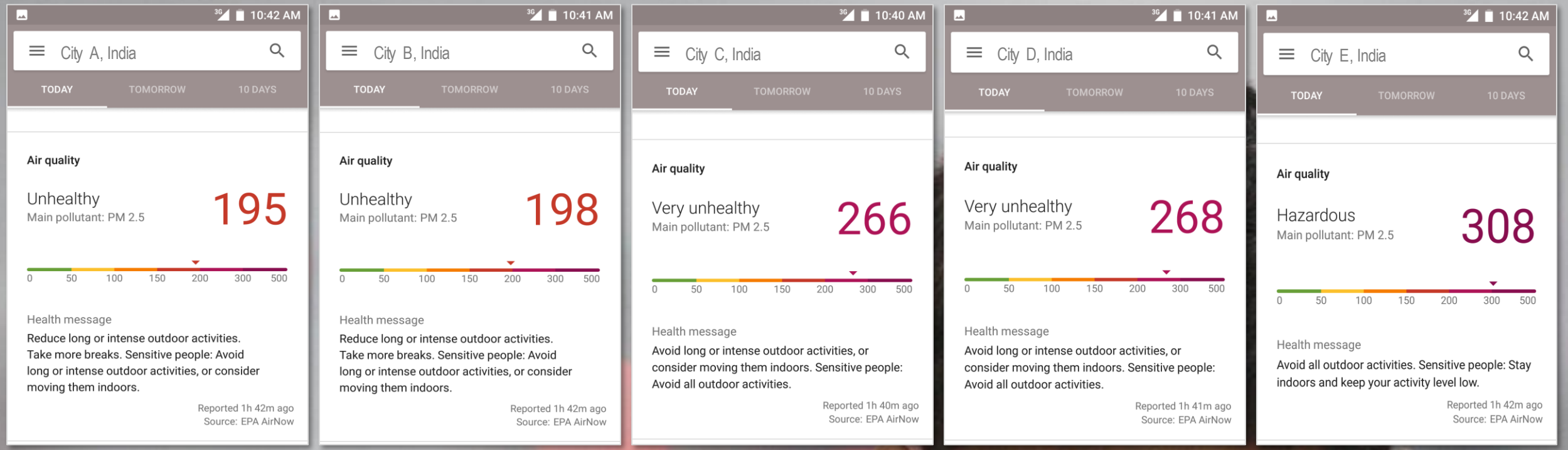
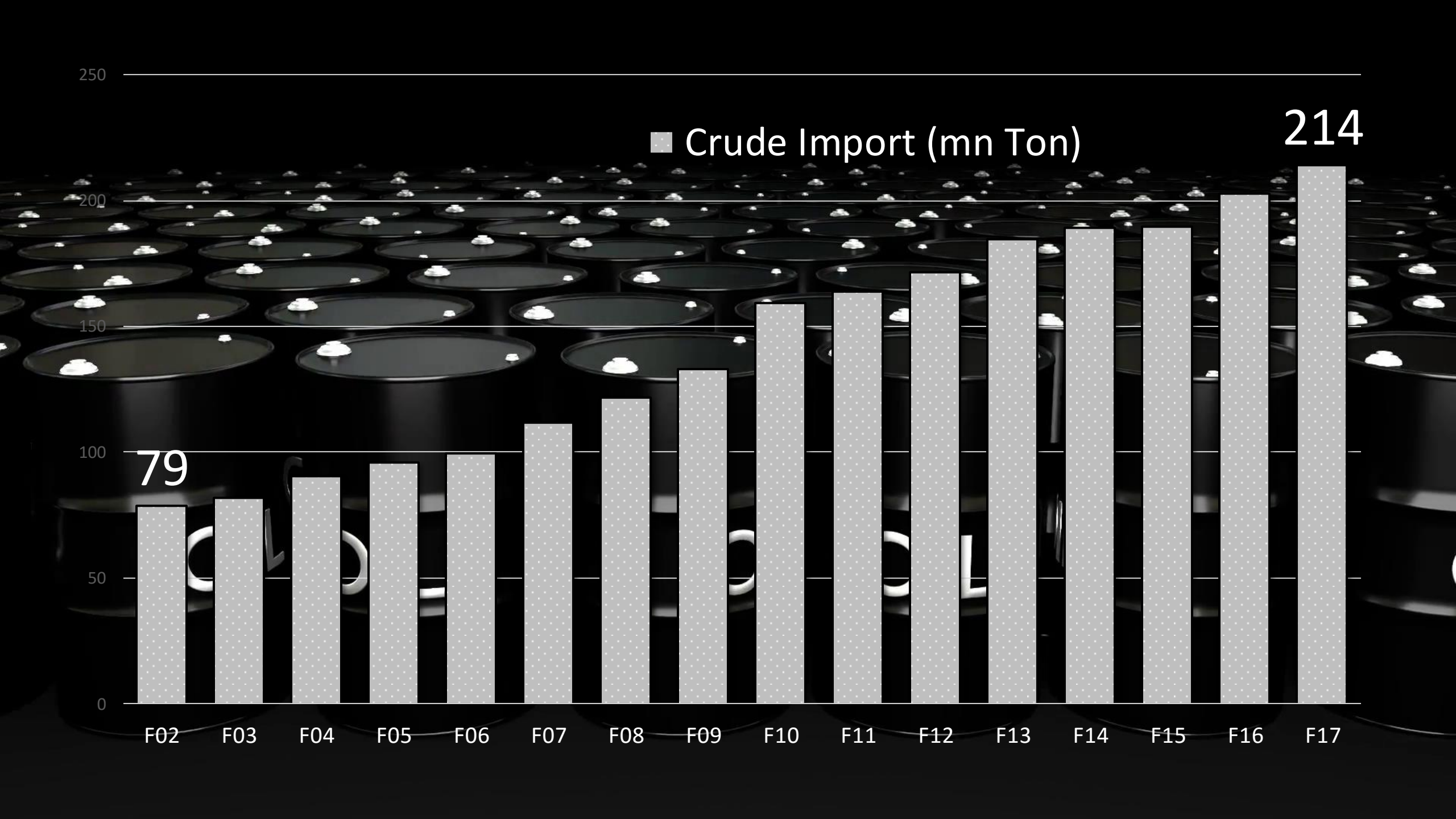
EV 2030

India's Race to Clean Mobility

Dr. Pawan Goenka
Managing Director, Mahindra & Mahindra Limited
12 January 2018


10:42 AM
City A, India
TODAY
TOMORROW
10 DAYS
Air quality
Unhealthy
Main pollutant: PM 2.5
195
0 50 100 150 200 300 500
Health message
Reduce long or intense outdoor activities. Take more breaks. Sensitive people: Avoid long or intense outdoor activities, or consider moving them indoors.
Reported 1h 42m ago
Source: EPA AirNow
10:41 AM
City B, India
TODAY
TOMORROW
10 DAYS
Air quality
Unhealthy
Main pollutant: PM 2.5
198
0 50 100 150 200 300 500
Health message
Reduce long or intense outdoor activities. Take more breaks. Sensitive people: Avoid long or intense outdoor activities, or consider moving them indoors.
Reported 1h 42m ago
Source: EPA AirNow
10:40 AM
City C, India
TODAY
TOMORROW
10 DAYS
Air quality
Very unhealthy
Main pollutant: PM 2.5
266
0 50 100 150 200 300 500
Health message
Avoid long or intense outdoor activities, or consider moving them indoors. Sensitive people: Avoid all outdoor activities.
Reported 1h 40m ago
Source: EPA AirNow
10:41 AM
City D, India
TODAY
TOMORROW
10 DAYS
Air quality
Very unhealthy
Main pollutant: PM 2.5
268
0 50 100 150 200 300 500
Health message
Avoid long or intense outdoor activities, or consider moving them indoors. Sensitive people: Avoid all outdoor activities.
Reported 1h 41m ago
Source: EPA AirNow
10:42 AM
City E, India
TODAY
TOMORROW
10 DAYS
Air quality
Hazardous
Main pollutant: PM 2.5
308
0 50 100 150 200 300 500
Health message
Avoid all outdoor activities. Sensitive people: Stay indoors and keep your activity level low.
Reported 1h 42m ago
Source: EPA AirNow


250
200
150
100
50
0
Crude Import (mn Ton)
79
214
F02
F03
F04
F05
F06
F07
F08
F09
F10
F11
F12
F13
F14
F15
F16
F17

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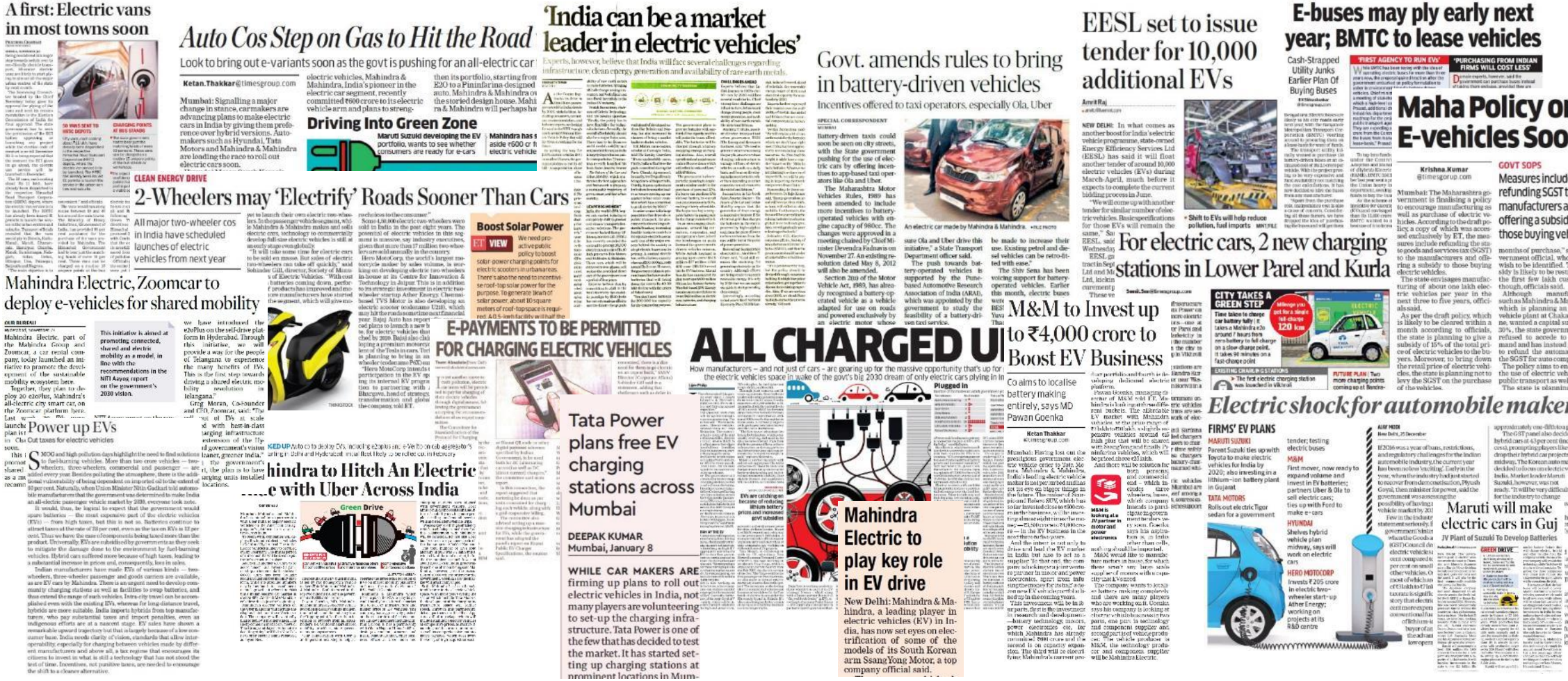
INDIA LEAPS AHEAD:
TRANSFORMATIVE MOBILITY SOLUTIONS FOR ALL

MAY 2017

2017

Year of the EV "Talk"



A first: Electric vans in most towns soon

Auto Cos Step on Gas to Hit the Road

Look to bring out e-variants soon as the govt is pushing for an all-electric car

Ketan.Thakkar@timesgroup.com

Mumbai: Signalling a major change in stance, carmakers are advancing plans to make electric cars in India by giving them preference over hybrid versions. Automakers such as Hyundai, Tata Motors and Mahindra & Mahindra are loading the race to roll out electric cars soon.

'India can be a market leader in electric vehicles'

Experts, however, believe that India will face several challenges regarding infrastructure, clean energy generation and availability of rare earth metals.

Driving Into Green Zone

Govt. amends rules to bring in battery-driven vehicles

Incentives offered to taxi operators, especially Ola, Uber

EESL set to issue tender for 10,000 additional EVs

E-buses may ply early next year; BMTC to lease vehicles

Cash-Strapped Utility Junks Earlier Plan Of Buying Buses

'FIRST AGENCY TO RUN EVs' 'PURCHASING FROM INDIAN FIRMS WILL COST LESS'

Maha Policy on E-vehicles Soon

Krishna.Kumar @timesgroup.com

GOVT SOPS

Measures include refunding SGST to the manufacturers and offering a subsidy to those buying vehicles

CLEAN ENERGY DRIVE

2-Wheelers may 'Electrify' Roads Sooner Than Cars

All major two-wheeler cos in India have scheduled launches of electric vehicles from next year

Boost Solar Power

ET VIEW We need pro-active public policy to boost solar-power charging points for electric scooters in urban areas. There's also the need to incentivise roof-top solar power for the purpose. To generate 1km of solar power, about 10 square meters of roof-top space is required. A 0.5-km facility will half the

Mahindra Electric, Zoomcar to deploy e-vehicles for shared mobility

This initiative is aimed at promoting connected, shared and electric mobility as a model, in line with the recommendations in the NITI Aayog report on the government's 2030 vision.

E-PAYMENTS TO BE PERMITTED FOR CHARGING ELECTRIC VEHICLES

ALL CHARGED U

How manufacturers – and not just of cars – are gearing up for the massive opportunity that's up for grabs in the electric vehicles space in wake of the govt's big 2030 dream of only electric cars plying in

Plugged In

M&M to Invest up to ₹4,000 crore to Boost EV Business

Co aims to localise battery making entirely, says MD Pawan Goenka

Ketan Thakkar
ktimesgroup.com

Power up EVs

Cut taxes for electric vehicles soon.

This i

SMEG and high pollution days highlight the need to find solutions to fuel-burning vehicles. More than two crore vehicles — two-wheelers, three-wheelers, commercial and passenger — are added every year. Besides polluting the atmosphere, there is the additional vulnerability of being dependent on imported oil to the extent of 80 per cent. Naturally, when Union Minister Nitin Gadkari told automobile manufacturers that the government was determined to make India an all-electric passenger vehicle country by 2030, everyone took notice.

It would, thus, be logical to expect that the government would spare batteries — the most expensive part of the electric vehicles (EVs) — from high taxes, but this is not so. Batteries continue to attract taxes at the rate of 28 per cent, even as the tax on EVs is 12 per cent. Thus we have the case of components being taxed more than the product. Universally, EVs are subsidised by governments as they seek to mitigate the damage done to the environment by fuel-burning vehicles. Hybrid cars suffered more because of high taxes, leading to a substantial increase in prices and, consequently, loss in sales.

Indian manufacturers have made EVs of various kinds — two-wheelers, three-wheeler passenger and goods carriers are available, as are EV cars by Mahindra. There is an urgent need to develop community charging stations as well as facilities to swap batteries, and thus extend the range of such vehicles. Intra-city travel can be accomplished even with the existing EVs, whereas for long-distance travel, hybrids are more suitable. India imports hybrids from top manufacturers, who pay substantial taxes and import penalties, even as indigenous efforts are at a nascent stage. EV sales have shown a remarkable upward trajectory but that is largely because of a low consumer base. India needs clarity of vision, standards that allow interoperability, especially for charging between vehicles made by different manufacturers and above all, a tax regime that encourages its citizens to invest in what is still a technology that has not stood the test of time. Incentives, not punitive taxes, are needed to encourage the shift to a cleaner alternative.

Tata Power plans free EV charging stations across Mumbai

DEEPAK KUMAR
Mumbai, January 8

WHILE CAR MAKERS ARE firming up plans to roll out electric vehicles in India, not many players are volunteering to set-up the charging infrastructure. Tata Power is one of the few that has decided to test the market. It has started setting up charging stations at prominent locations in Mum-

Mahindra Electric to play key role in EV drive

New Delhi: Mahindra & Mahindra, a leading player in electric vehicles (EV) in India, has now set eyes on electrification of some of the models of its South Korean arm SsangYong Motor, a top company official said.

For electric cars, 2 new charging stations in Lower Parel and Kurla

Electric shock for automobile makers

FIRMS' EV PLANS

MARUTI SUZUKI
Parent Suzuki ties up with Toyota to make electric vehicles for India by 2020; also investing in a lithium-ion battery plant in Gujarat

TATA MOTORS
Rolls out electric Tigor sedans for a government tender; testing electric buses

M&M
First mover, now ready to expand volume and invest in EV batteries; Partner Bluo & Ola to sell electric cars; ties up with Ford to make e-cars

HYUNDAI
Shelves hybrid vehicle plan midway, says will work on electric cars

HERO MOTOCORP
Invests ₹205 crore in electric two-wheeler start-up Ather Energy; working on projects at its R&D centre

Maruti will make electric cars in Guj

JV Plant of Suzuki To Develop Batteries

- Will 2018 be the Year of EV “Action”?

- Will Mobility in India be substantially Electric by 2030?
  - If so, what are the implications?

Myths Related to EVs

1. CO_2 emitted from power generation makes EVs unclean

2. India does not have sufficient power for EVs

3. We are substituting Oil import with Lithium import

BEVs* are Significantly Cleaner Even After Counting the CO_2 Emission from Power Generation

	e2o+ (Battery EV)	Equivalent Petrol Veh.	Equivalent Diesel Veh.	Equivalent CNG Veh.
CO_2 (g/km)	98	~135	~125	~118
Tail pipe Emission (for a new BS IV vehicle)				
CO (g/km)	ZERO	~1.000	~0.500	~0.400
HC (g/km)		~0.075	-	
NOx (g/km)		~0.080	~0.250	~0.080
PM (g/km)		~0.002	~0.025	~0.002

Source : M&M Data, Industry Information * BEV – Battery Electric Vehicle

BEVs will Become Cleaner with Cleaner Power Generation

	2016	2021-22	2026-27
CO_2 emission from Power generation in India (kg/kWh)	0.732	0.581	0.522
CO2 g/km of BEV	**98.4**	**78.1**	**70.2**

Source : M&M Estimates, National Electricity plan - 2016"- CEA published by Central Electricity Authority, Ministry of Power, Govt. of India

10 million EVs in Operation will Consume Just 3.2% of Total Power Generation Capacity

3.2%

Assumption of 10 mn EVs and Power Generation Capacity in 2022

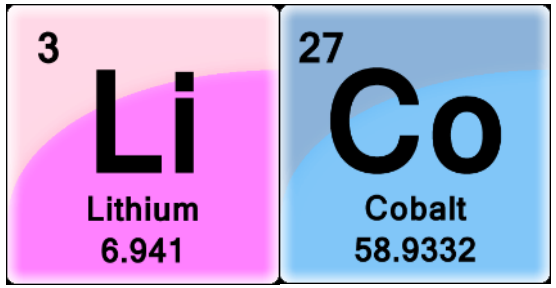
Source : M&M Estimates, Draft National Energy Policy

Lithium Import/car is less in Value than Crude Import

USD 4,800

USD 2,750

(40% Less)



USD 1,050

(75% Less)

- Import value estimated for a car operation of 200,000 km
- Li-ion cell cost estimate for year 2021-22

Source : M&M Estimates, Crude price at USD 61.6 / bbl

Real Hurdles to EV Adoption

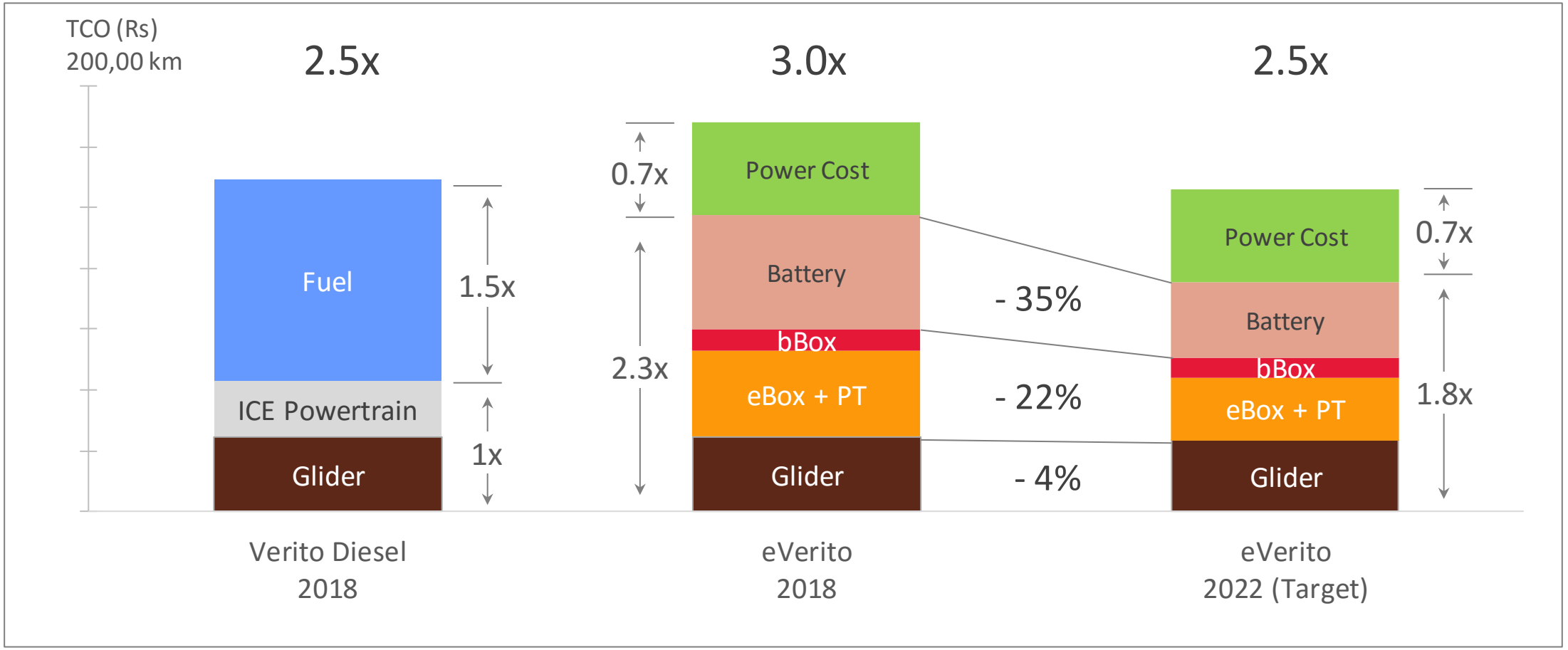
1. Lack of
Charging infrastructure

2. Risk averseness towards early
technology adoption

3. High acquisition cost
leading to unaffordable TCO

Battery Cost is the Single Largest Lever to EV Cost Reduction

Indicative Numbers

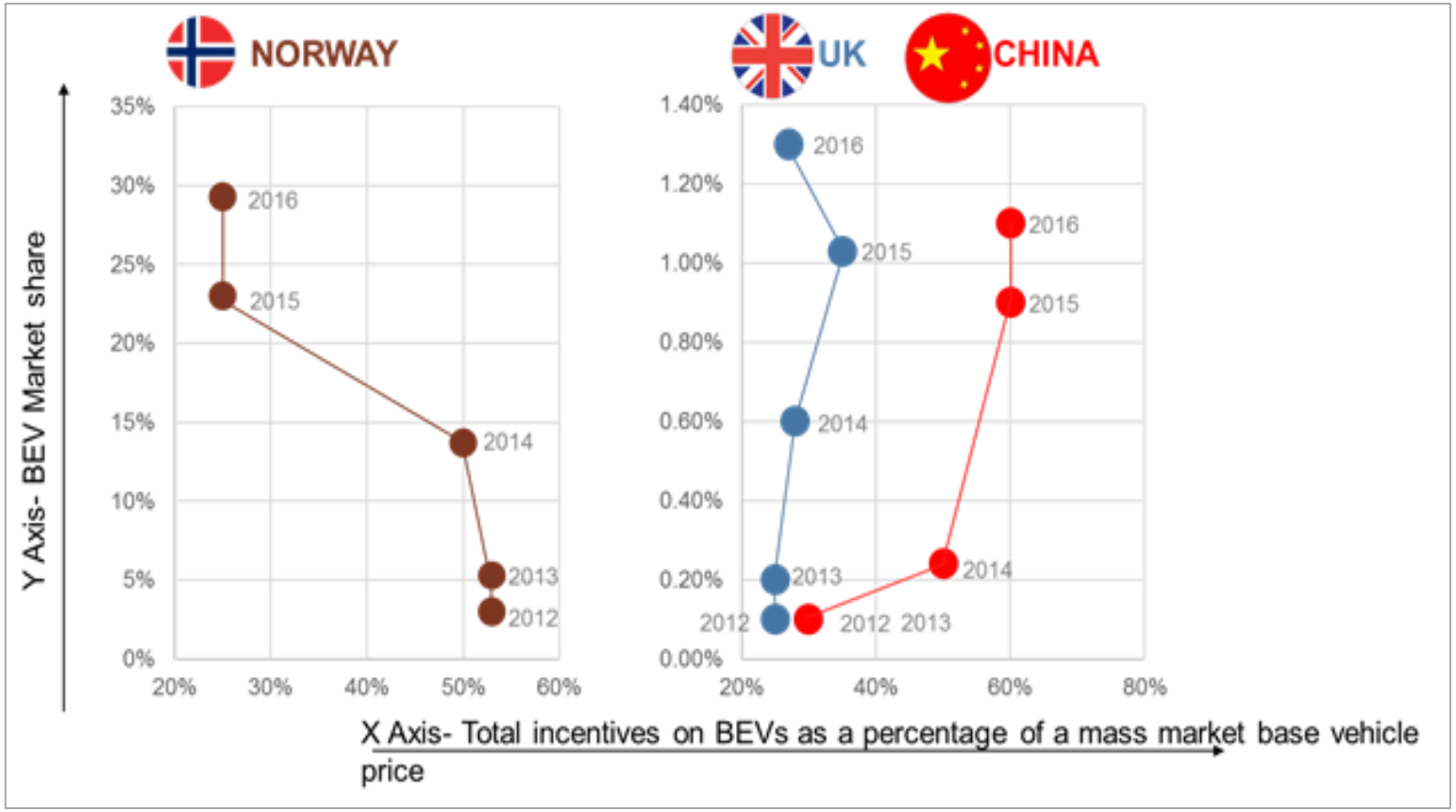


Subsidies important till battery cell prices reach sub $100/kWh

TCO Economy of Using EVs

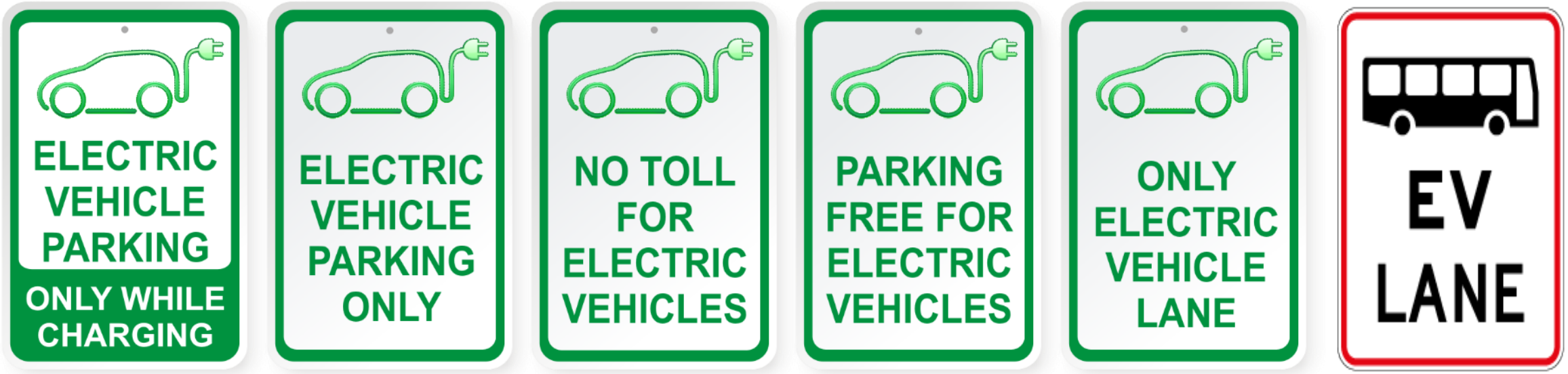
	With Current subsidy & Current Battery Prices	With No Subsidy & USD 100 Cell Price
3W eRick + eAuto		
4W Personal application		
4W Fleet Application		
4W Commercial Application		
Buses		

Learning from Norway, China, UK : Cash incentives and Much More

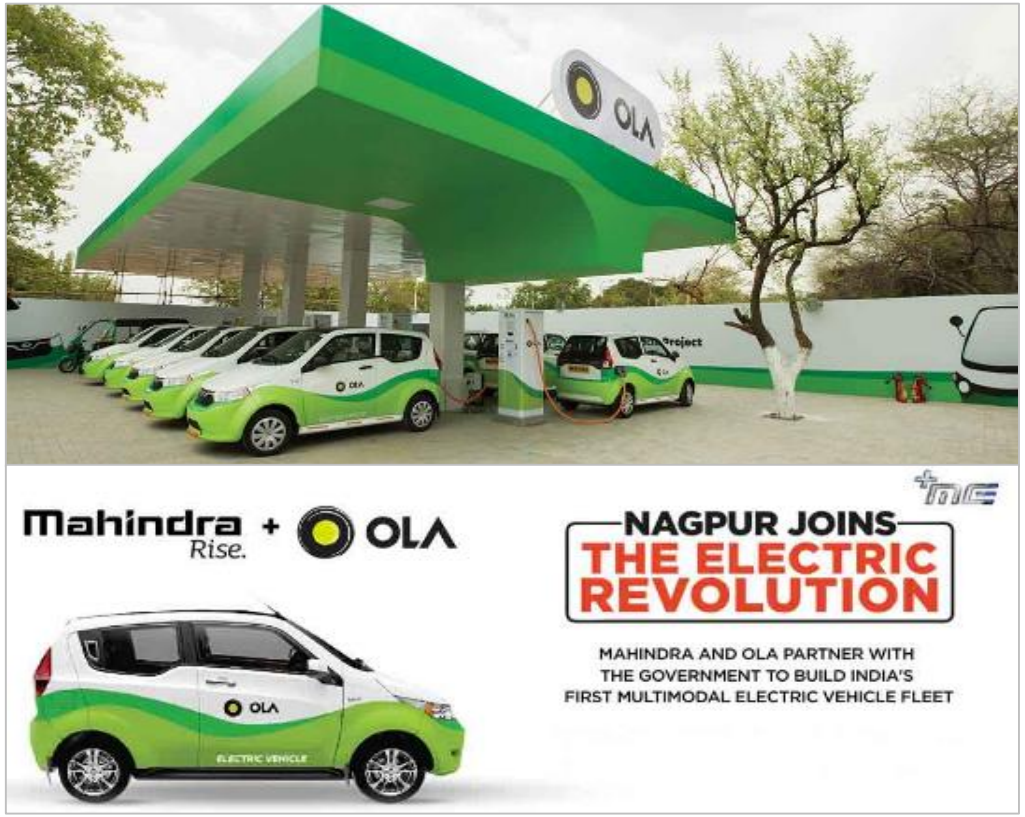


Key markets have provided a high level of incentives to help grow market share of EV's and then have tapered off the incentives helping the EV market to grow organically

Non Fiscal Incentives



3,500 BEVs Fleet on Indian Roads with 50 mn cumulative miles clocked



Government Buying : India Setting the Example

EESL Issues India's First Ever Tender to Procure 10,000 Electric Vehicles

EESL to float tender for 10,000 additional electric vehicles

Basic specifications for the electric vehicles will be same as last tender, says EESL managing director Saurabh Kumar

Delhi Govt Picks Up 500 Electric Buses to Counter Rising Pollution

Home › Business

Government to provide grants to cities buying electric vehicles for mass transport

By PTI | Published: 05th November 2017 12:47 PM |

Recommendations to speedup EV adoption

- Current incentives to continue (till cell prices below $ 100 /kwh)
- Localization of EV components
- Non fiscal incentives for EVs
- Charging infrastructure
- Government / Fleet Buying

Some Concerns to be Addressed

1. What happens to the IC Engine industry ?

2. What happens to employment in Auto Industry ?

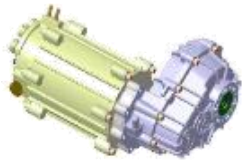
Scenario for ICE vehicles

- Inter-city mobility will still be driven by IC engines
- Estimates for ICE share and CAGR 2017-2030

Vehicle Segment	% ICE in 2030	CAGR 2017 - 2030
PV	~ 60%	4%
LCV	~ 30%	Flat
MHCV	~ 95%	8%
2W	~ 50%	4%

Source : M&M Estimates, Inputs from NITI Aayog Report

New Opportunities in the Auto Industry



EV powertrain sub systems

Opportunity to create/grow electronics hardware industry in India

Battery module / pack

Creating manufacturing jobs for batteries and the energy storage industry

Power Electronics

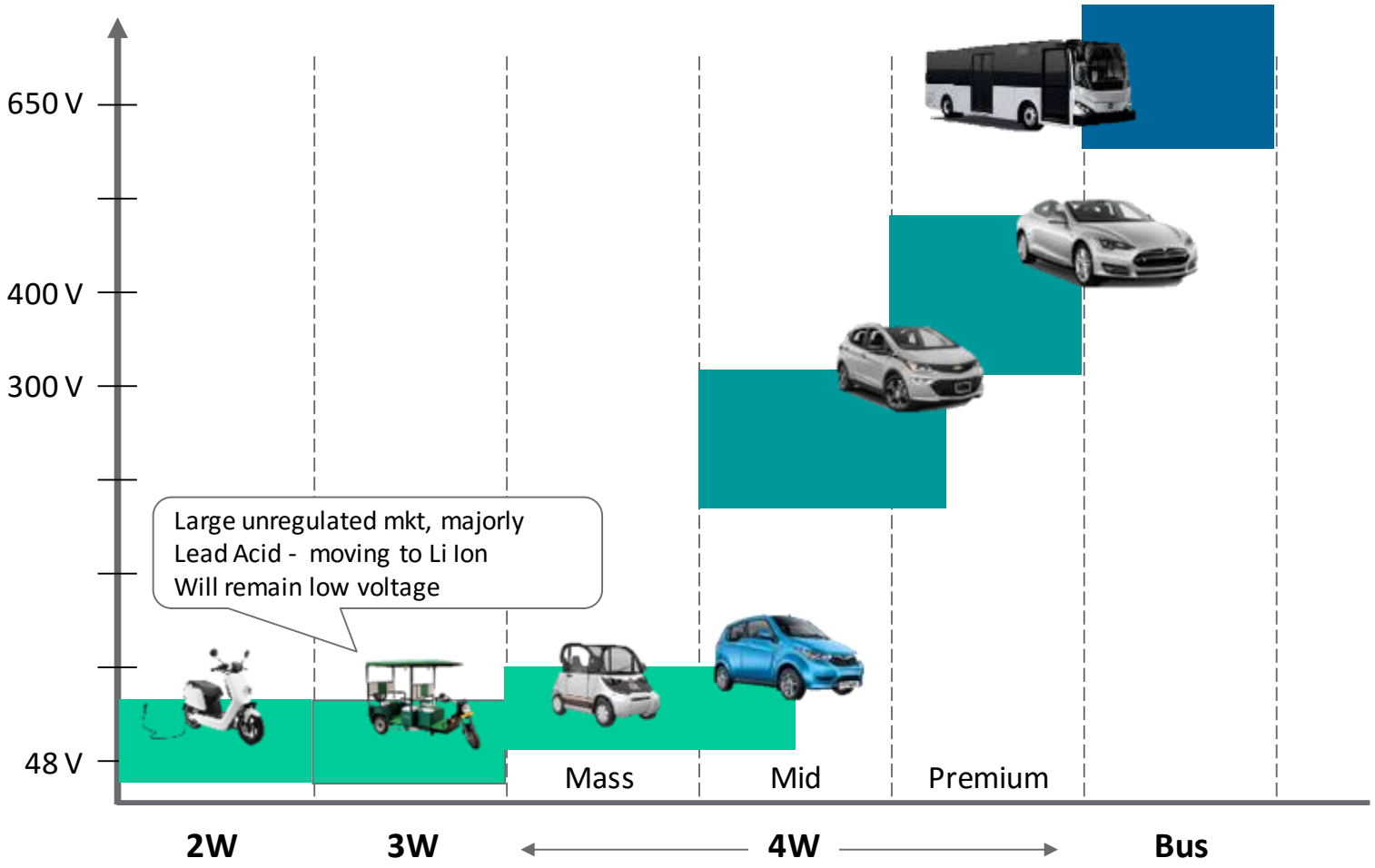
Light weighting is one of the key necessities for EVs and can provide growth to the aluminium and chemical industries

Light weighting technologies

Software

Each EV model requires millions of lines of software code to operate, creating jobs in software

India Complexity arising from Affordability & Application Spectrum



Mass intra city transport

Executive employee commute
Premium personal application

Last mile commute
Short distance intra city commute

EV Technology : India Operating across the Technology Spectrum

Battery	Motor – Charging – System Voltage

- Energy density and fast charging requirements driving battery chemistry research
- Solid state and Lithium Air battery chemistry seem to be top contenders

- India will need to work with a mix of low and hi voltage systems
  - Motors : BLDC – PMSM – liquid cooled
  - Charging : BCP < 100 V and BCP > 100V
  - Voltage : 48-72V and 350+V
  - Slow charging – Fast charging – Battery Swapping

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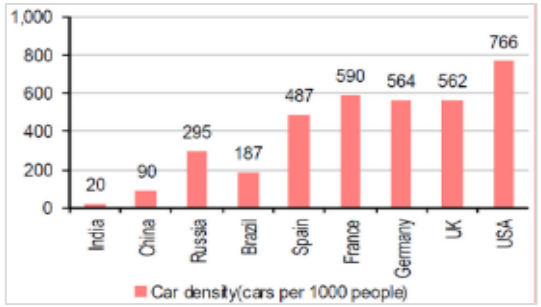
an Opportunity for

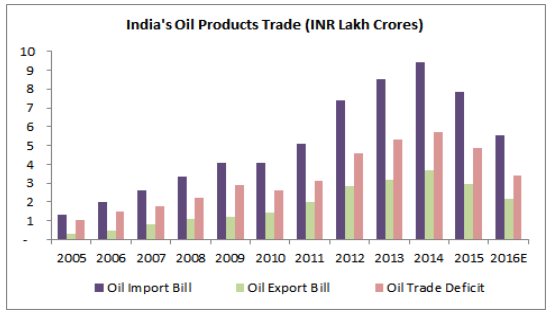
India : Poised for the EV Revolution

Low PV penetration



However there exists a high level of …

High Oil import bill



Being offset by …

Rise in public infra

Leading to high requirement of …

Congestion & Pollution

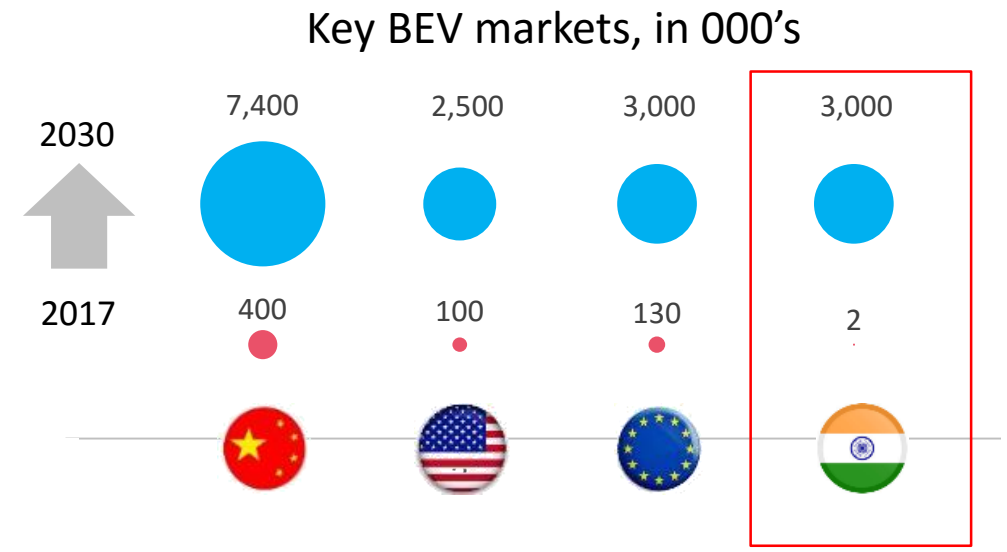
Rise in Renewables

Last mile mobility

Electric Mobility

Shared Mobility with Fleets

EVs : The ‘Make in India’ Opportunity



Source: Goldman Sachs Global Investment research, September 2017

India likely to become the 2nd largest EV market in the world

- R & D
- Manufacturing
- Infrastructure
- Export

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Opportunity for Brand India

Opportunity for India to leapfrog and become a globally attractive destination for manufacture of EVs, EV components and EV software

In Summary

- No doubt of India's market potential for EVs
- A very significant opportunity for 'Make in India'
- Need a long term view to capitalize the EV Opportunity
  - Indigenization of technology is crucial
  - Battery cost, Charging infrastructure cost and Sweating of assets is the key to EV affordability
  - Initial push through subsidies and incentives with phased tapering in 3-5 years
- Joint working between Government and Industry

Thank You.

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