



WORLD FUTURE FUEL SUMMIT & EXPO

Sustainable Future Fuel for Global Green Climate

Decarbonized Fuels for Smart Mobility

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Four Pillars of Smart Mobility



Shared

The mobility platform of the future will build on the idea of distributed and shared mobility. Fewer people will own cars and instead will opt to use on-demand services, enabling greater vehicle-use efficiency and less congestion.



Multimodal

The future of mobility will consist of a highly flexible platform comprising various modes of transportation, each providing a unique solution. Every leg of a journey will come with an array of transportation options.



Electric

The first electric car was built in 1832, and we've come a long way since then. Today, EVs have better power, speed, and safety compared with gas-powered cars, and they're better for the environment.



Autonomy

Although still in development, AV systems and hardware are heavily researched and have received more than \$10B of funding. Large automakers and tech giants are racing to build the first fully commercialized product.

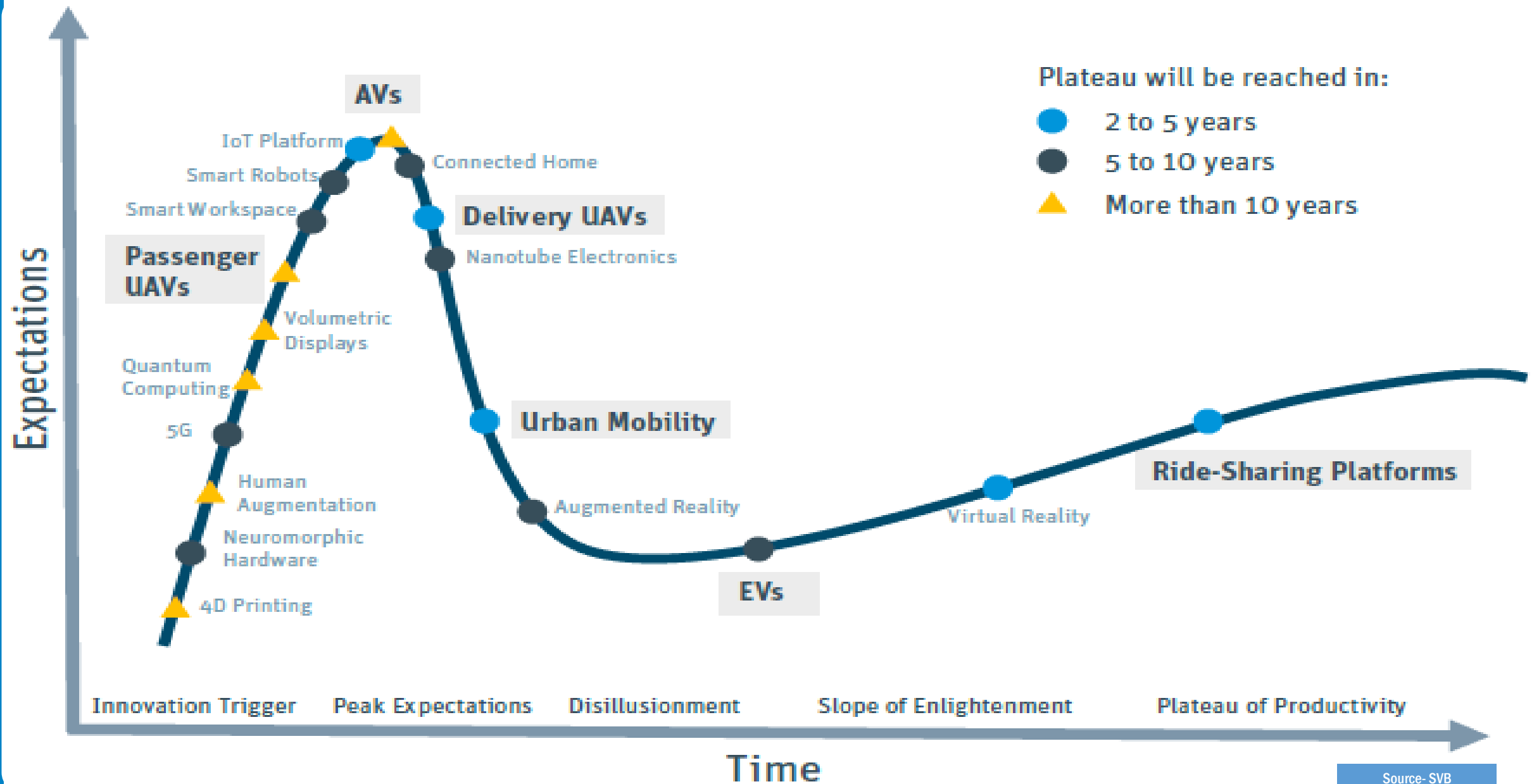
Global Venture Capital Activity in Mobility*

Number of Startups:	242	Number of Startups:	72	Number of Startups:	448	Number of Startups:	202
Capital Invested:	\$58.0B	Capital Invested:	\$4.1B	Capital Invested:	\$24.7B	Capital Invested:	\$10.0B
Number of Deals:	574	Number of Deals:	151	Number of Deals:	986	Number of Deals:	398
Investors:	1,318	Investors:	362	Investors:	1,290	Investors:	848
Largest Deal:	\$7.3B	Largest Deal:	\$621M	Largest Deal:	\$3.2B	Largest Deal:	\$1.0B

The Technology Has Arrived



Adoption Will Take Time



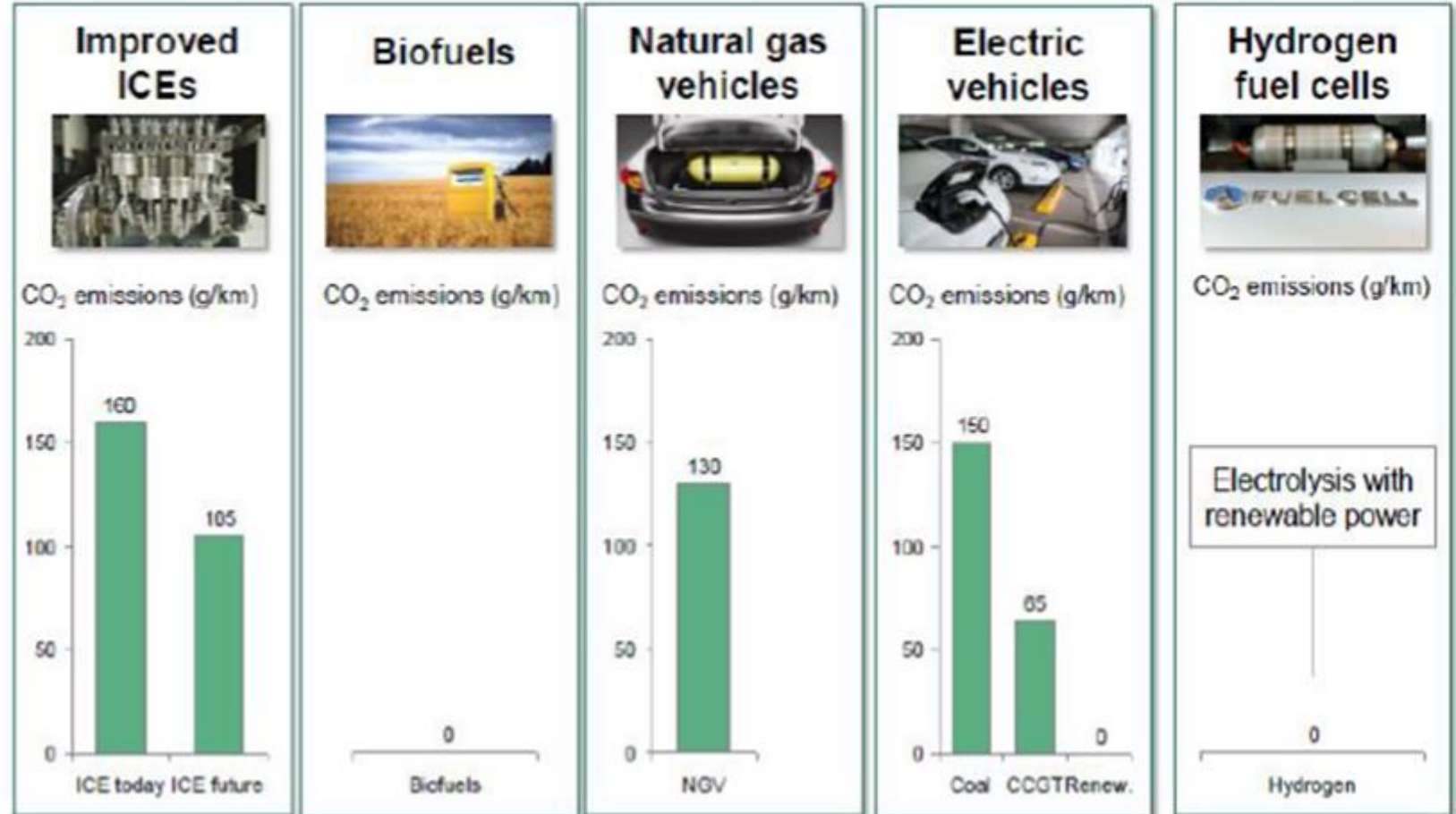
Countries aiming to reduce GHG emissions

The current global commitments are not sufficient to prevent temperature rise above 2C

To keep us below 1.5C, the carbon emissions need to be cut by 45% by 2030

Corporate Average Fuel Consumption Standards (CAFCS) -an important decarbonization strategy

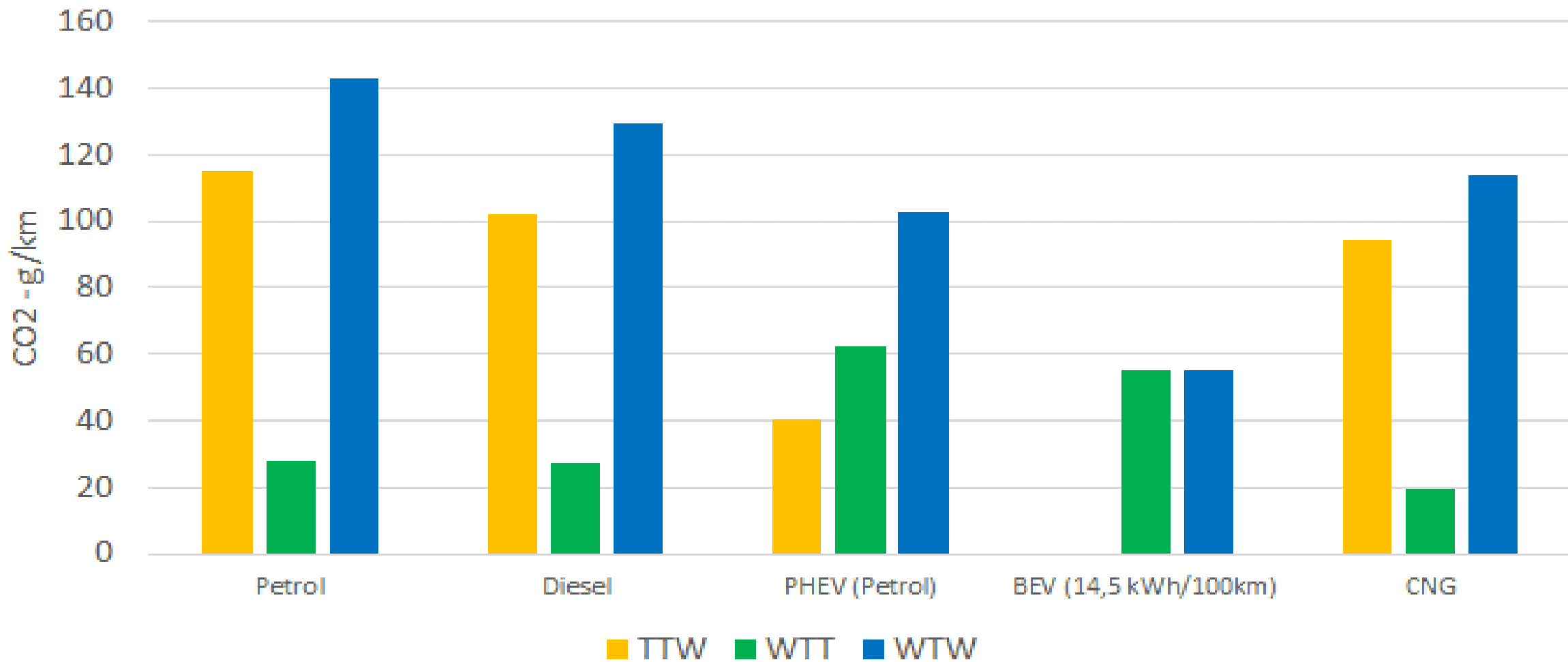
CO₂ emissions of different technologies (g/km)



- Decreasing diesel LDVs –6.9 Lpe/100 km'05 to 5.7 Lpe/100 km'19 (-20% of global, -24% LDV wt.), large cars increasing (6%)
- India - 130 gCO₂/km in 2017 (stage 1- 1037 Kg) and 113 gCO₂/km in 2022 (Stage 2, 1145Kg) (4.77 litre per 100 km)
- Europe – 95gCO₂/km (1400 kg), 60 CO₂ g/km for cars in 2030 (electrification to avail super credits)

Life cycle emissions

WTW emissions comparison c-segm vehicle - WLTP

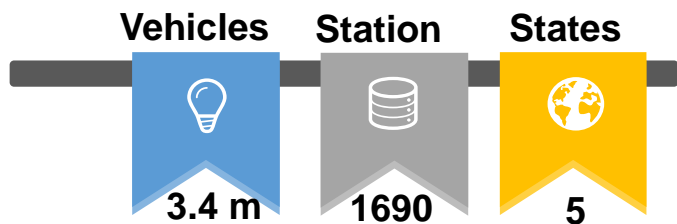


Market penetration through classification

Developed Market



The market is mature and having large number of CNG stations, CNG powered vehicles.

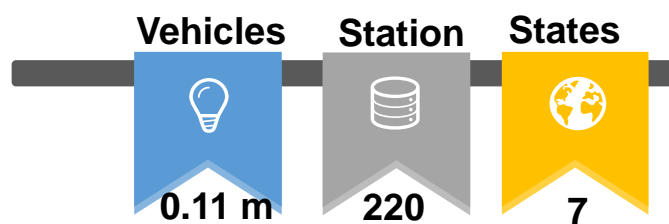


Improve Market

Developing Market



The states, the CNG is introduced only 3-4 years back.

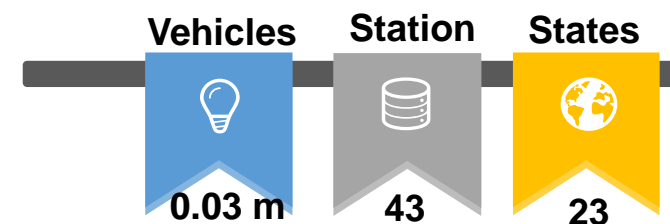


Increase Market

Emerging Market

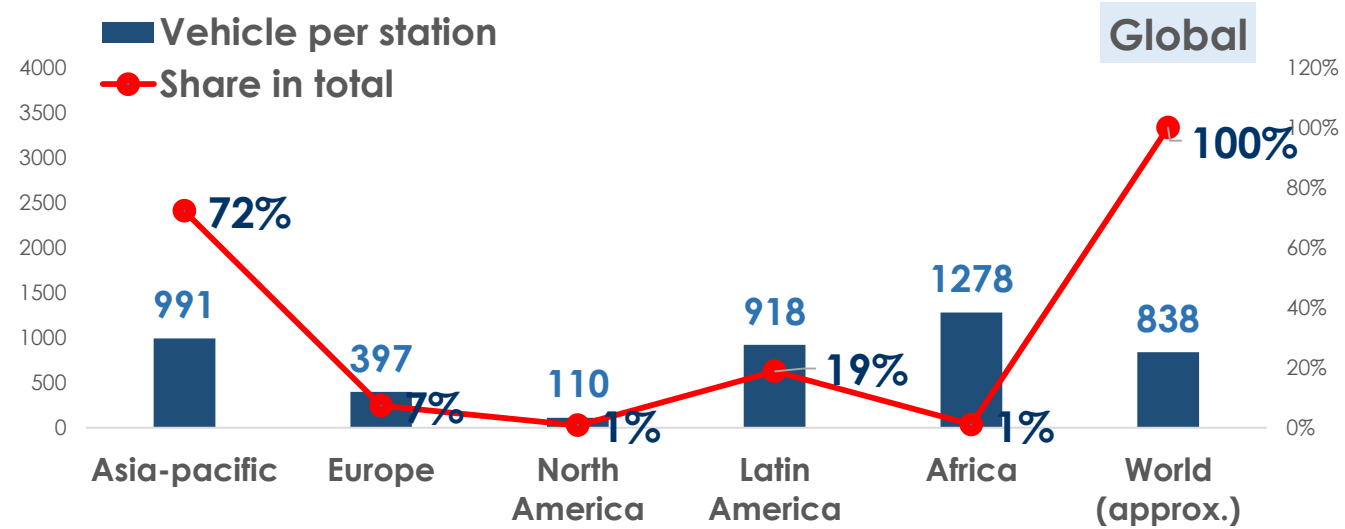
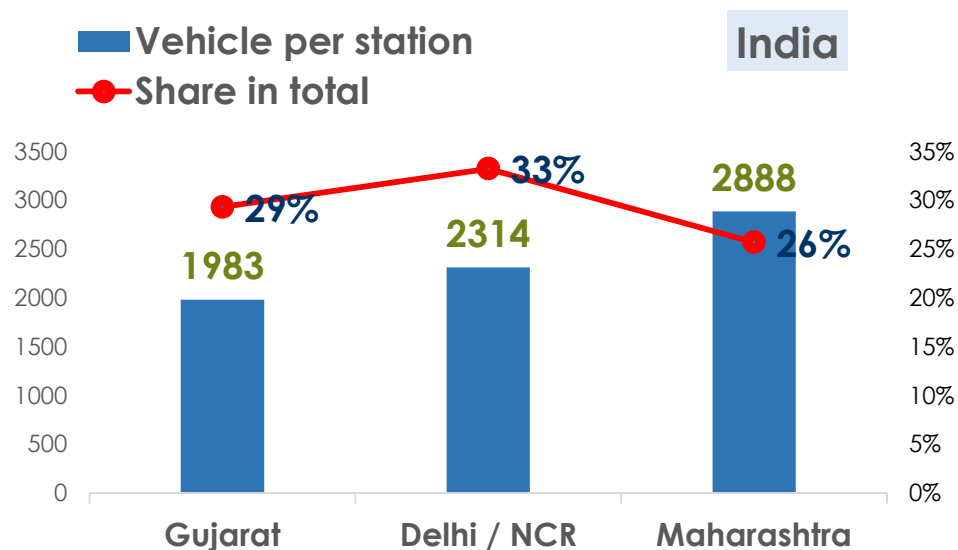


The CNG stations just commissioned recently or yet to commission.



Boost Market

Ramp up CNG stations- Massive opportunity



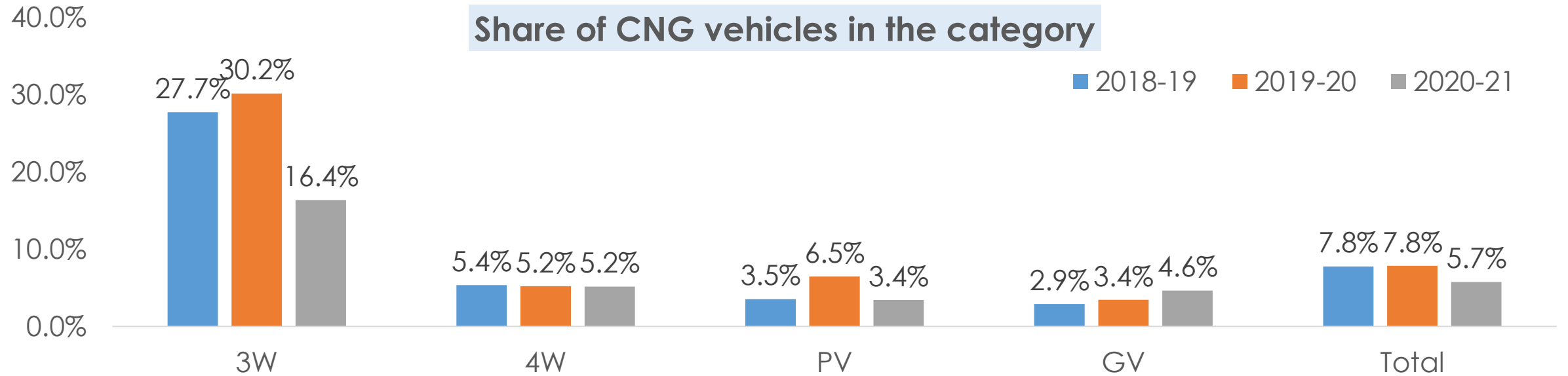
- 88% of total CNG stations
 - Highest in Maharashtra- 2888V per station

- 91% in Asia-pacific & Latin America
 - World average – 838V per station (Highest – 1278)

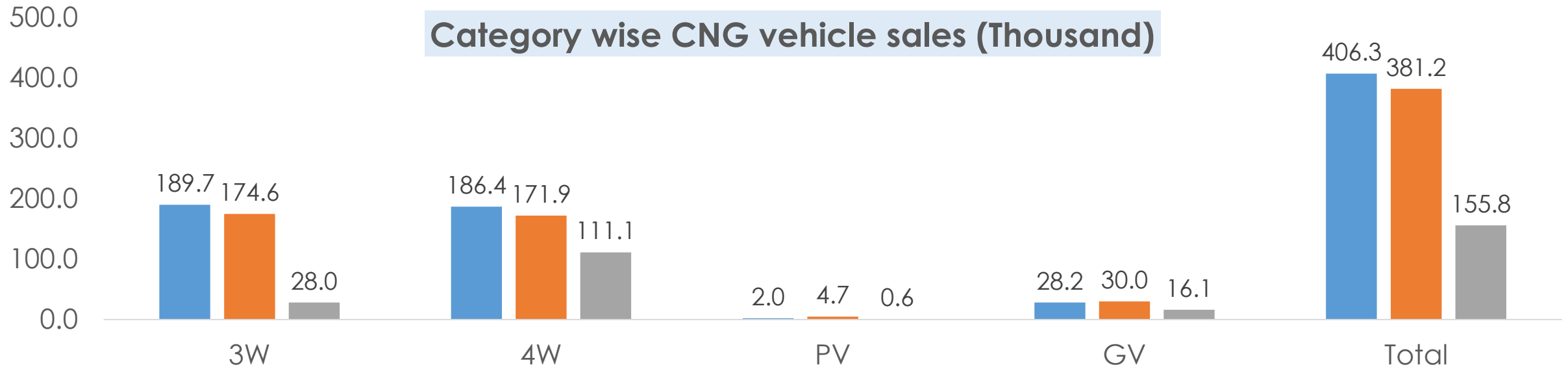
- 9th & 10th round - 228 GA's, 404 districts, 27 S&UTs, 70 % population, 53 % GA (65 New GAs in 11th)
- 9th round - 4603 CNG stations (2026) & 10th round - 3578 CNG stations (2028)- 10000 by 2028
- Implementation of awarded projects under bidding rounds will be the key;
- Retail outlets of OMCs may play a greater role to be a great enabler;

4 lakh CNG vehicles sales with share of 7.8% in total

Share of CNG vehicles in the category



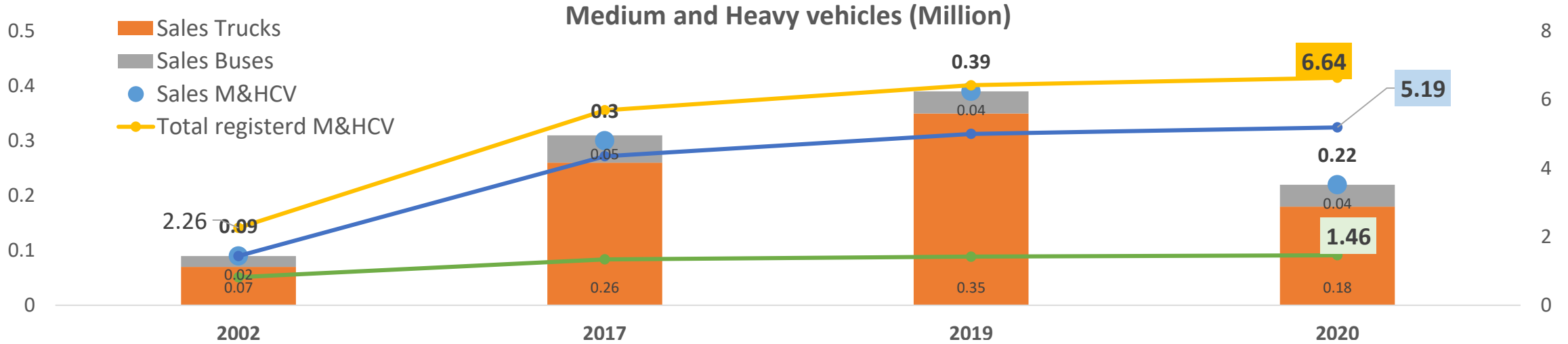
Category wise CNG vehicle sales (Thousand)



Government aims 10 Million CNG vehicle by 2030 from presently 4 million vehicles

LNG as transport fuel for M&HDV

30000 vehicles would be needed for each MMTPA of LNG



Total NH length - April 2019	1.42 Lakh
LNG stations to cover NHs	700 No's
LNG stations to cover GQ	30 No
LNG stations for top 10 NHs	68 No

Expanding the share of natural gas from current 6% to 15% by 2030.

Buses - CAGR-5Y	2.9%
Trucks - CAGR-5Y	5.9%
Average addition buses -5Y	2.42 Lakh
Average addition trucks-5Y	15.3 Lakh
Trucks- LNG to replace diesel	19.7 MMT
Buses- LNG to replace diesel	6.6 MMT

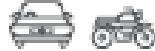








Opportunities

- PSU OMCs to develop 50 LNG stations on Golden Quadrilateral, North South and East West Highways
- As per PNGRB recent clarification LNG station can be established by any entity
- Major OEM's working on development LNG powered Vehicles
- Viability Gas Funding (VGF) initially to develop eco system on one major highway

Challenges

- Unstable and volatile LNG price depending on external factors
- Fuel loss affects the economy-Boil off during idling
- Limited local manufacturers – retrofits, cryogenic cylinders and new LNG vehicles
- High differential cost between diesel and LNG vehicles

Business EV adoption in India

Transport use case	Business influence on electrification	Early adoption potential	Popular vehicle type used	Prioritised used cases
People movement				
Self-driven				
Personal vehicle (self-owned)	○	◐		
Vehicle as a service				
Leased vehicle	◐	◐		
Rental vehicle	●	◐		
Ride as a service				
Employee and customer transport	●	●		✓
Platform based ride-hailing	●	●		✓
Conventional taxi service (intracity & outstation)	○	○		
Mass transit	○	●		
Goods movement				
Long distance road freight	◐	○		
Last mile deliveries	●	●		✓

● High ◐ Medium ○ Low

Large-scale adoption of EVs needs to be accompanied by system-wide changes:

- Customer acceptance
- Manufacturing
- Availability of various vehicle
- Awareness of technology
- Charging infrastructure
- External Dependency
- Pricing -TCO

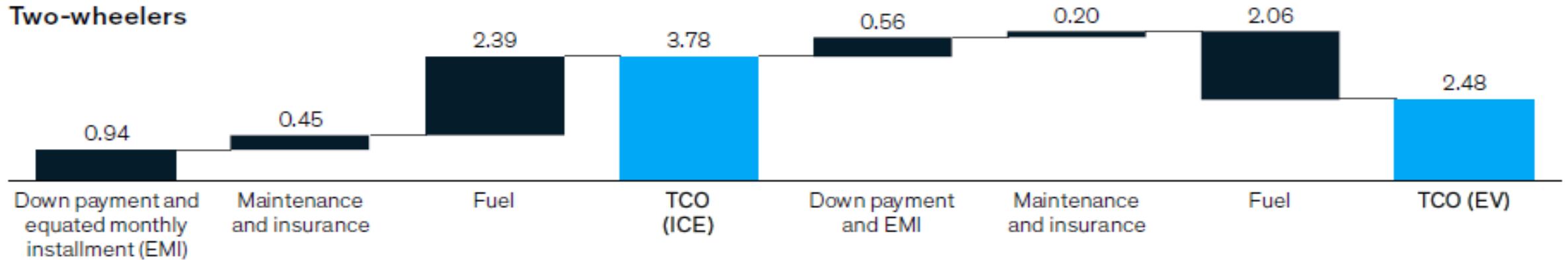
Under FAME II scheme, to promote demand for EVs, incentives such as purchase subsidies, tax exemptions, access to financing, scrapping & retrofit incentives, priority permits, green zones, parking incentives and toll fee waivers given

Small-format e-mobility offers significant cost advantages over ICE

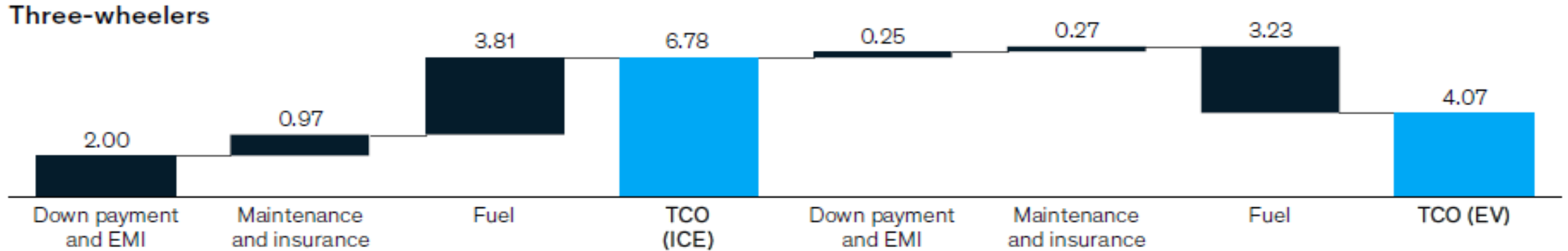
Total cost of ownership (TCO) comparison of electric vehicles (EVs) versus ICE vehicles¹

Cost per 100 km (USD)

Two-wheelers



Three-wheelers



¹ Assumptions: Life of vehicle = 7 years; debt share = 70%; loan tenure = 4 yrs for 2Ws, 5 yrs for 3Ws; daily distance = 60 to 75 km for 2Ws, 125 to 150 km for 3Ws; mileage = 40 km for 2W EVs, 45 km for petrol 2Ws, 17 km for 3W EVs, 30 km for diesel 3Ws.

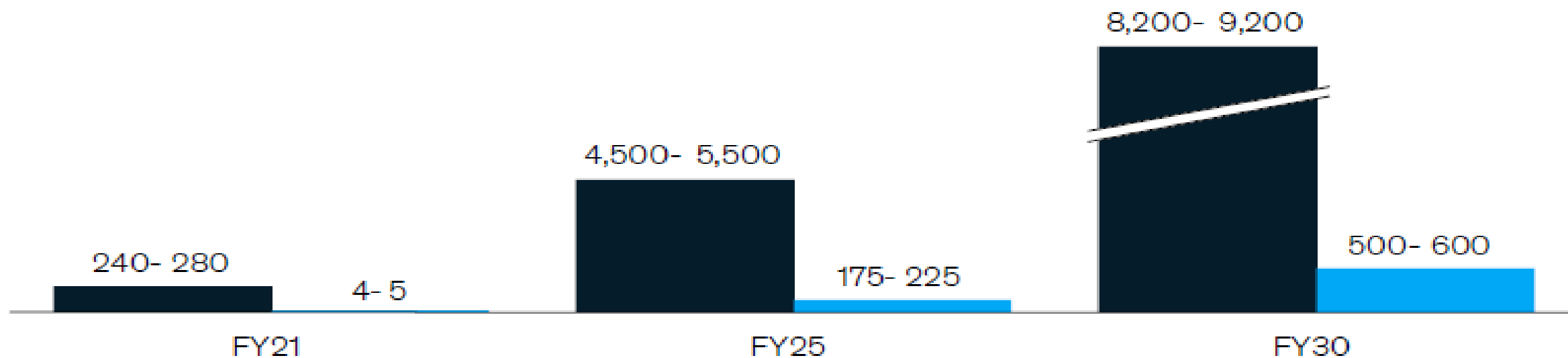
Source: Expert interviews; McKinsey analysis

Demand for small format e-mobility - about 9 million units by 2030

Demand for electric two- and three-wheelers in India^{1,2}

'000 units; Base case

■ Two-wheelers (2Ws)
■ Three-wheelers (3Ws)



Percentage of total sales that are for electric vehicles



2Ws

25-30%

35-40%



3Ws

25-30%

60-65%

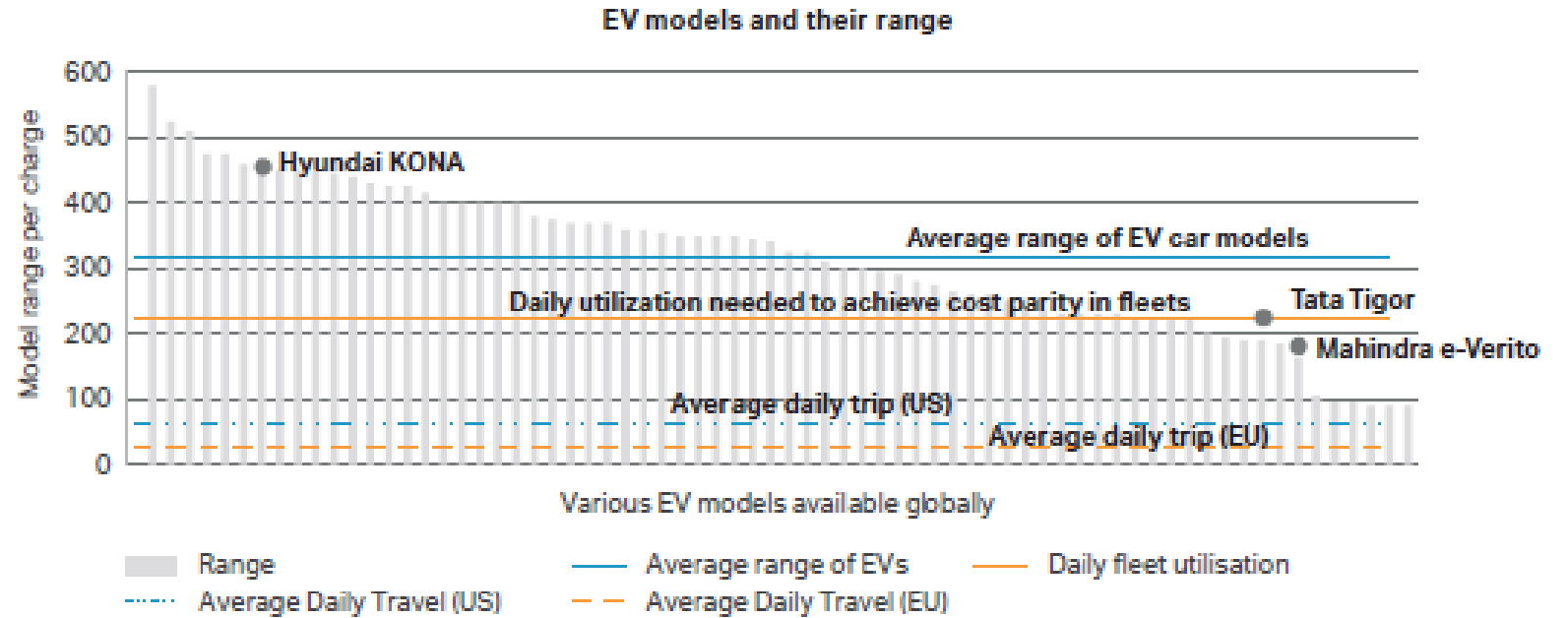
¹ Includes direct sales and lease/rent numbers.

² Based on TCO parity analysis (switch rate from ICE to EV) and market maturity adoption curve (availability of charging infrastructure, finance availability, and range evolution).

Source: Expert interviews; McKinsey analysis.

EV car models

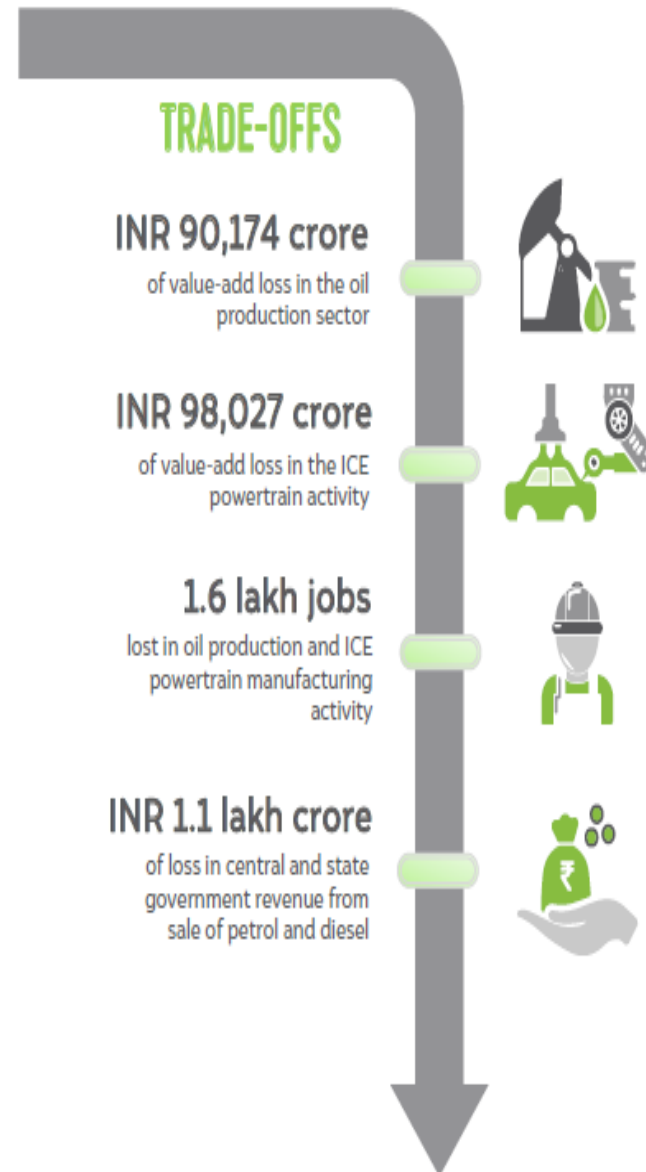
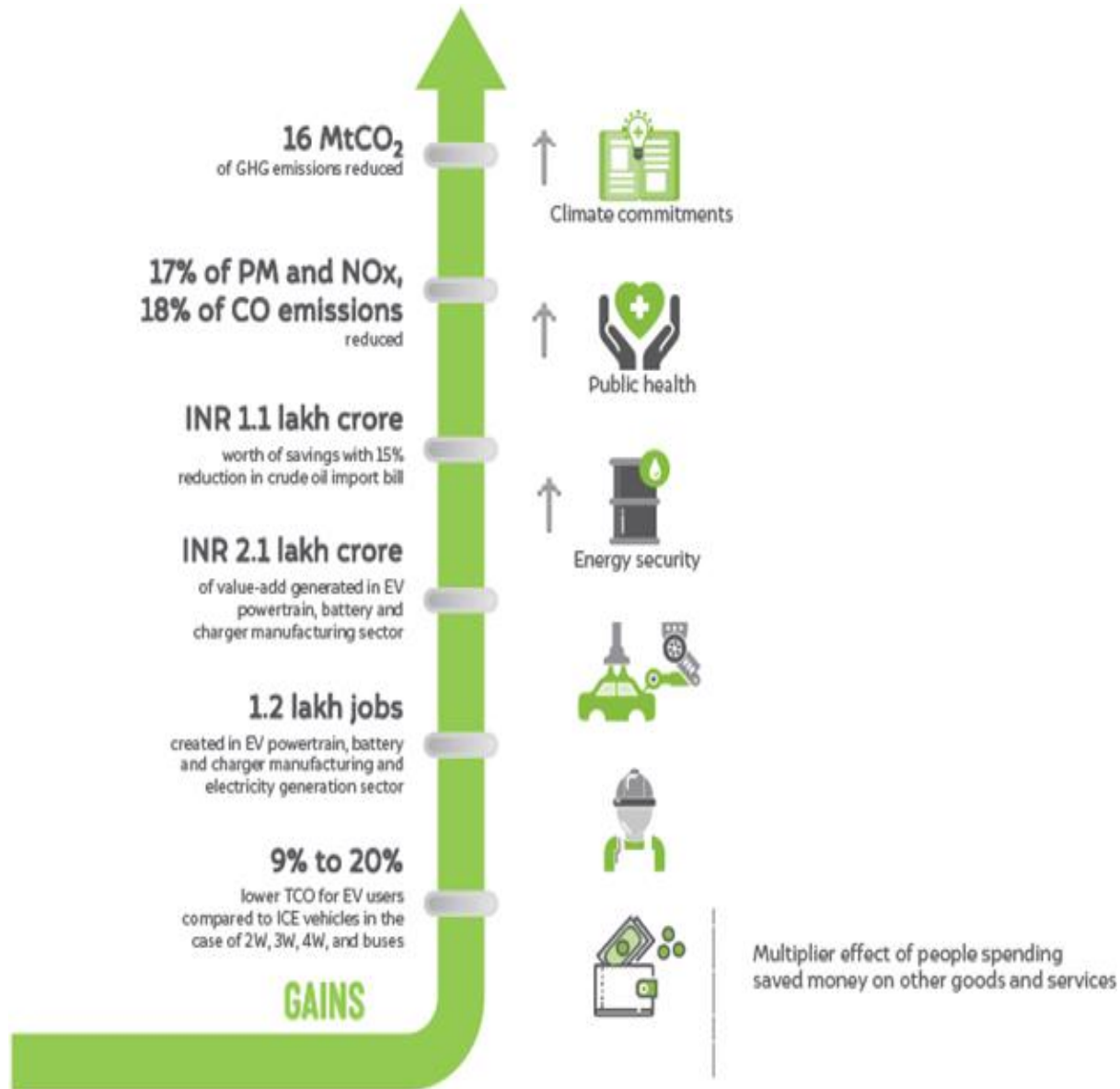
- Vehicle scrape policy
- Stringent mileage norms
- Incentives



Average charging time across various vehicle segments available in India

Vehicle segment	Battery*	Usual range*	Fast charging**	Slow charging**
2 wheelers	3-5 kWh	60-100 kms	0.5 hrs	1.5-2 hrs
3 wheelers	3-5 kWh	60-80 kms	0.5 hrs	1.5-2 hrs
4 wheelers	15-25 kWh	120-160 kms	1.5 hrs	6-7 hrs
Buses	180-300 kWh	180-220 kms	4-6 hrs	-

30 % share of India's vehicle sales by 2030... if happens



but...

Ways to tackle them

Further increase in value-addition and employment from:

Battery recycling

Installation and operation of EV charging infrastructure

Construction of giga-factories

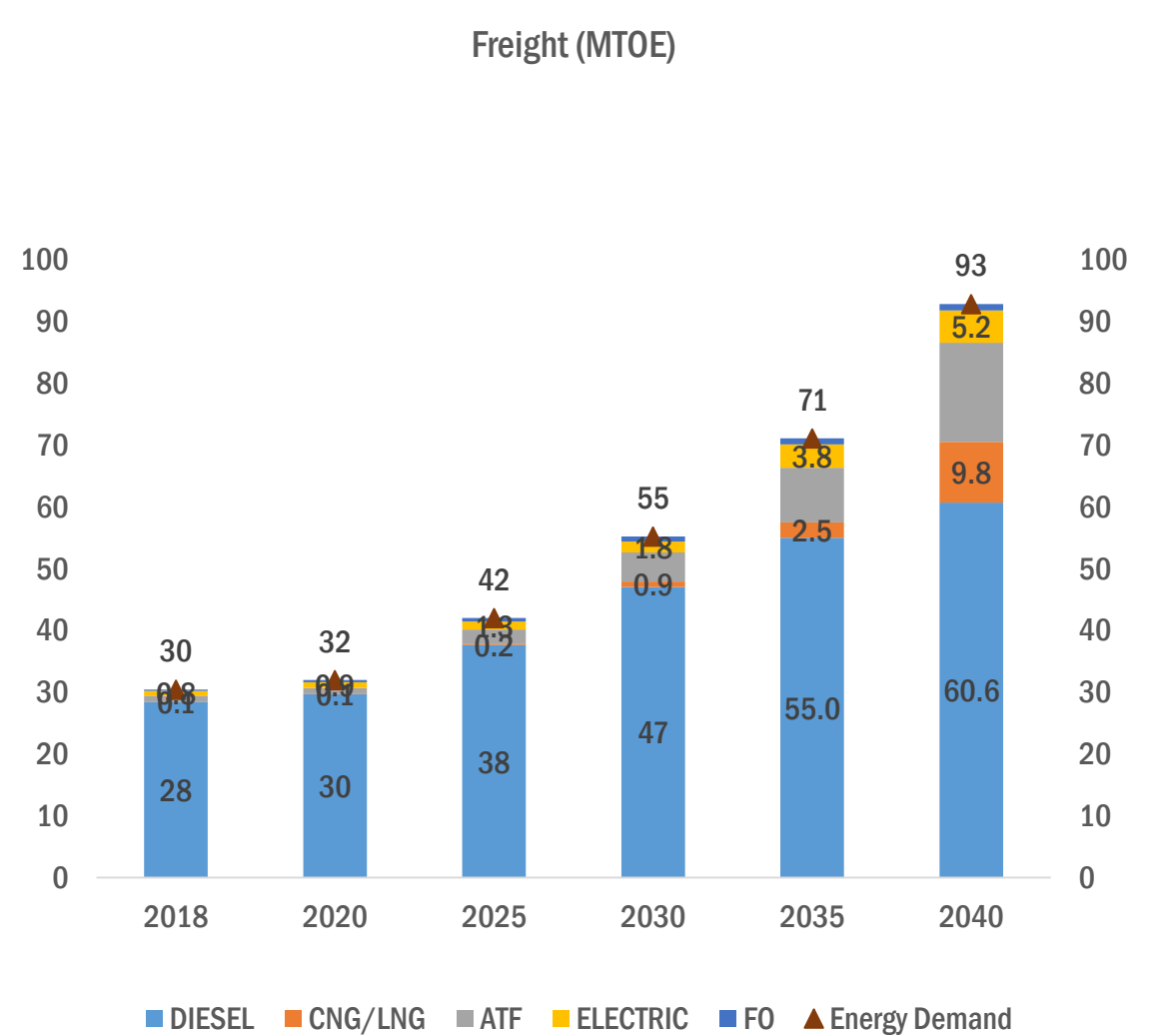
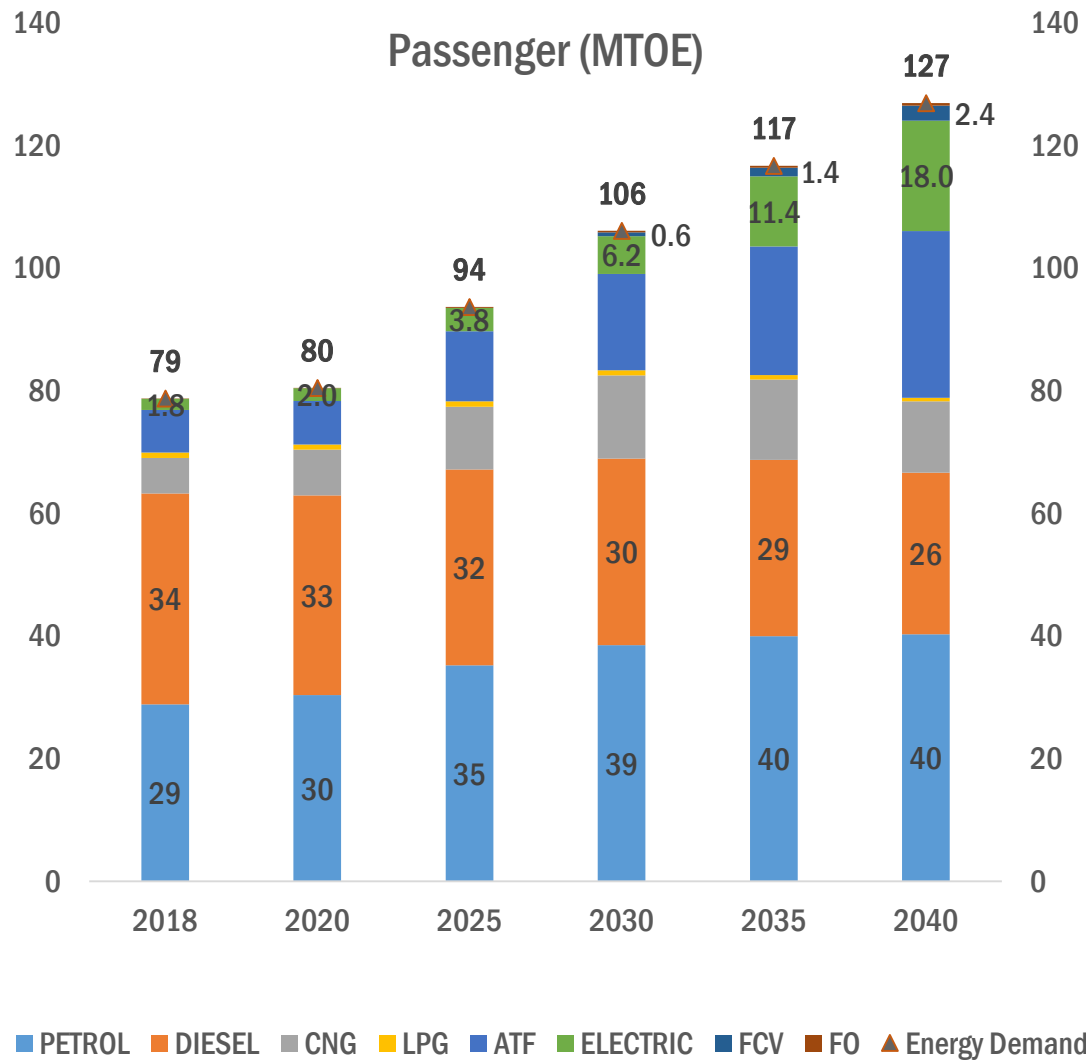
Telematics products and services

Distribution and sale of electricity

Abating impact on government revenues via:

Pre-emptive action to diversify sources of revenue for central and state governments

Demand for fuels- Transformation



Conclusions and take away - Decarbonization

- Oil and gas will co-stay for long, significantly until till 2030 (Can we prove it wrong?)
- Clean fuel vehicles will decelerate the rate of growth of conventional fuel (Winner fuel ?)
- Comprehensive policy on mobility – Decarbonization strategy (Mobility or Fuel or vehicles?)
- Rationalization of technology (Metrics of apt technology ?)
- Price protection and incentives to build the LNG ecosystem (Externalities ?)
- All the stakeholders to facilitate more variants – Flex fuel, LNG and E-HDVs (Timeframe?)
- Cost optimization through domestication of technology (Energy security considered?)

Thank you!



*The best way to predict the future is to
invent it – Alan Kay*

