India’s Initiative Towards Tighter Emission & Fuel Efficiency Norms

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ARAI - At A Glance

ARAI®
Progress through Research

Corporate Office
ARAI, Kothrud, Pune

Forging Industry Division
ARAI-FID, Chakan, Pune

Homologation & Technology Centre
ARAI-HTC, Chakan, Pune

- Established in 1966 at Pune, India
- Human Resource of 680+
- Facilities & Infrastructure: Rs.720 Crore
- Affiliates in China & Korea
- Accredited with
  - ISO 9001, 14001
  - OHSAS 18001
  - NABL (ISO/IEC 17025)

Laboratories:

- Powertrain, Emissions, Passive Safety, Safety & Homologation, Vehicle Evaluation, Materials, Automotive Electronics, Structural Dynamics, NVH, CAE, Calibration
- Academy
- Forging Industry Division
- Homologation and Technology Centre
- Regional Centre South Chennai

53 years of Building Automotive Excellence

Journey and Service Portfolio

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Journey

1970

Testing House

2010 Onwards

Testing + R&D House

Facility Establishment

Tools

1966 – 1980

Testing Competency

Experience

1981 – 1990

Technology Development

Expertise

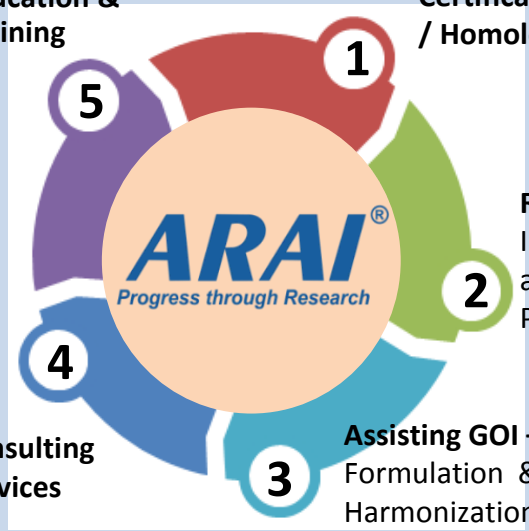
1991 – 2010

Research

Knowledge

Beyond 2010

Service Portfolio



Education & Training

Certification Testing / Homologation

R&D – National Interest, Industry and Internal R&D Projects

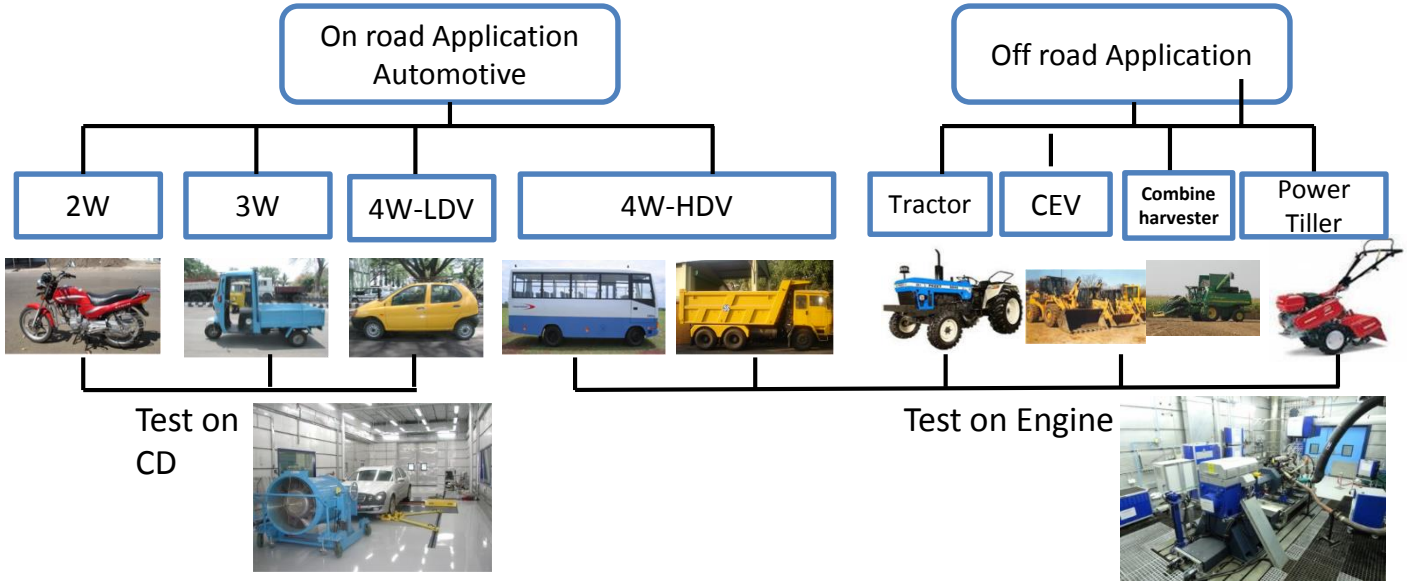
Assisting GOI – Standards Formulation & Regulations Harmonization

Consulting Services

53 Years of Building Automotive Excellence (1966 – 2019)

BSVI- Overview

Vehicle applications covered under CMVR



Crawler Based Non-roadable machine Stage IV/ Stage V norms are under finalisation

- **Types of certification**
  - Type Approval
  - Conformity of Production
  - In-Use compliance (PUC)
  - In-service Conformity
- **Documentation & Procedures**
  - AIS : AIS-137 Type Approval & Conformity of production test procedure
  - Government notifications : Effective dates & limits, fuel Specification, COP requirement

Emission Regulation Worldwide

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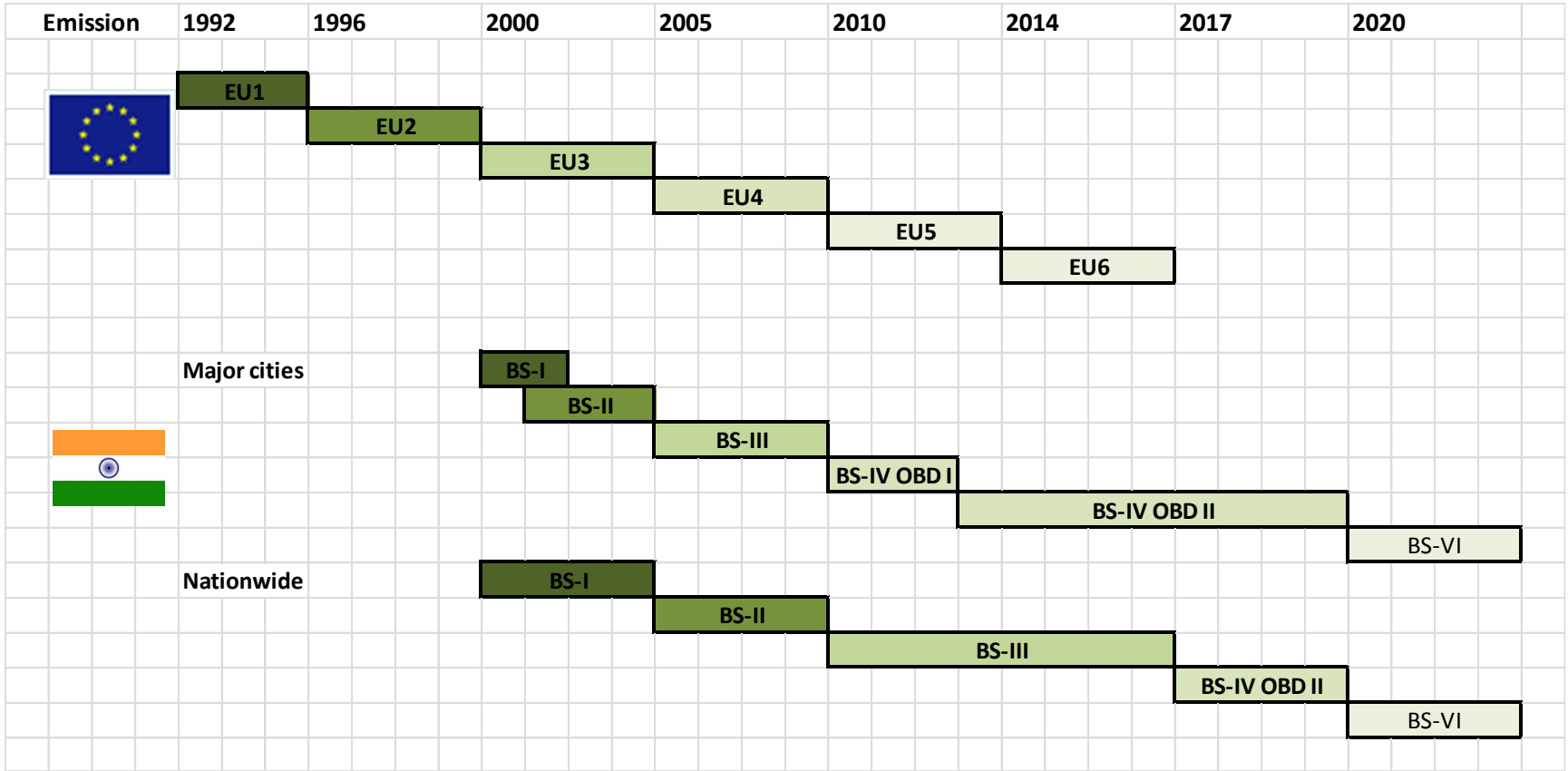
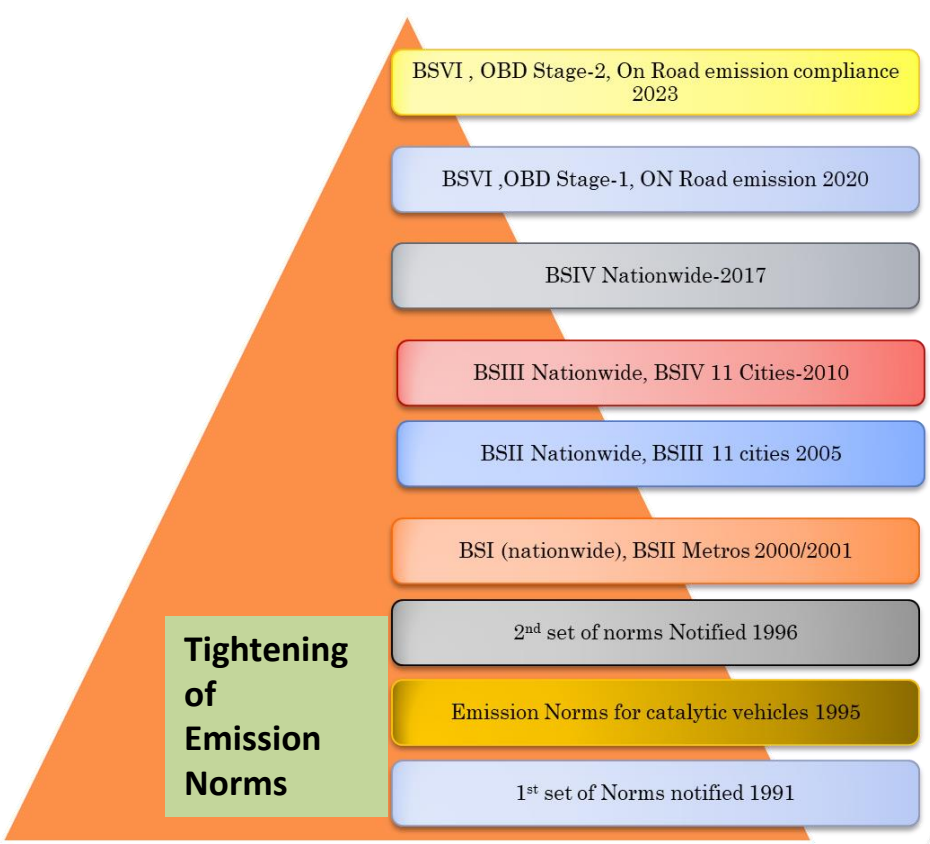
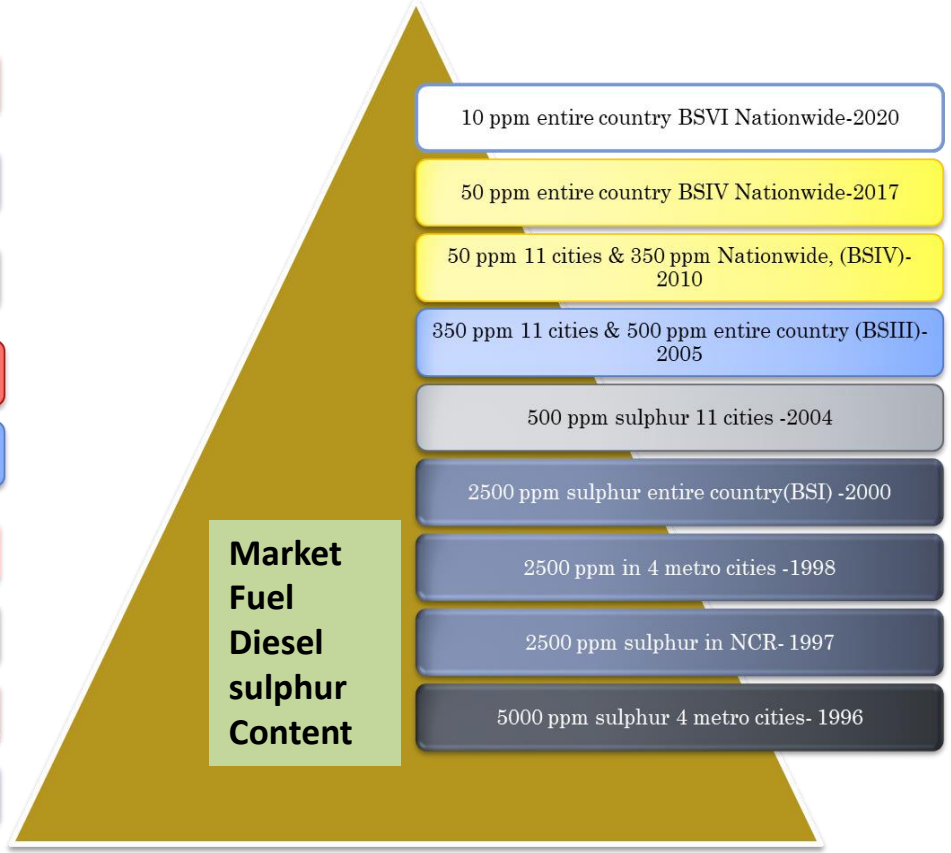
Progress through Research



Emission Norms and Fuel Quality improvement





India Road Map for Fuel Efficiency Norms

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Fuel Efficiency Standards for Passenger cars & Labelling

Fuel Efficiency standards for Heavy Duty vehicles

Fuel Economy norms for 2/3 Wheelers

Fuel Efficiency Standards for Tractors and subsequent labelling

Electric vehicles (EV) and charging Infrastructure for EVs

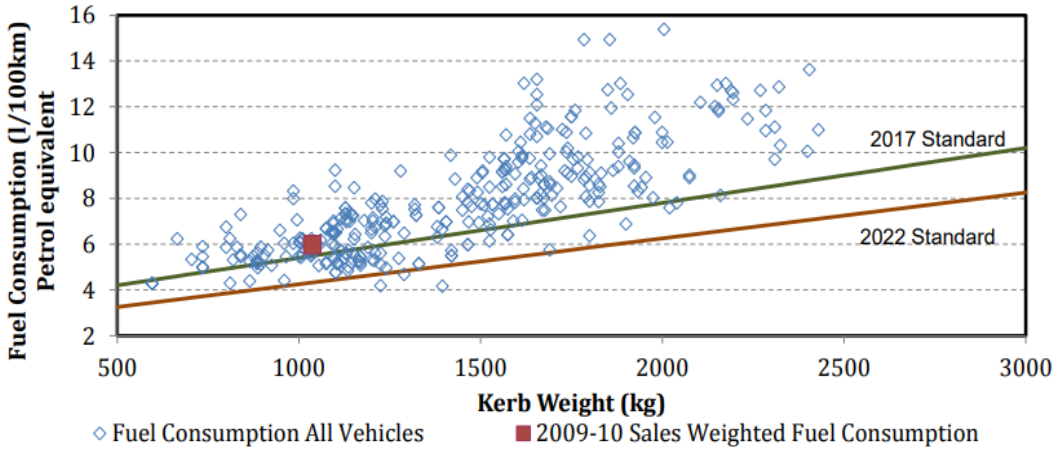
Indian FE Regulations

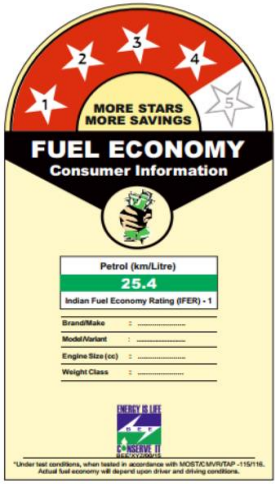
- ✓ **Fuel efficiency norms for For M1 category (<3.5 tons GVW) are notified - Implementation from 1st April 2017 (Notification GSR 954 (E) dated 4th October 2016)**

  Vehicles to comply with the Average Fuel consumption Standard, notified under the Energy Conservation Act, 2001 vide notification of the Government of India in the Ministry of Power number 1072 (E), dated the 23rd April, 2015.

  - **Applicable procedure – AIS:137 and its Parts , as amended from time to time.**
  - **Applicable to vehicle below 3.5 tons.**
  - **Manufacturer to declare CO_2 values for all variants for CAFÉ.**
- ✓ **Fuel Efficiency norms for heavy commercial diesel vehicles above 12.0 tons have been notified.**
- ✓ **Fuel Efficiency norms for light and medium duty commercial diesel vehicles between 3.5 tons to 12.0 tons is under finalisation.**
- ✓ **Simulation Test Procedures are under Evaluation for future regulatory purposes.**

Fuel Efficiency Standards for Passenger Cars & Labelling





Phase-1 2017-18

- CAFE: 5.5 l/100 km (129.8 gmCO_2/km) @1037 kg

Phase 2 2022-23

- CAFE: 4.78 l/100 km (113.0 gmCO_2/km) @1145 kg

Average Fuel Consumption Standard

- Average Fuel Consumption Standard = Average Fuel Consumption standard in petrol equivalent liter per 100 kilometre.

  = a x (W-b) + c

  Where, a, b & c = constants

  W = Weighted average of unladen mass in kg of all new said motor vehicle, manufactured or imported for sale by the manufacturer.

Constant	For fiscal year 2017-18 to 2021-22	For fiscal year 2022-23 onwards
a	0.0024	0.002
b	1037	1145
C	5.4922	4.7694
Avg. F.C . Standard	0.0024 x (W-1037)+5.4922	0.002 x (W-1145)+4.7694
Target CO2	130 g/km @1037 kg ULW	113 g/km @1145 kg ULW

FE Regulations for > 12.0 Ton Diesel Vehicles

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- Evaluation of fuel economy using Constant Speed Fuel consumption (CSFC) test as per IS:11921:1993.
- Fuel consumption (km/l) is being determined at constant speeds of 40 km/h & 60 km/h with vehicle in fully laden condition.
- CSFC Test is carried out for all combinations of Tyres, Drive train which produces higher fuel consumption as per worst case criteria.
- HDFE Consolidated BSIV Data analysis was done as indicated below ;
  - FE data collection & analysis performed on 1000+ vehicle configurations of different manufacturers.
  - Analysis carried out on results of fuel consumption measured as per category, GVW & axle configuration of vehicle.
  - Deriving limiting equation at 80 percentile for fuel economy (l/100km) at 40 km/h & 60km/h speed.
- Government of India has issued notification SO 2670 (E) for M3 & N3 categories of vehicle through Ministry of Power.
- Monitoring performance of vehicles over Limiting equation.

Proposed Fuel Efficiency Standards for Commercial Vehicles in India

ARAI® Progress through Research

Phase 1 (Track Testing)

- Constant Speed Fuel Consumption (CSFC) at 40 kmph & 60 kmph (>12t HDV) & 50 kmph for buses

Vehicle Category	Gross vehicle weight (tonnes)	Axle configuration	Equation	Fuel consumption (l/100km)	
				Value at lower weight limit	Value at upper weight limit
40 kilometers per hour					
N3 Rigid Vehicles	12.0-16.2	4x2	Y = 0.362X + 10.327	14.7	16.2
	16.2-25.0	6x2	Y = 0.603X + 6.415	16.2	21.5
	16.2-25.0	6x4	Y = 0.723X + 4.482	16.2	22.6
	25.0-31.0	8x2	Y = 0.527X + 8.333	21.5	24.7
	25.0-31.0	8x4	Y = 0.928X - 0.658	22.5	28.1
	31.0-37.0	10x2	Y = 0.960X - 5.100	24.7	30.4
N3 Tractor Trailers	35.2-40.2	4x2	Y = 0.986X - 7.727	27.0	31.9
	40.2-49.0	6x2	Y = 0.628X + 6.648	31.9	37.4
	40.2-49.0	6x4	Y = 1.255X - 18.523	31.9	43.0
M3 Vehicles	12.0 and above	4x2 and 6x2	Y = 0.509X + 11.062	17.2	

Vehicle Category	Gross vehicle weight (tonnes)	Axle configuration	Equation	Fuel consumption (l/100km)	
				Value at lower weight limit	Value at upper weight limit
60 kilometers per hour					
N3 Rigid Vehicles	12.0-16.2	4x2	Y = 0.788X + 9.003	18.5	21.8
	16.2-25.0	6x2	Y = 0.755X + 9.546	21.8	28.4
	16.2-25.0	6x4	Y = 1.151X + 3.122	21.8	31.9
	25.0-31.0	8x2	Y = 0.650X + 12.160	28.4	32.3
	25.0-31.0	8x4	Y = 0.968X + 7.692	31.9	37.7
	31.0-37.0	10x2	Y = 0.650X + 12.160	32.3	36.2
N3 Tractor Trailers	35.2-40.2	4x2	Y = 0.208X + 32.198	39.5	40.6
	40.2-49.0	6x2	Y = 0.628X + 15.298	40.5	46.1
	40.2-49.0	6x4	Y = 1.342X - 13.390	40.6	52.4
M3 Vehicles	12.0 and above	4x2 and 6x2	Y = 0.199X + 19.342	21.7	

***Notification is under review for revised GVW**

Proposed Fuel Efficiency Standards for Commercial Vehicles in India

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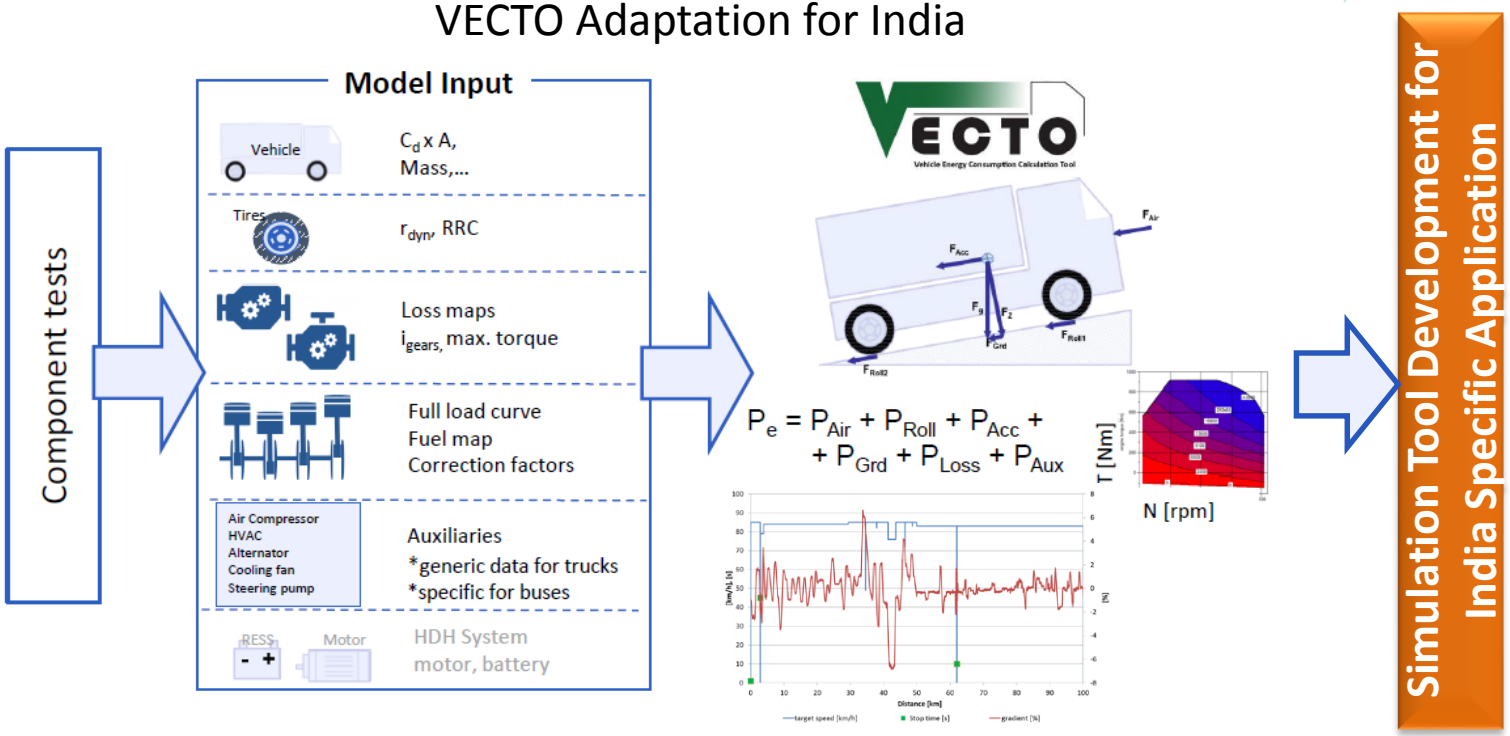
Phase 2 (Simulation)

- Drive Cycle based fuel consumption (Under discussions)

VECTO Adaptation for India



Thank you !