



busworld[®]
academy

KNOWLEDGE PLATFORM
FOR THE WORLDWIDE
BUS & COACH SECTOR

The implementation of electro-mobility today

Jan Deman, Director Busworld Academy



WORLD BUS DEMAND

Item	2008	2013	2018	% Annual growth	
				2008-2013	2013- 2018
Global Bus Demand	452.0	512.0	664.0	2.5	5.3
North America	58.0	52.1	59.2	- 2.1	2.6
Western Europe	35.1	27.4	34.3	- 4.8	4.6
Asia/Pacific	245.5	303.0	403.0	4.3	5.9
Central & South America	39.0	48.6	62.4	4.5	5.1
Eastern Europe	37.0	32.5	39.1	- 2.6	3.8
Africa/Mid.East	37.4	48.4	66.0	5.3	6.4



CURRENT FLEETS AND FUTURE TRENDS

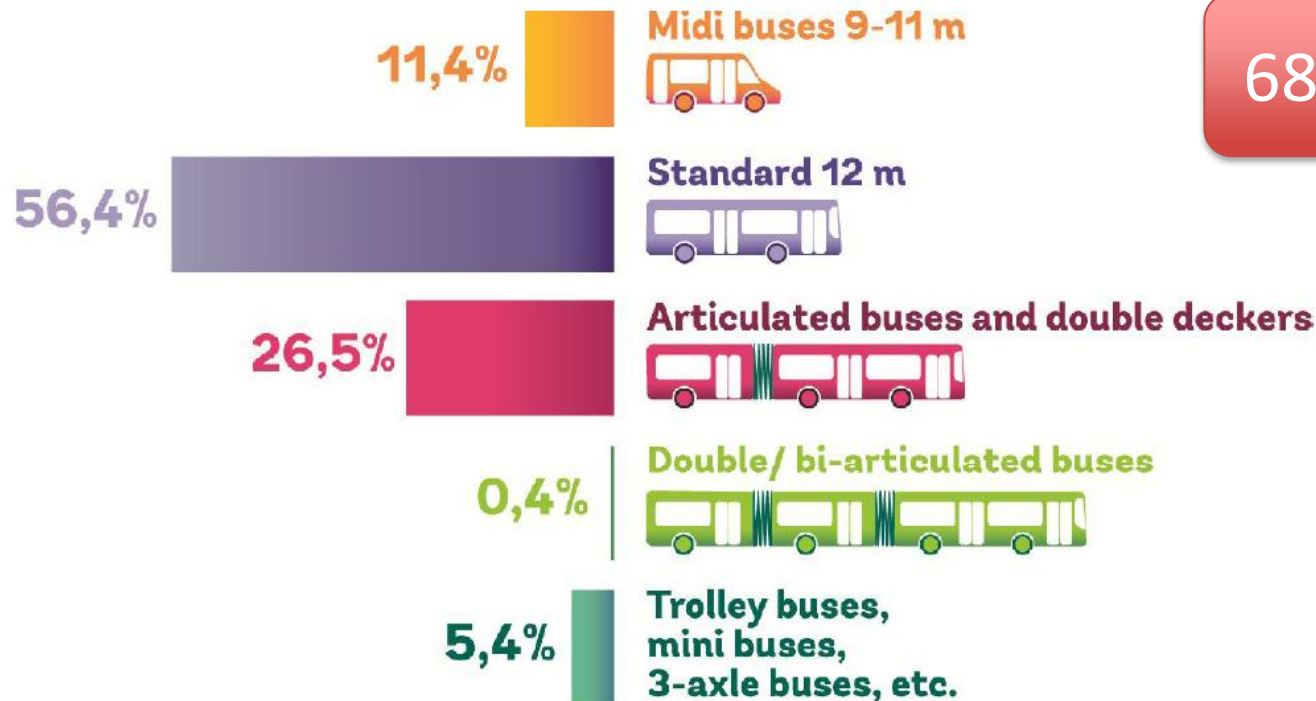
A study by 3iBS

Overall, responses were collected from **70** stakeholders
operating in **63** cities totalling a fleet of around
70.000 buses & trolley buses serving
a population of over **100.000.000**
inhabitants in **24** countries



FLEET COMPOSITION

Bus fleet breakdown per vehicle size



68.508 buses

Current
Fleets



FLEET COMPOSITION

Respondents distribution according to future plans to change bus fleet composition (percentage totals up > 100%)

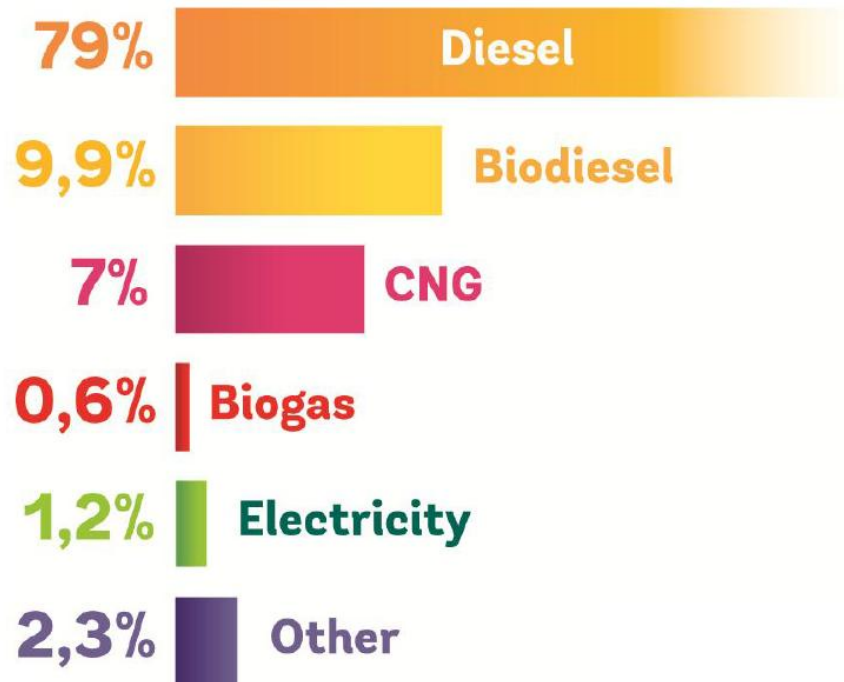


Future Trends



PROPULSION

Bus fleet breakdown per fuel or energy used

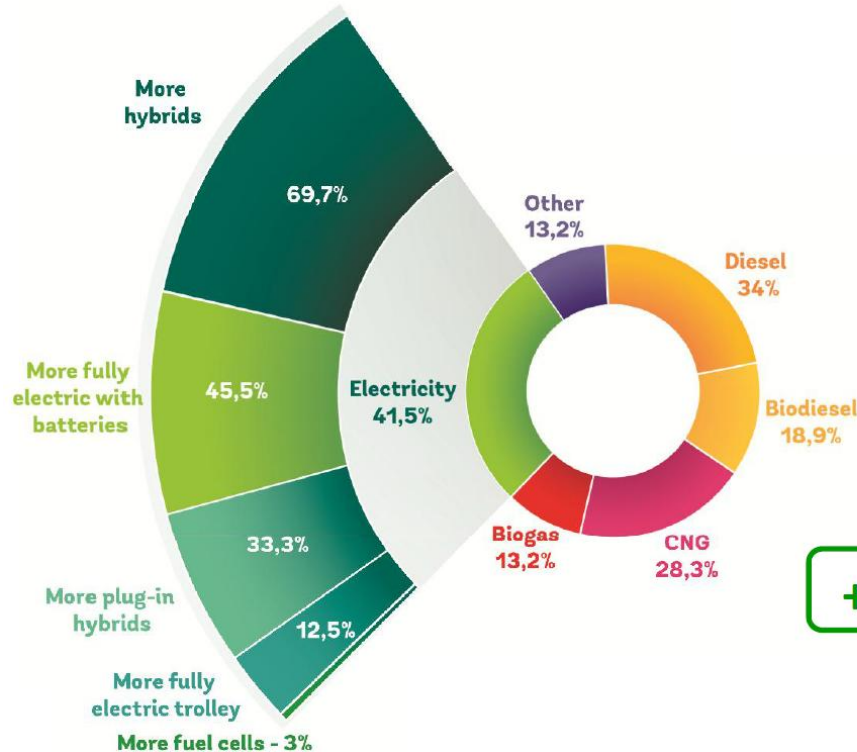


Current
Fleets



PROPULSION

Respondents distribution according to future plans to change propulsion system ratio (percentage totals up > 100%)



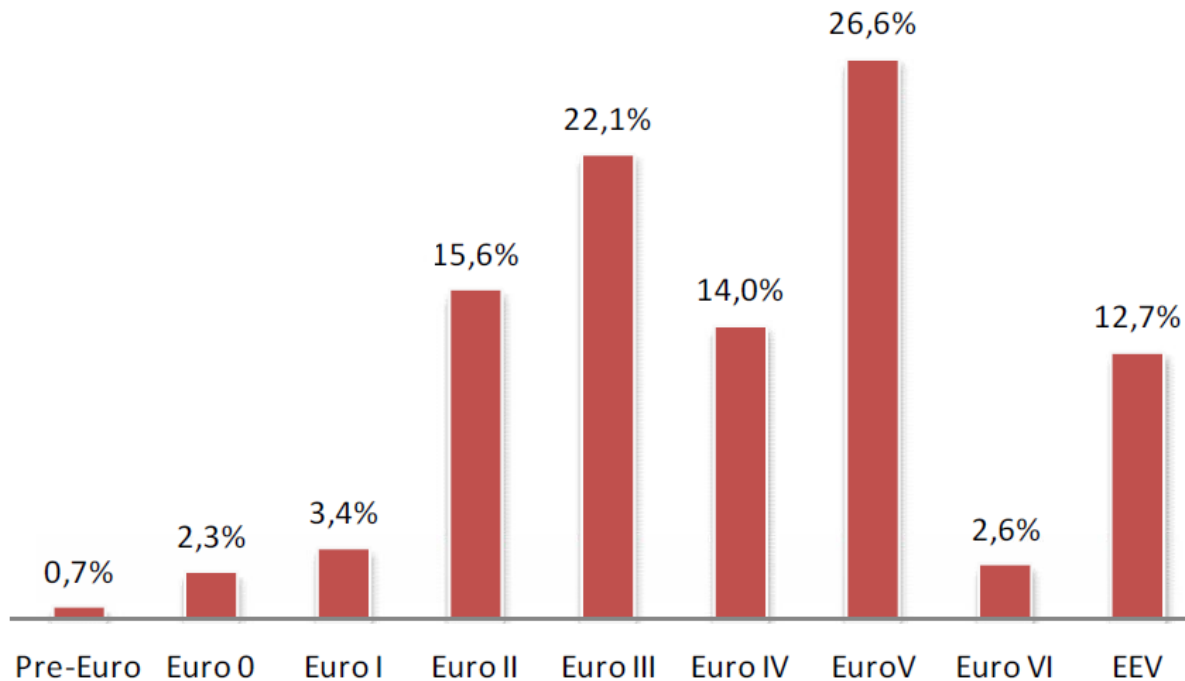
+ 41,5%

Future Trends



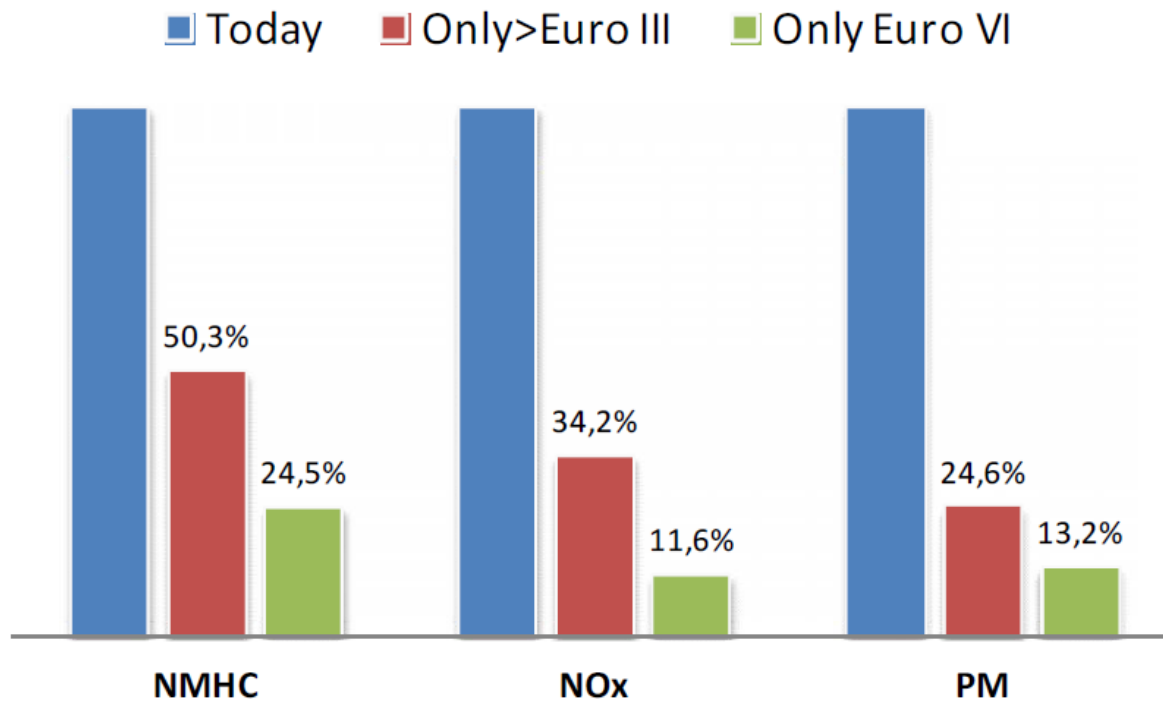
EURO STANDARDS

Bus fleet breakdown per Euro Standards

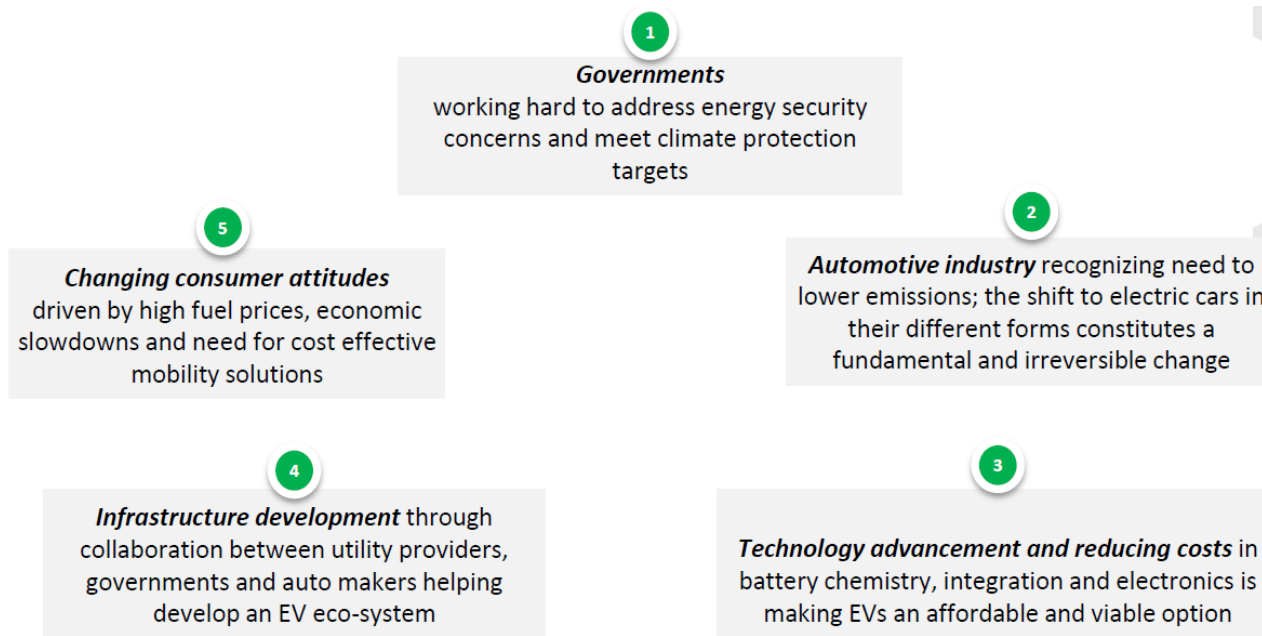


EURO STANDARDS

Estimated emissions reduction by renewing the fleet



Multiple forces giving the strongest push ever for the electrification of transportation



The global EV industry is experiencing rapid growth in sales as well as in product offerings



Indian government projections on the xEV Market in India

Vehicle Seg./ country		2W	4W Range		Buses	Total range	
India xEV projections 2020	Numbers	4.8	1.6	1.7	0.002	5	7
Penetration of xEV India	%	15.0%	17.8%	18.9%	-	14-16 %	
Total vehicle Sales India	Numbers	32	9	9	-	43	
Global xEV projections 2020	Numbers	27	5	13	0.12	32.12	40.12
Global penetration of xEV	%	35.5%	7%	19%	20%		
Total vehicles 2020	Numbers	76	70	70	0.57		
India Share as per above	%	17.8%	12.8% - 30%				

What are the factors that will determine this?



Urbanization – Some Predictions for India in 2020

590 million people will live in cities, nearly twice the population of the United States today

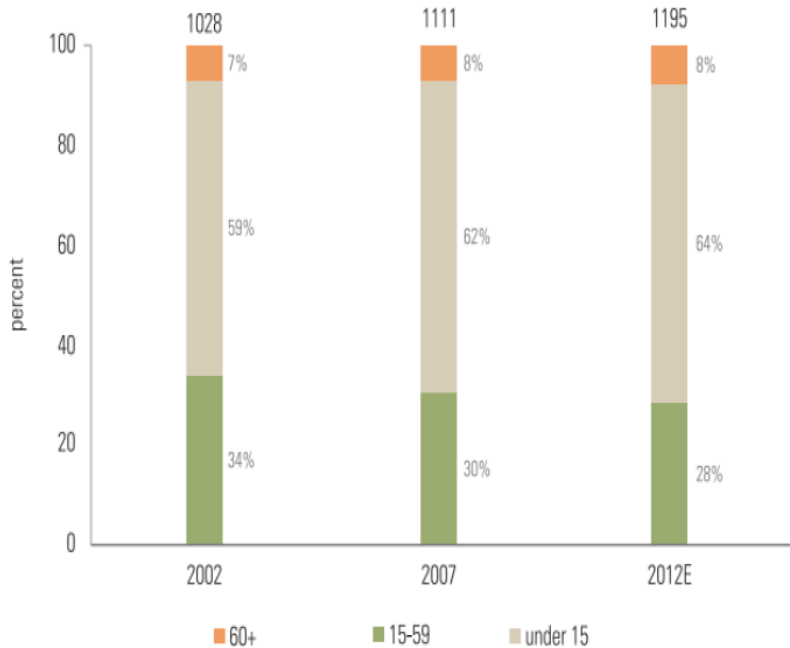
68 cities will have population of 1 million plus, up from 42 today; Europe has 35 today

7,400 kilometers of metros and subways will need to be constructed – 20 times the capacity added in the past decade



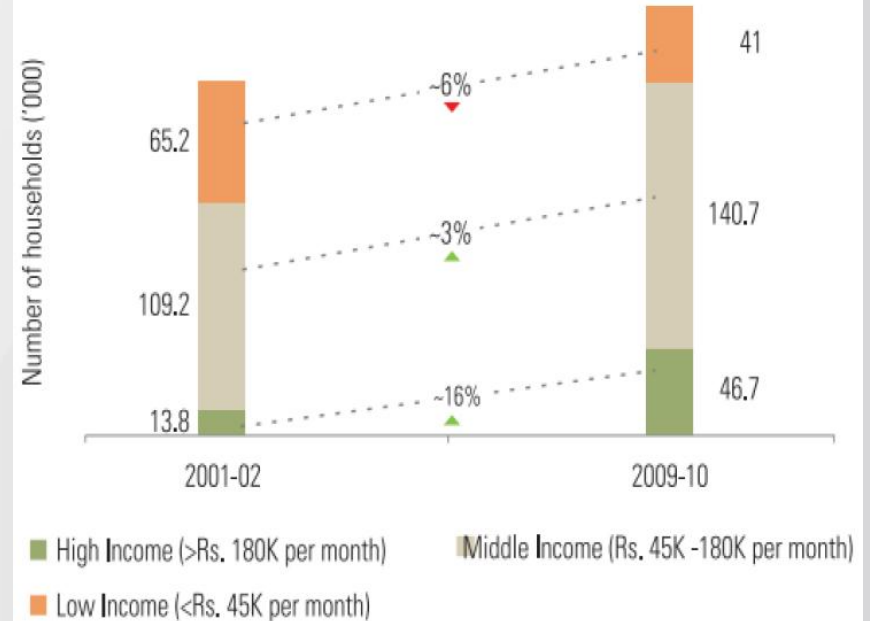
Affluence & Demographics

India's changing demographic profile (Mn) across age groups



Source: Planning Commission India

Growth in Population Categories with higher incomes

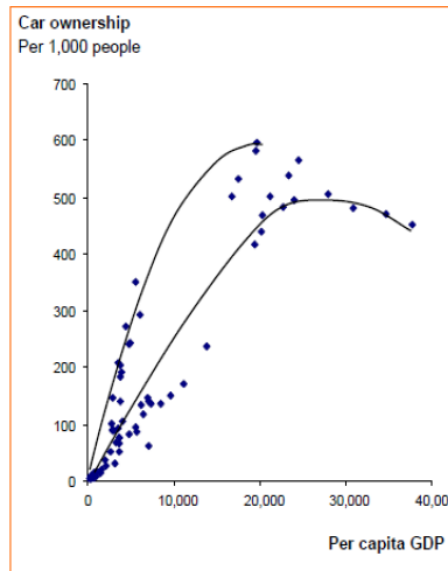
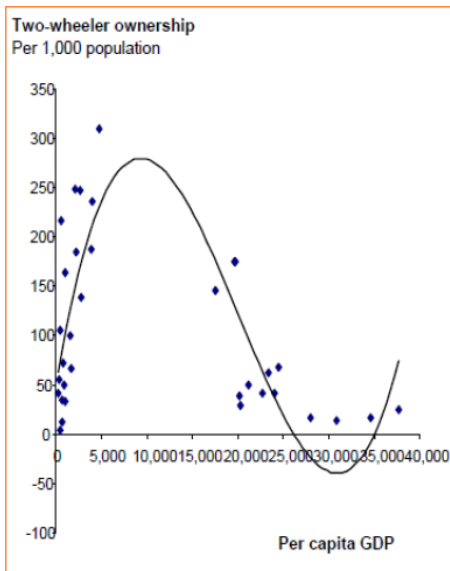


Source: NCAER Estimates



Increase in vehicle ownership

As incomes rise, vehicle ownership will rise proportionately



Urban travel in Indian cities predominantly happens through walking, cycling and public transport, including intermediate public transport (IPT)

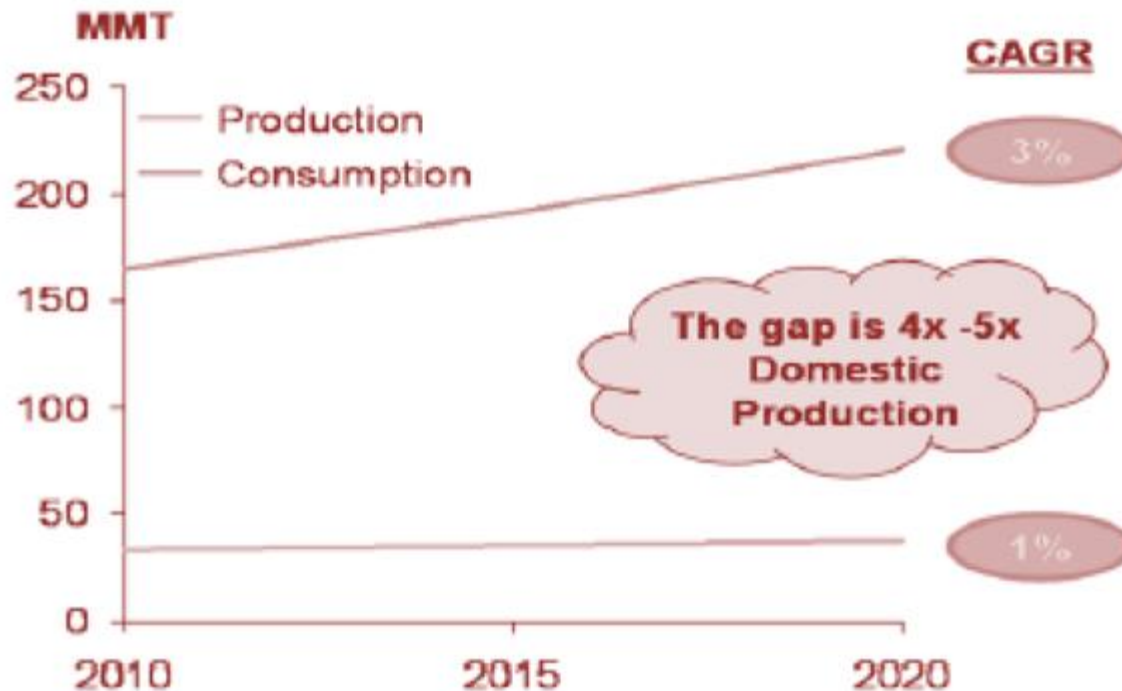
- Car ownership: 3-13 % of the households
- Two wheelers: 40-50 %

Source: Global Insight, Indiatat: press searches; National Highway Authority of India; McKinsey Global Institute analysis



The Energy Security Imperative

India: Production and Consumption of Crude Oil (2010-20, MMT)



Industry Standing

India is the World's –

- Largest 3-wheeler market
- Second-largest 2-wheeler market
- Tenth largest passenger car market
- Fourth largest tractor market
- Fifth largest commercial vehicle market
- Fifth largest bus & truck market

*Confederation of Indian Industry data



Overview of Characteristics of xEVs Present or Anticipated in India

Parameter	2-wheelers	3-wheelers	Smaller 4-wheelers	Larger 4-wheelers	Buses
xEV technology	BEV	BEV, Hybrid (?)	Mils, strong, PHEV, BEV		
Typical drivetrain voltage levels (v)	~48 V	~48 V	48 V – 72 V	> 100 V	> 300 V
Typical drivetrain power levels (kW)	< 2 kW	< 7 kW	19 kW up to ~60 kW	Expected to be ~80 – 100 kW for BEVs	~50-60 for mini buses; >100 kwh for large buses
Current and near term battery chemistry commonly used	Lead acid, may see introduction of li-ion	Lead acid & li-ion	Lithium – ion		
Battery capacity (kWh)	1 – 2 kWh today; 3 – 4 kWh future	5 -10 kWh (?)	10 – 15 kWh for BEV's; <5 kWh for PHEV's	25-50 kWh for BEV's	N.A.
Typical range	50 – 100 kms	50 – 100 kms	100 – 180 kms (future)	100 – 200 kms	100 + kms



Opportunities & Pathways for collaboration via Busworld & Busworld Academy

Avenues for Knowledge Sharing

Technologies

1. Light-weighting
2. Efficient drivetrains
3. Battery life cycle modeling and usage, second life applications
4. Smart grid integration
5. Vehicle-to-X communication and safety technologies

Applications

1. Integrated Multi-modal transport
2. Integration with renewables
3. Public charging infrastructure development experience⁴
4. Policy development and implementation experience





busworld[®]
academy

KNOWLEDGE PLATFORM
FOR THE WORLDWIDE
BUS & COACH SECTOR

**Follow us via
academy.busworld.org**

