

ELECTRIC MOBILITY: CHALLENGES AND OPPORTUNITIES



**Presentation by O.P. Agarwal
Office of the C&AG of India
29th May 2026**

OUTLINE

- Some basics
 - Benefits and challenges with EVs
 - India's uniqueness
 - Key policy questions
 - Progress so far
 - Moving forward
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SOME BASICS

HOW ARE EVS DIFFERENT

- Use electricity as fuel in place of petroleum fuels
 - Need charging instead of petroleum fuel filling
 - Charging takes several hours compared to just a few minutes for petroleum fuelling
 - Unable to travel very long distances with a single charge - “Range anxiety”
 - Use very heavy batteries for storing electricity as against much lighter petroleum fuel tanks
 - Energy density of batteries is low
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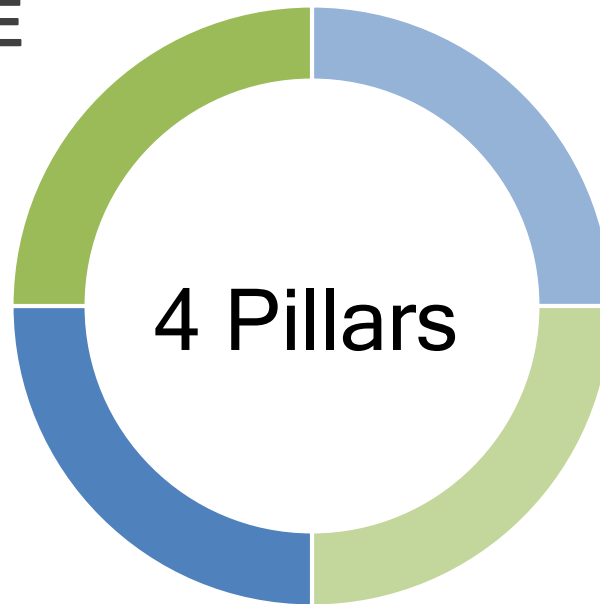
PILLARS OF THE EV ECOSYSTEM

ELECTRIC VEHICLE

Charging
Infrastructure

BATTERIES

OTHERS
Manufacturing,
Power grid, R&D



METHODS OF REFUELLING BATTERIES

- **Slow charging** - uses lower current - safer, but slower
 - **Fast charging** - uses higher current - faster but can damage the battery
 - **Swapping** - replaces a discharged battery with a charged one
 - Batteries being heavy, swapping needs mechanical devices
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TYPES OF EVS

- **BEV** - Fully electric - no other fuel - also known as pure electric
 - **HEV** - Hybrid EV - uses petroleum fuel as a back up
 - **PHEV** - Plug in Hybrid EV - uses petroleum fuel as a back up and also has the provision to plug in the vehicle for charging
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BENEFITS AND CHALLENGES OF EV

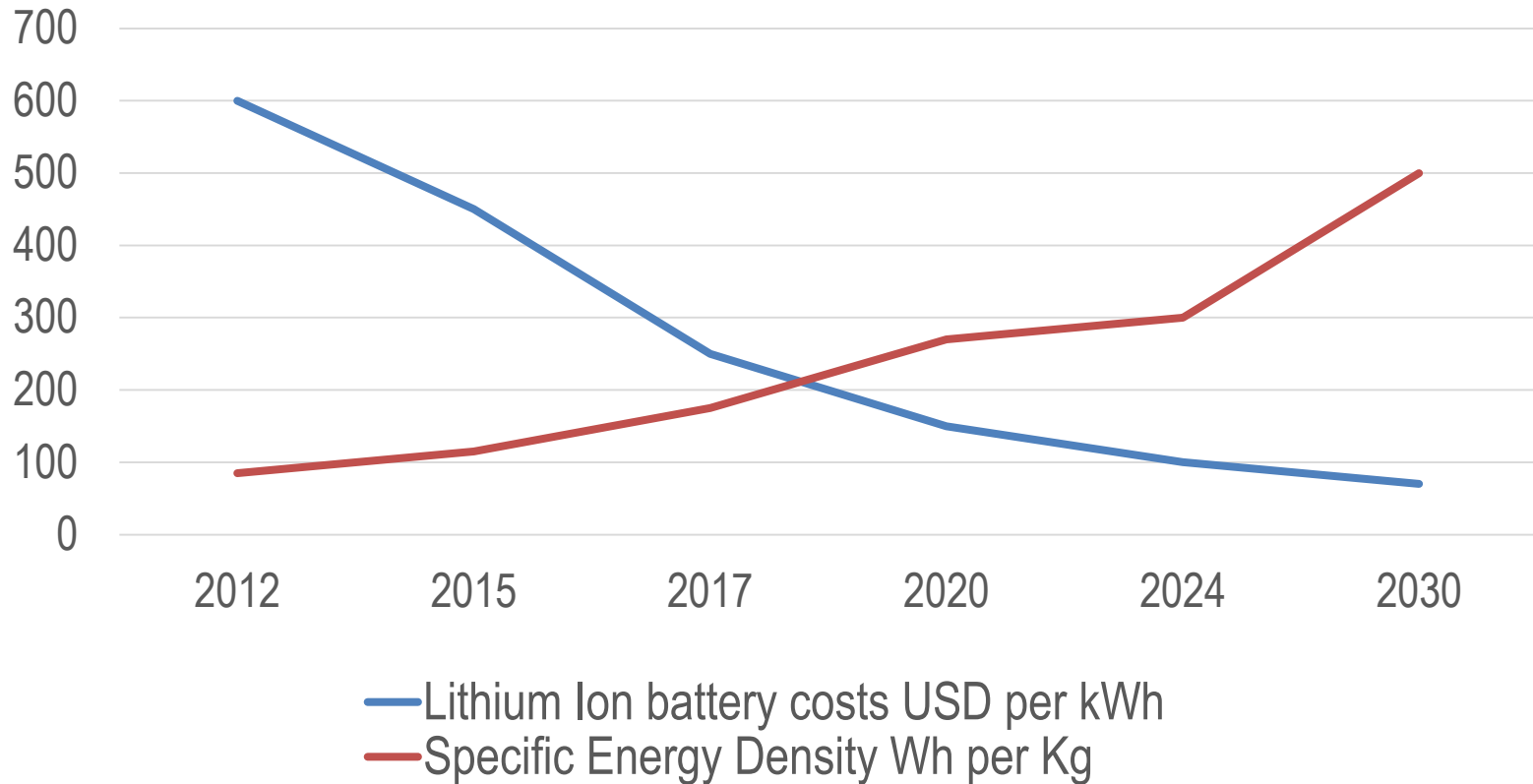
BENEFITS

- Diversified fuel base for generating electricity - supports energy security issues
 - No tail pipe emissions - reduces local air pollution
 - Lower GHG emissions - good from the climate change perspective
 - Lower operating costs - supports vehicles that are intensively used
 - Can support scaling of renewable energy - both need batteries
 - Can help improve the Plant Load Factor of power plants - especially if TOD metering is introduced
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CHALLENGES

- High capital cost - largely due to high battery costs
 - Long charging time
 - Low range - due to low energy density
 - Inadequate charging infrastructure - frequent charging needs
 - Power availability
 - Dependence on imports for battery cells
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BATTERIES WERE A BARRIER - HIGH COST + LOW ENERGY DENSITY



- **Falling battery prices + rising energy density spurred interest in EVs**
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INDIA'S DRIVE TOWARDS ELECTRIC MOBILITY SEEKS TO:

Reduce dependence on imported fossil fuels

Reduce GHG emissions

Reduce urban air pollution

Secure technological leadership

INDIA'S UNIQUENESS

India's Uniqueness

- 75% of vehicle fleet is 2W | Cars barely 15%
- 98% of the vehicle fleet comprises either small vehicles (2W or small cars) or public transport or goods vehicles
- Trip lengths are relatively small - only about 15% of the trips in urban areas are >10 Km
- Only 4% of vehicles responsible for 50% of emissions (Buses & Trucks)
- The Indian consumer is extremely cost-conscious
 - ✓ Fuel economy and capital cost dominate purchase decisions



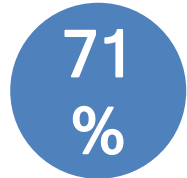
DOMINANT TRAVEL MODES

Dominant travel modes in cities with 5+ Million popln

Walking	15 - 35%
Public transport	30 - 60%
Motorized 2-wheelers	10 - 22%
Motorized 3-wheelers	5 - 15%
Cars	5 - 15%

In smaller cities: share of walking and motorized 3 and 2 wheelers is greater than that of cars and public transport

TRIP LENGTHS



Of the trips are of less than 5 km



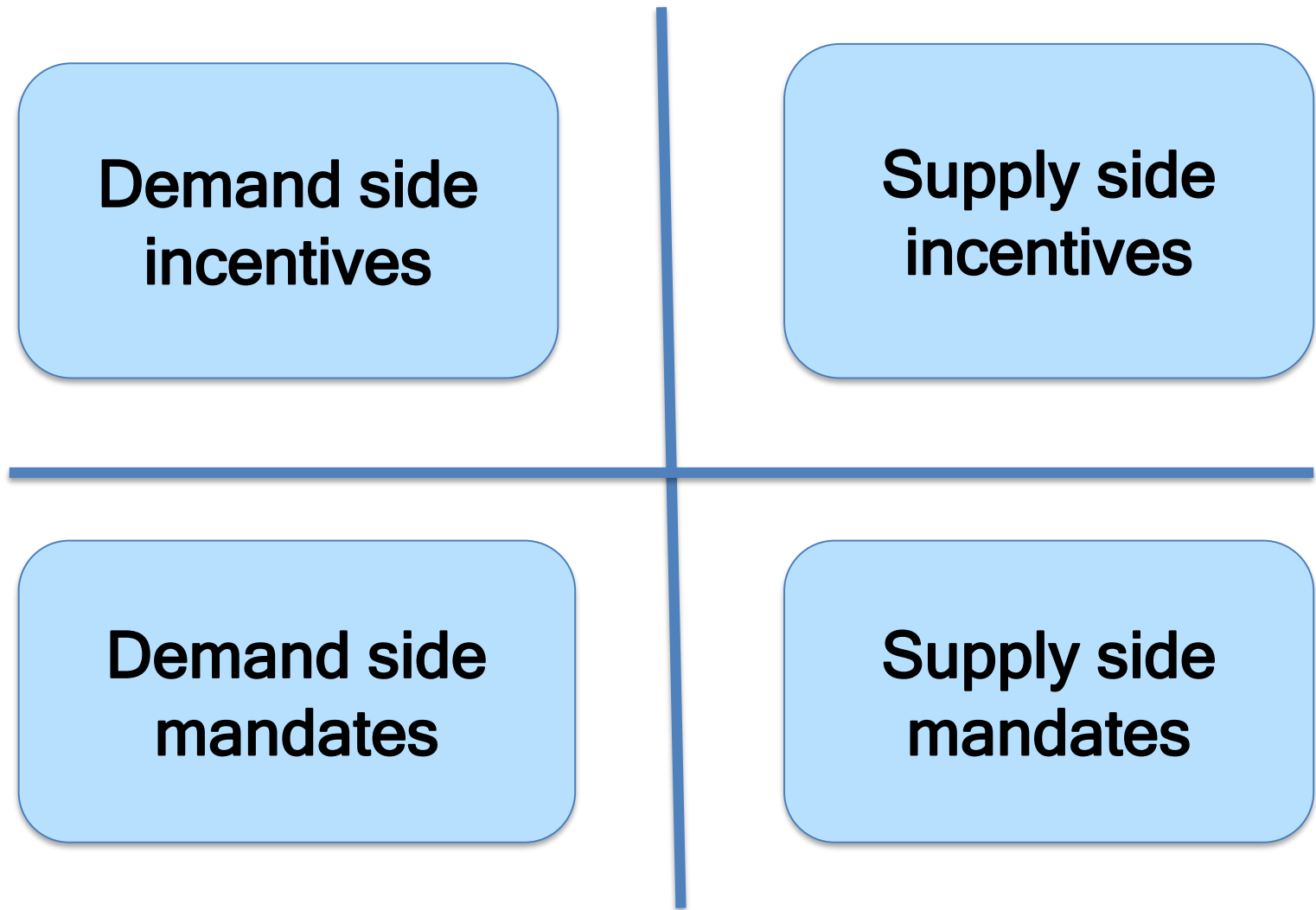
Of the trips are of length greater than 10 km

- With high urban densities, India lives and moves differently.
- An average vehicle would travel much less in India as compared to the developed world

TRAVEL SPEEDS & AMBIENT TEMPERATURES

- India's average vehicle speed is less than 25 kmph
 - Significantly different from developed countries where avg speeds are 40 to 60 kmph
 - Ambient temperature: exceeds 40 °C, often 45 °C
 - Has implications for charging in ambient conditions
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POLICY APPROACHES



IMPORTANT POLICY QUESTIONS

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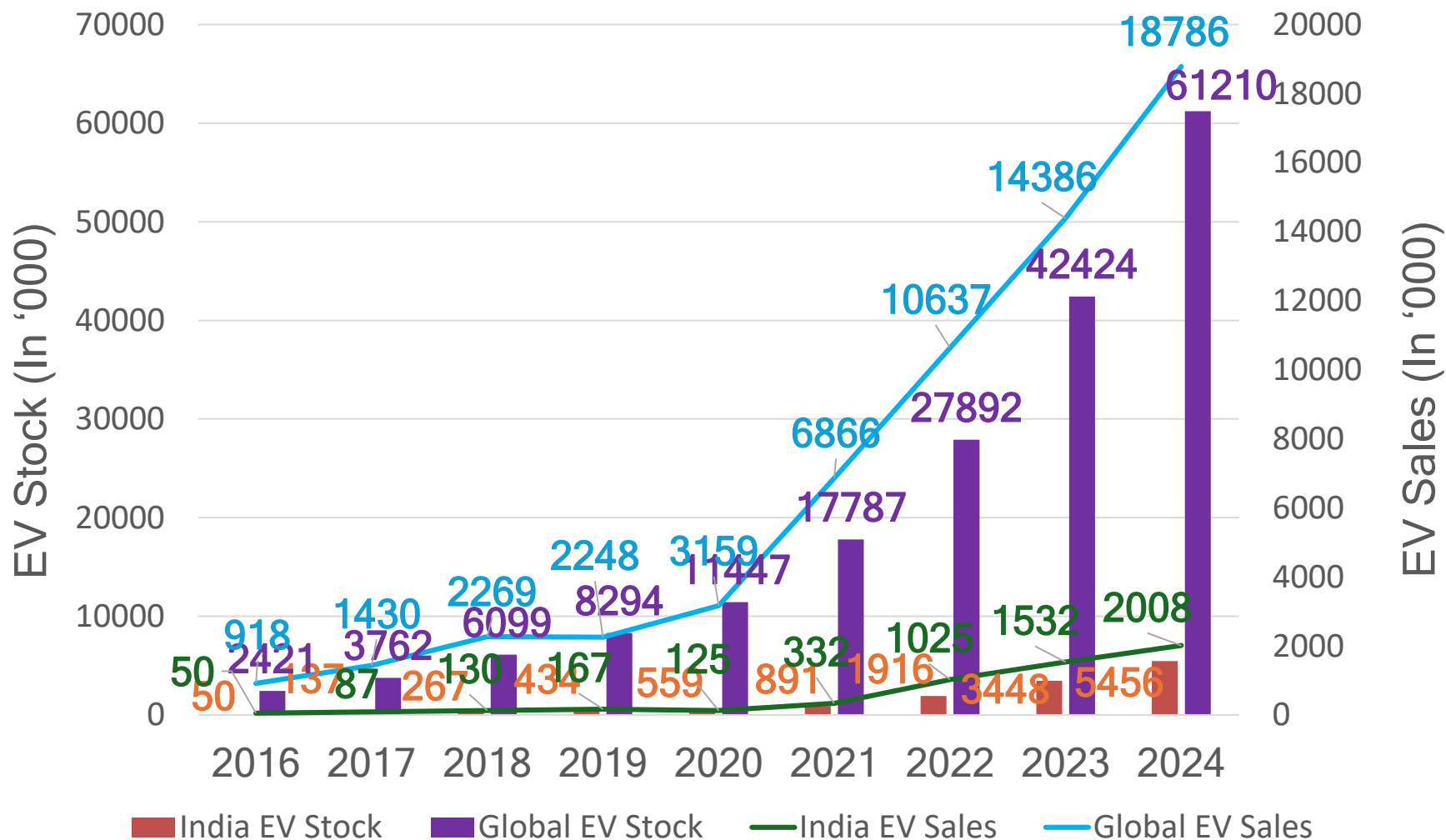
- Which vehicles to support - all or only a subset
- Only provide incentives or have mandates
- Should these be on the supply side or the demand side, or both
- Provide support across the country or concentrate efforts in a few places to start with
- Support the asset or support its usage

DO NOT COPY THE WEST

- World uses large battery to overcome range-anxiety: increase costs / weight
 - Not necessary in India
 - To maximise battery life, charge slow, rather than fast
 - To handle higher ambient temperature consider swapping
 - Convert battery capital costs into operational costs
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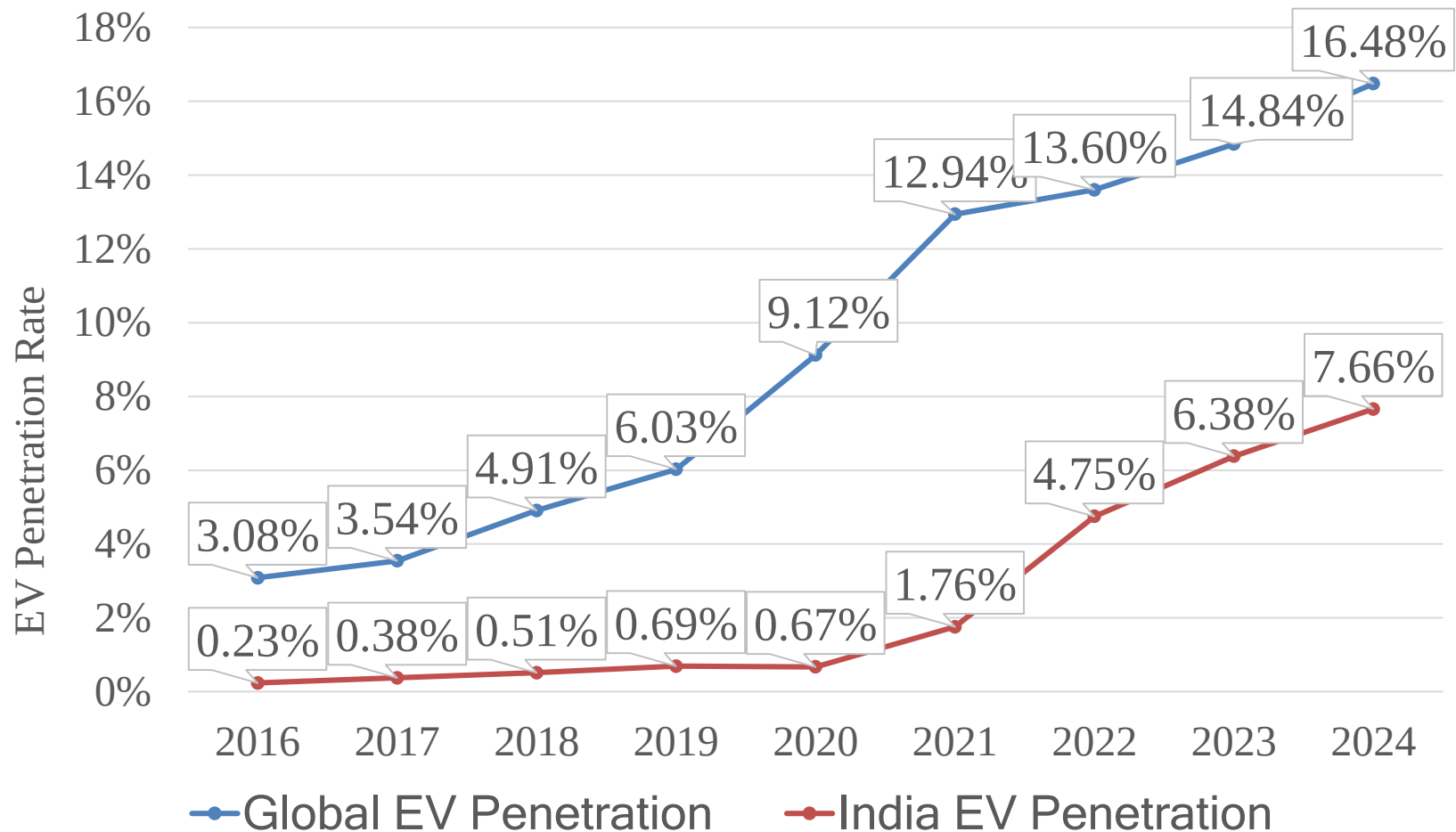
PROGRESS SO FAR

EV SALES & STOCK - INDIA & GLOBAL



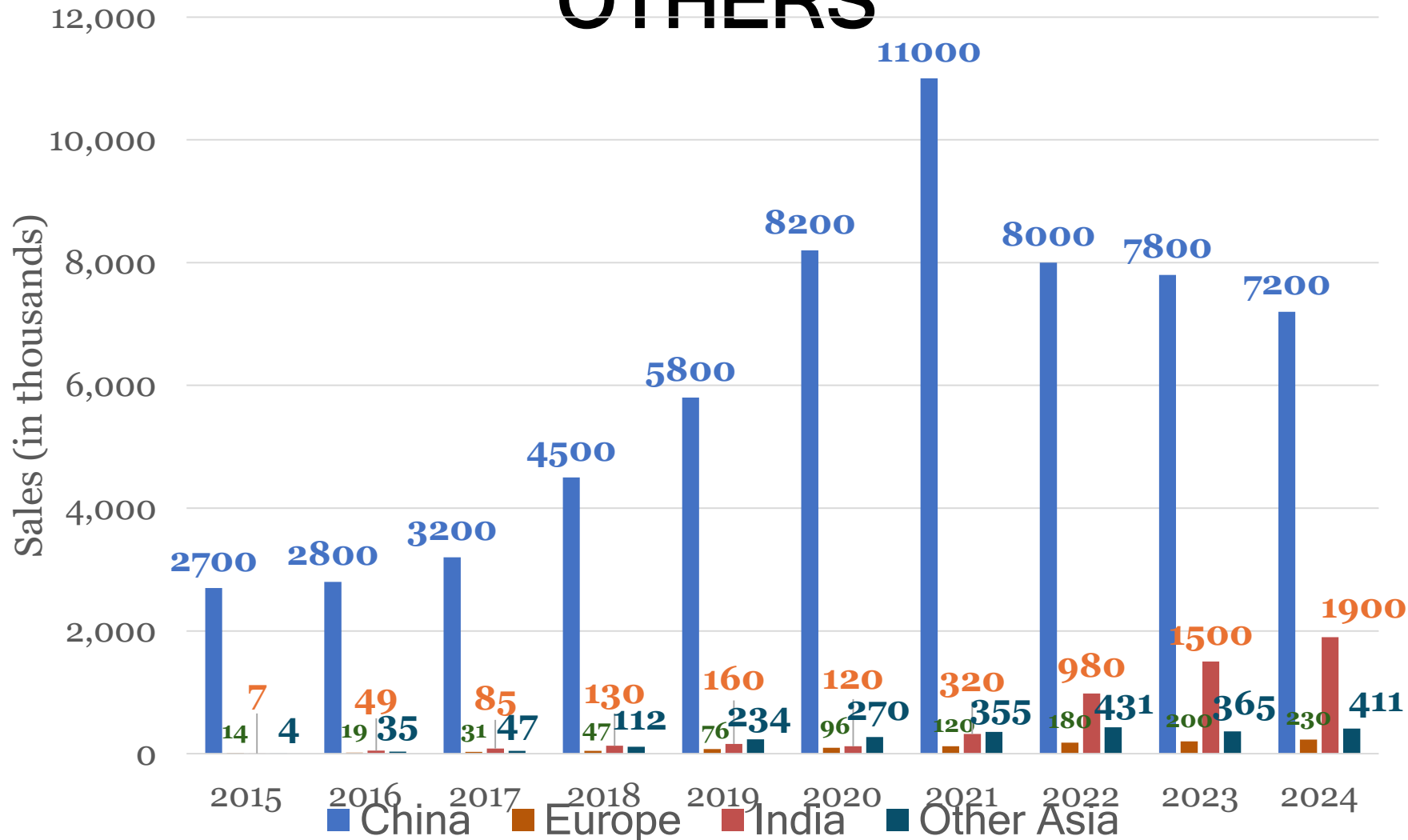
Source: 1. IEA Global EV Data Explorer for global data, 2. VAHAN Portal for India data

EV PENETRATION RATE - INDIA & GLOBAL



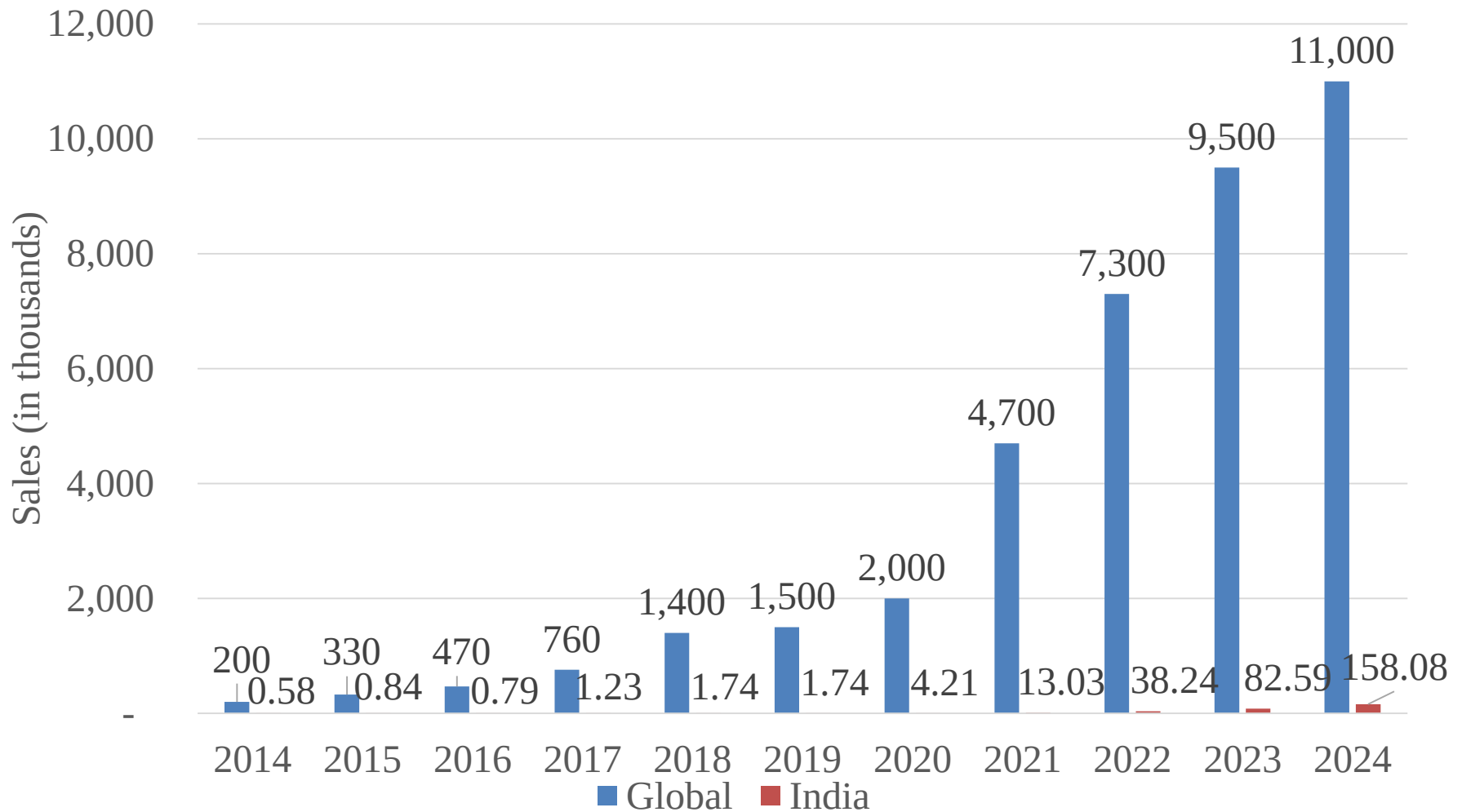
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E-2W & E-3W SALES - INDIA VS OTHERS



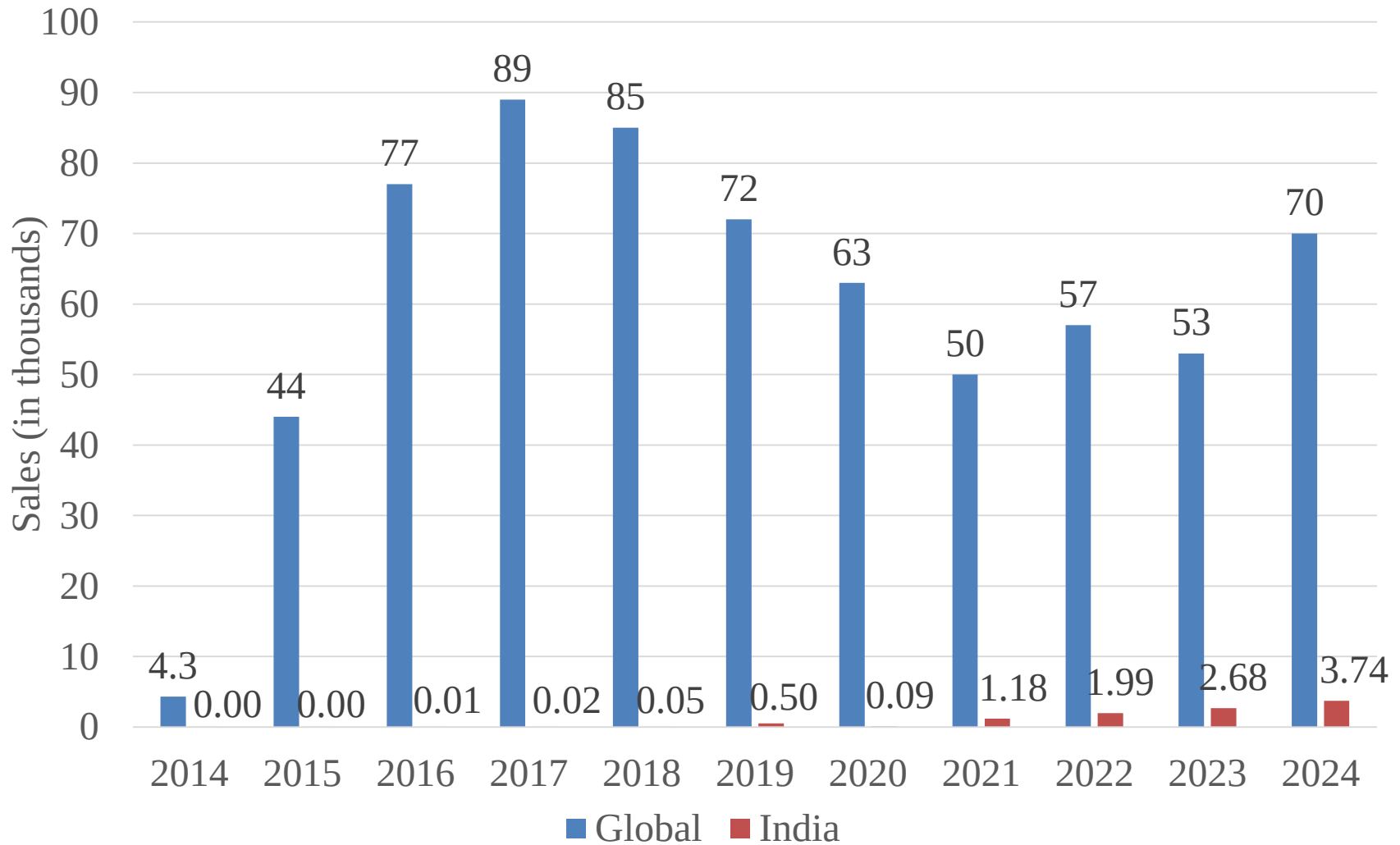
Source: 1. IEA Global EV Data Explorer for global data, 2. VAHAN Portal for India data

E-4W SALES - INDIA & GLOBAL



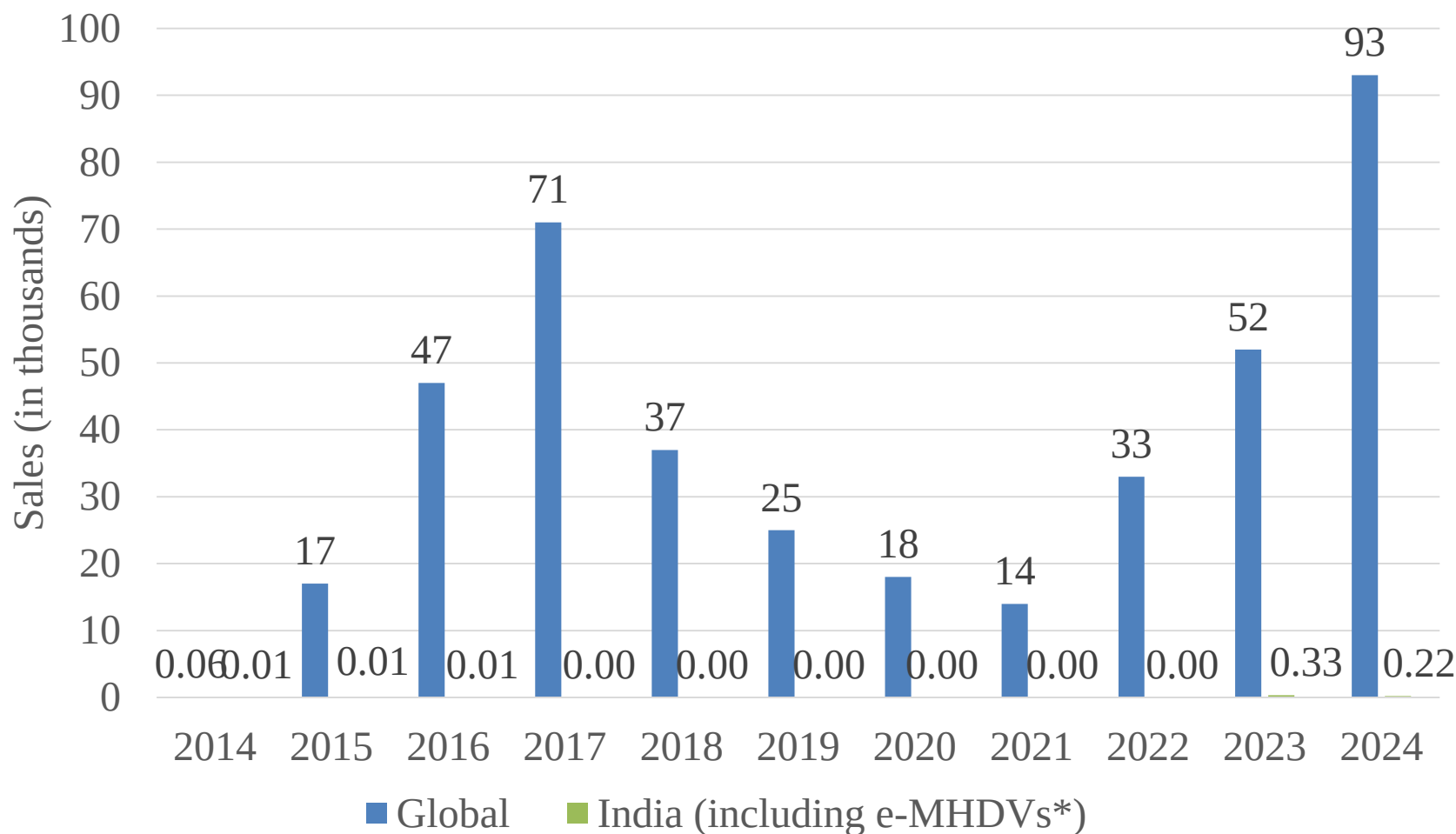
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E-BUS SALES - INDIA & GLOBAL



Source: 1. IEA Global EV Data Explorer for global data, 2. VAHAN Portal for India data

E-TRUCK SALES - INDIA & GLOBAL



*Note - Total e-Trucks in CY2024 – 280 (excluding N1 category)

Source: 1. IEA Global EV Data Explorer for global data, 2. VAHAN Portal for India data

KEY POINTS THAT EMERGE

1. Adoption of EV is increasing in India but slower than major players like the US, EU and China.

2. Pace has picked up after COVID

1. India is doing well with e-2W and e-3W

2. It has made some progress on e-Buses

3. e-Cars have been slow, but picking up

4. E-trucks have virtually not taken off

1. We have only reached a penetration level of 7.6% in 2024, against a target of 30% by 2030 - long way to go

2. Need for a major step up in the pace of transition

WAY FORWARD

NITI AAYOG RECOMMENDATIONS



Unlocking a \$200 Billion Opportunity:
— Electric Vehicles in India —



Suggestion 1 - Incentives to Mandates

- A certain percentage of vehicles manufactured and registered each year to be zero emission vehicles - increase the percentage each year
- Clearly state a national ambition
 - ✓ All new vehicles registered from a certain year only to be ZEV - 2047

Suggestion 2 - Focus on a subset of vehicles

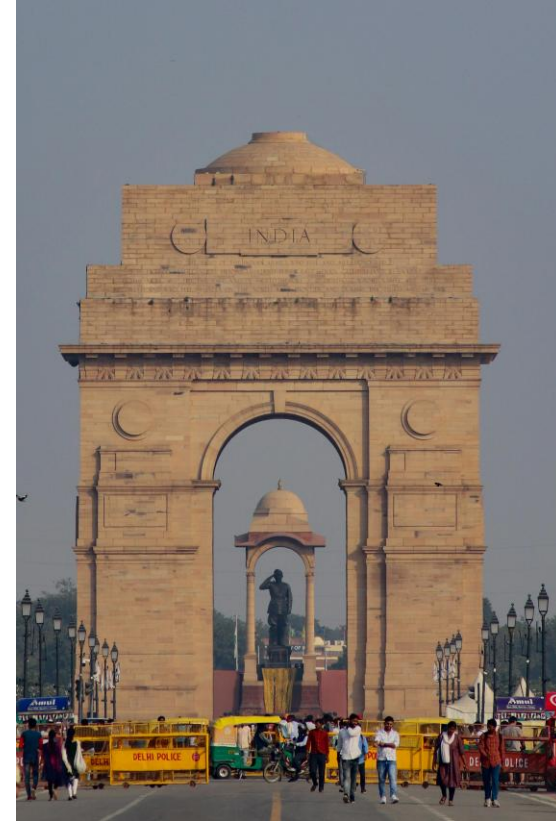
- 50% emissions are from buses & trucks, which constitute only 4% of the vehicle fleet.
- Trucks emit 53% of PM

- Based on India's uniqueness, and usage patterns, focus on:
 - e-Buses
 - e-Trucks
 - e-Urban Freight vehicles
 - e-Para-transit
 - e-2W

Relatively easy to set up charging infrastructure for them

Suggestion 3 - Saturation rather than wide distribution

- Pick 5 cities for 100% transition of buses, para-transit and urban freight vehicles to be electric in the next 5 years
 - ✓ 5 pilot cities to ideally be mid-sized cities with air quality problems
- Scale up to 20 cities in 10 years from now
- Scale up further to reach a 2047 target



Suggestion 4 - Finance for e-buses & e-trucks

- Capital financing is a big challenge with eBuses and eTrucks
 - Capital cost is 3X ICE vehicles
 - Industry dominated by small owners
- Financial institutions see this as a major risk and are reluctant to fund
- Needs blended financing and some kind of payment guarantee /insurance mechanism
- May need an interest subsidy mechanism



Suggestion 5 - Support services rather than assets

- Financial incentives have so far supported assets (vehicles and charging infrastructure)
- Risk of **underutilisation** of subsidised assets
- Approach -
 - ✓ Incentivise services delivered (e.g., veh-km run, per unit electricity supplied for charging, etc.)
 - ✓ Successful examples: **Grand Challenge** - subsidies linked to per km of service



Suggestion 6 - Shifting capital cost to operating cost

- Leasing vehicles instead of buying them
- Decoupling the battery from the vehicle and leasing batteries
- Requires a battery Aadhar system for tracking battery health and battery standards for interoperability
- **Battery as a Service**

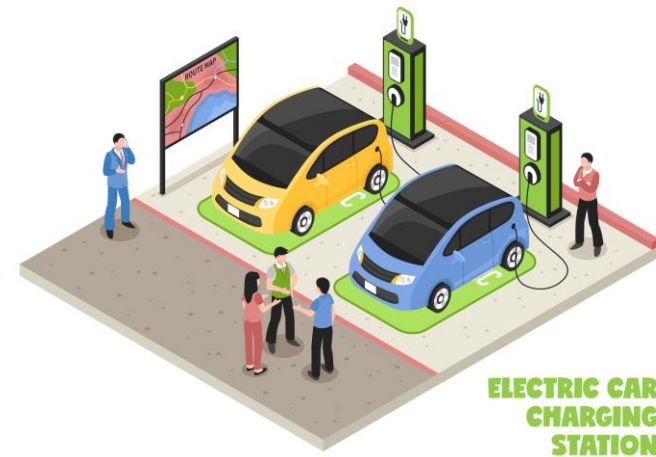
Suggestion 7 - R&D on new battery tech

- Batteries will be critical for many needs - EV, renewable energy, etc
- Current technologies make us highly dependent on imports
- Scattered ongoing work to develop new technologies
- Need to coordinate and support this towards commercialisation
- Need for an industry - academia - govt partnership



Suggestion 8 - Strategic Scaling of Charging infrastructure

- Uniform geographical spread - underutilised PCS
- Approach -
 - ✓ Data-driven location planning based on vehicle movement pattern
 - ✓ Strategic hubs along highways at existing rest/ checkpoints for trucks & buses
 - ✓ Dedicated agency (like Singapore's EVe) to coordinate and plan
 - ✓ Time-of-Day (TOD) pricing to manage peak demand



Suggestion 9 - Enhance awareness & information systems

- General lack of awareness on the benefits of EV, including lower life cycle cost
- Inadequate information systems to support transition
- Need to develop an awareness program that focuses on both



Thank You