Status from India-
Heavy Duty Electric and Fuel Cell Vehicles

GRPE workshop on low- and zero-emissions heavy duty vehicles

Prashant Pawar,
General Manager, Emission Certification Lab.
The Automotive Research Association of India, Pune, India

ARAI
Progress through Research

Indian Initiatives for cleaner transport

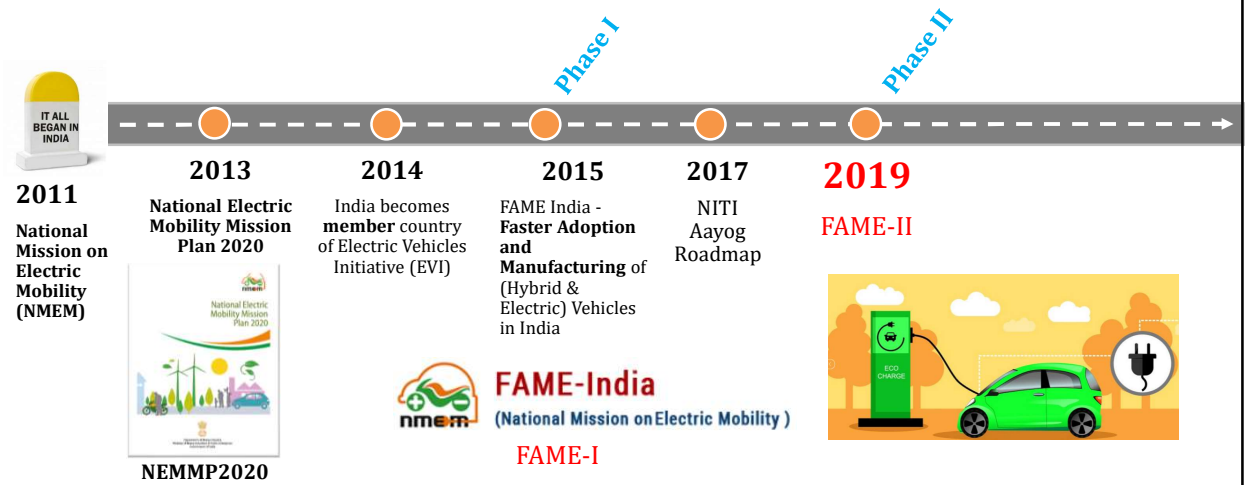
- Indian began its pollution control initiatives by adopting EU regulations in a phase-wise manner right from Euro-I
  - First country to leap-frog from Euro-IV to Euro-VI directly in a short period of time
- India has been giving Alternative fuels, a major thrust both from environment and energy security point of view.
- CNG /LPG have been major alternative fuels for India since the beginning of millennium.
  - Current Focus is on infrastructure development in tier-II cities
- Ethanol and biodiesel have been given equal importance as transport fuels.

Indian Initiatives for cleaner transport

- Recently, electrification of transport vehicles has become a focus point of the Government for reducing pollution in cities
- The FAME India scheme (Faster Adoption and Manufacturing of (Strong) Hybrid and Electric Vehicles in India) was introduced in 2015 with an aim of supporting battery-powered vehicles so as to promote environment-friendly commute options.
- Second phase of the FAME India scheme focuses on electrifying India's public and shared transport system through support of subsidies for electric vehicles such as buses, passenger cars and two-wheelers.
- In August 2019, the government announced plans to procure 5,585 electric buses, to help clean up the environment. With such strong government support, the Indian electric bus market value is predicted to increase from $94.3 million in 2020 to $1,364.4 million by 2025, at a 48.8% CAGR between 2021 and 2025 as per estimates

E-mobility-Government Initiatives

Ministry of Heavy Industries & Public Enterprises (Department of Heavy Industries)



Levers to Support xEV adoption-FAME-I

(Faster Adaption and Manufacturing of Electric (& Hybrid) Vehicles)

Demand Generation
- Mandating xEV in govt fleets and pub. Transport
- Cash Incentives
- Tax Incentives
- Road Tax Exemption

Supply Related Interventions
- Encouraging Domestic Mfg.

R&D
- Domestic xEV manufacturing and lowering cost in future

Infrastructure
- Charging infrastructure at
  - Bus Depots
  - Apartment complexes
  - Malls
  - Parking garages
  - Workplaces
  - Public Buildings

Govt.---Academia---Industry collaboration

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Demand incentive to purchaser: FAME-I

Vehicle Category	Incentive
2 Wheelers	Rs. 7,500 to 29,000 (~USD 500)
3 Wheelers	Rs. 11,000 to 61,000 (~USD 1,000)
Passenger Cars	Rs. 60,000 to 1,38,000 (~USD 2,000)
Light Commercial Vehicles	Rs. 1,02,000 to 1,87,000 (~USD 3,000)
Buses 	• **Incentive Level 1** (For min 15% localization): **60%** of purchase cost or **INR 8.5 million**, whichever is lower • **Incentive Level 2** (For min 35% localization): **60%** of purchase cost or **INR 10 million**, whichever is lower

- Incentive will disbursed in **03 equal installments in 03 years**.
- **Localization** will be calculated based on **Ex-Factory Price.**
- OEM to issue **self-certification** for localization contents.
- Additional incentive **for EVSE, up to 10%** of total eligible incentive for fleet of buses.

Source: https://www.fame-india.gov.in/

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FAME India Scheme Phase II - Overview

- Implementation over a period of 3 years starting from 1st-April-19
- FAME II has Three Broad Verticals

Incentive Based on Battery kWh

Charging Infrastructure

Information, Education and Communication (IEC)

Sr. No.	Component	2019-20	2020-21	2021-22	Total Funds in Crores
1	Demand Incentives	822	4587	3187	8596
2	Charging Infrastructure	300	400	300	1000
3	Administrative Expenditure including Publicity, ICE Activities	12	13	13	38
	Total for FAME II	1134	5000	3500	9634
4	Committed Expenditure of Phase I	366	0	0	366
	Total	1500	5000	3500	INR 10000 Crores

1.5 Billion USD

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Deployment of Electric Buses

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Electric Bus Procurement Under FAME-I

- ❑ 11 cities with million-plus population were sanctioned E-buses.
- ❑ Ministry allocated 390 electric buses to selected cities.
- ❑ Ministry also approved funding of 130 electric buses to Ahmedabad (50 buses), Himachal Pradesh (50 buses) and Navi Mumbai (30 buses)

City, State	Number of Buses	Length	Contract Type
Bangalore, Karnataka	60	12 Meter	Gross Cost Contract
	20	9 Meter	Gross Cost Contract
Hyderabad, Telangana	40	12 Meter	Gross Cost Contract
Mumbai, Maharashtra	80	9 Meter	Gross Cost Contract
Indore, MP	40	9 Meter	Outright Purchase
Lucknow, UP	40	9 Meter	Outright Purchase
Kolkata, West Bengal	40	9 Meter	Outright Purchase
	40	12 Meter	Outright Purchase
Jammu, J&K	15	9 Meter	Outright Purchase
Guwahati, Assam	15	9 Meter	Outright Purchase

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Electric Bus Started by State Government

Telangana State Road Transport Corporation (TSRTC) started its first fleet of **40 electric buses in Hyderabad** on 5th March 2019

West Bengal Transport Corporation (WBTC) started **40 electric buses** on 31st March 2019

Lucknow City Transport Services Limited (LCTSL) started 40 **electric buses** in Feb 2019

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Electric Bus Deployment Under FAME-II

08-August-2019

Sanctioned **5595 Electric Buses to 64 Cities**

- ❑ **5095 electric buses to 64 Cities** / State Transport Corporations for **intra-city operation.**
- ❑ **400 electric buses** for intercity operation and
- ❑ **100 electric buses** for last mile connectivity to Delhi Metro Rail Corporation (DMRC)

These buses will run about **4 billion kilometers** during their contract period and are **expected to save cumulatively about 1.2 billion liters** of fuel period, which will result into **avoidance of 2.6 million tonnes of CO2 emission**.

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Regulatory update- For PEV and H2FC

- Major efforts put-in in setting up regulatory framework for PEV/HEV/H2FC in line with EU.
- Regulations in place for environmental performance as well as safety aspects
- Next few slides present a summary of regulatory framework for PEV and H2FC in India.
- Focus is on faster transposition of EU regulations/ GTRs for PEV/HEV/H2FC into Automotive Industry standards (AIS)

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2 June 2021

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EV Regulations In India

Indian Standard	Ref. Standard
AIS 038 Rev 1 : Requirements for Construction and Functional Safety	UN Regulation 100
AIS 039 Rev 1: Measurement of Electrical Energy Consumption (Wh/km)	UN Regulation 101
AIS 040 Rev 1: Method of Measuring the Range (km)	UN Regulation 101
AIS 041 Rev 1: Measurement of Net Power & Maximum 30 minute power	UN Regulation 85
AIS 049 Rev 1: CMVR Type Approval for Electric Vehicles	-
AIS 048: Safety Requirements for Traction Batteries	USABC, ISO/IEC Standards
AIS 038 Rev 2: Specific Requirements for Electric Power Train of Vehicles (M & N Category)	GTR 20 Phase 1 and UN R 100 Rev 3 Transposition Document.
AIS 156: Specific Requirements for Electric Power Train of Vehicles (L Category)	UN Regulation 134 and GTR 13
AIS 157: Safety and Procedural Requirements for Type Approval of Compressed Gaseous **Hydrogen Fuel Cell Vehicles**	UN Regulation 134 and GTR 13
AIS 168: Specific Requirements for A6 and A7 Category Electric Power Train **Agricultural Tractors**	REGULATION (EU) No 167/2013 and REGULATION (EU) No 3/2014 REGULATION (EU) 2015/208

AIS 039 Rev 1: Electrical Energy Consumption

Applicable for M3 and N2/N3 Category Vehicles also.

- Test using driving Cycle on Chassis Dynamometer
- India Specific Driving Cycles for eBuses-**"Delhi Driving Cycle"**
- For N2/N3 Category Driving Cycle is **"Part 1 of MIDC"**
- Measurement of Energy Required per km: **Wh/km**

HCV Chassis Dynamometer

※MIDC= Modified Indian Driving Cycle. Part 1 is Urban Part

AIS 040 Rev 1: Measurement of Range

Applicable for M3 and N2/N3 Category Vehicles also.

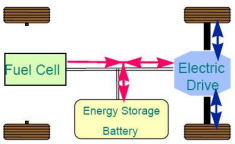
- Test using driving Cycle on Chassis Dynamometer
- India Specific Driving Cycles for eBuses-**"Delhi Driving Cycle"**
- For N2/N3 Category Driving Cycle is **"Part 1 of MIDC"**
- Measurement of **Distance covered** by vehicle in one full charge

※MIDC= Modified Indian Driving Cycle. Part 1 is Urban Part

AIS 157:Safety & Procedural Requirements for Type Approval of Fuel Cell Vehicles

Applicable for M3 and N2/N3 Category Fuel Cell Vehicles.

- Aligned with UN R 134 and GTR 13
- **Standards Covers**
  - Fueling Receptacles
  - H2 Storage System and Safety
  - H2 Fuel Lines
  - Fuel Cell Stack
  - High Voltage Electrical Safety
  - Traction Battery safety
  - Electric Propulsion
  - Performance Test



Thank You

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