



WELCOME

Work Shop on Heavy Duty Fuel Efficiency Regulations









- 1. About PCRA
- 2. Impact of Growing Economy in India
- 3. Why FE Norms for Heavy Duty Vehicles



- 4. Development of Fuel Economy norms for heavy duty vehicles.
- 5. Formation of Steering Committee





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Automobile Domestic Sales Trend





PCRA – An Integrated Energy Solution Provider

Source-SIAM





CRUDE OIL IMPORT (MMT)



Source: PPAC

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INDIA's Consumption Pattern of Petroleum products







Demand Projection of HSD in India



97.8

104.1 110.7

2021-22

100 86.7 92 81.6 76.9 68.4 **69.4** 60.07 64.75 69.16 80 56.24 **Demand** in 51.71 MMT 60 **40** 20 0 2009-10 2010-11 2011-12 2012-13 2013-14 2014-15 2015-16 2015-16 2015-16 2015-16 2015-20 2019-20 2019-20 2008-09 ■ HSD

Years

Note : Actual data up to 2014 -15 taken in graph

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Background :

- India's requirement of HSD to increase from 69.4 MMT in 2014-15 to 110.7 MMT in 2021-22.
- Major Consumption is by Heavy Duty Vehicles (trucks and buses).







- Rising incomes, increasing government focus on infrastructure development and increasing economic activity are the key drivers, which are expected to fuel the demand for commercial vehicles in India
- Between 2012-13 and 2024-25, sale of buses is expected to grow at a CAGR of 5.7 per cent to increase from 0.11 million to 0.21 million
- Trucks sales is estimated to register strong growth of around 8.9 per cent to increase from 0.80 million in 2012-13 to 2.23 million in 2024-25
- Total number of on-road buses and trucks in 2025 is estimated to be around 23 million

Estimated number of on-road buses and trucks



Source: IMaCS Analysis





Figure depicts Energy loss in vehicles caused due to various factors and potential energy savings.

Types	Urban / Intercity (percent)	Potential of energy savings (percent)
Engine Losses	60	28
Heat rejection	26	
Exhaust heat	24	
Gas exchange	4	
Friction	1.5	
Engine accessories	2.5	
Aerodynamic losses	4-10 / 21	11.5
Drivetrain losses	5-6 / 2	
Braking losses	15-20 / 0-2	
Auxiliary loads	7-8 / 4	
Rolling resistance	8-12 / 13	11

Source: NRC,2010

- Engine losses account for maximum losses.
- It is followed by braking losses, losses due to aerodynamics, rolling resistance, loads, and drive trains.

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PCRA Fuel consumption standards typically includes



- \checkmark Approaches to the design of fuel consumption target values
- ✓ Stringency of the target
- ✓ Timing of Introduction
- ✓ Compliance roadmap







Fuel consumption standards based on

- I) GVW or Kerb weight
- 2) Segments of buses and trucks
- Type of fuel consumption standards
 - I) Engine standards
 - 2) Vehicle standards
- Unit(s) of fuel consumption standards km/L or L/km or L/ton-km or L/kWh
- Alignment of fuel consumption standards and emission standards

Testing procedure for fuel economy test

- I) On-road testing
- 2) Engine testing
- 3) Chassis + Engine testing
- 4) Computer simulation

Test cycles for fuel consumption testing





Fuel consumption norms in other countries



Country/ Region	Regulation Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Japan	Fuel Econom y					Phase 1 regulation implemented, starting MY2015						
		Standard proposal	Final rule			Regulation implemented starting MY 2014 (Mandatory DOT program starts MY 2016)						
States	efficiency				Pha propos final	nase 2 osal and al rule?				Phase 2 implementation?		
Canada	GHG/ Fuel efficiency			Standard proposal and <i>final rule?</i>		Reg	Regulation implemented starting MY 2014 ? Phase 2 implementation			Phase 2 implementation?		
Mexico	Fuel Efficiency			Standard proposal?			Regulation implemented starting MY Pho 2016 ? implemented			Phase 2 implementation?		
China	Fuel Consumption	Test procedur e finalised	Industry standard proposal	Industry standard implemented <i>Standard</i> proposal?	Final Rule?	Regulation implemented starting MY 2015 ?				Y 2015 ?		
European Union	GHG	Technic	cal studies	Impact Assessment	Test pro final	st procedure finalised? Policy implemen			entation?			

Source: ICCT-Anup .B presentation on "HDV vehicle FE regulatory development around the world 3.7.12



Fuel consumption norms for buses and trucks in other countries



Country/ Region	Standard	Measure	Structure	Targeted Fleet Test Cycl		Implementation
Fuel consumption	on standards					
United States Fuel		mpg	Single standard for cars and size-based standards for light trucks	New	U.S. CAFE	Mandatory
Japan	Fuel	km/l	Weight-based	New	JC08	Mandatory
China	Fuel	l/100-km	Weight-based	New	NEDC	Mandatory
Australia	Fuel	l/100-km	Single standard	New	NEDC	Voluntary
South Korea	Fuel	km/l	Engine-size based	New	U.S. EPA City	Mandatory
Taiwan Fuel		km/l	Engine-size based	New	U.S. CAFE	Mandatory
Emission standards						
European Union	CO ₂	g/km	Single standard	New	NEDC	Voluntary
Canada	GHG (CO ₂ , CH ₄ , N ₂ O, HFC _S)	l/100-km	Vehicle class-based	In-use and new	U.S. CAFE	Voluntary
California	GHG (CO ₂ , CH ₄ , N ₂ O, HFC _S)	1, g/mile Vehicle class-based 3)		New	U.S. CAFE	Mandatory





- One of the pre-requisites for development of fuel consumption standards is collection of **baseline data** for various models of buses and trucks under pre-defined test conditions.
- For establishing the baseline for fuel consumption standards, fuel consumption or **fuel economy data under standardised test conditions** is required for each model of buses and trucks for all manufacturers for the baselines year.
- One of the biggest challenges for developing fuel consumption standards for trucks and buses was non-availability of any reported fuel economy data of trucks and buses, either by manufacturers or government bodies.

FUEL ECONOMY NORMS FOR HEAVY DUTY VEHICLES



Suggested Methodology/approach :

- Main issues for resolution
- What types of vehicles should be regulated?
- What test procedures and methodologies are appropriate for measuring the fuel efficiency?
- What metric(s) would be appropriate for measuring and expressing HDV fuel efficiency performance?
- What is the range of factors such as design, functionality, use and duty cycle to be considered?
- What methods will be used to determine compliance and overall program effectiveness?

Key areas requiring comprehensive work

(a) Industry Characterization

- Description and weight rating of vehicle classes, market segments.
 - Review of current Domestic and International fuel efficiency voluntary and regulatory actions.

FUEL ECONOMY NORMS FOR HEAVY DUTY VEHICLES



.....Suggested Methodology/approach

- (b) Evaluation of technology costs and benefits
- Definition of baseline engine and vehicle configurations.
- Overview of gasoline, diesel and natural gas engine technologies.
- Estimated costs and benefits of different technologies, applicability in the near- and mid-term.

(c) **Definition of test procedures**

- Overview of existing engine test procedure
- Procedures being followed in other countries.

PCRA FUEL ECONOMY NORMS FOR HEAVY DUTY VEHICLES



.....Suggested Methodology/approach

(d) Vehicle Simulation Modeling

- Evaluation of feasibility of using a model to simulate testing.
- Application of model for vehicle certification purpose.

(e) Evaluation of Standard Stringency and Emission criteria

- Evaluation of fuel consumption and greenhouse gas emission reduction as well as cost for each of the scenario.
- Air quality and health benefits of proposed standards.
- Evaluation of other program impacts including noise, energy security impacts.
- Evaluation of Trailers.

(f) Additional considerations

- Lead-time given for implementation of standards
- Any flexibility mechanisms including averaging, banking and trading and credit of innovative technologies.





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Project Approach

Stakeholder Consultation

 Interactions were performed with Labs & Manufacturers Association to assess the test capacity methods and market structure of HDV segment

Vehicle Classification

 Vehicle Classification is being done to identify the category of vehicles to be covered under the HDV FE norms i.e. passenger carriers and good carriers.

Market Analysis

 Market Analysis is being done to analyze the market size of HDV M and N category.

Test Methods & Labs

 Analysis of test methods national & international and laboratory capacity assessment is being done to understand the facility in place in India to undertake the HDV testing.







Vehicle Classification

Vehicle Category	Category Name	Category Details (GVW in Tons)					
Buses (Carrying Passengers)							
Category – M ₁	Car	< 3.5T					
Category – M ₂	Bus	< 5T					
Category – M ₃	Bus	> 5T					
Trucks (Carrying Goods)							
Category – N ₁	LCV	≤ 3.5T					
Category – N ₂	MCV	> 3.5T ≤12 T					
Category – N ₃	HCV	> 12 T					





Test Methods

S. No.	Type of Test	Simulation of	Countries considering fuel consumption norms for HDVs
1.	On-road	NA	India
2.	Chassis Dynamometer	Road	China
3.	Engine Dynamometer	Road and non-engine components	US, EU, Japan
4.	Computer Simulation	All	US, EU, Japan, China





Lab Capacities in India

Parameters	ARAI	VRDE	ICAT	CIRT
Test Track	NA	Available	Development under process	NA
Facility for chassis Dynamometer	Yes	Yes	Yes	NA
Facility for Engine Dynamometer	Yes	Yes	Yes	Yes
FE – Test Equipment	Yes	Yes	Yes	Yes
Trained Manpower	Yes	Yes	Yes	Yes
NABL Accreditation	Yes	Yes	Yes	Yes





- a) To undertake detailed analysis of HDV's
- b) To start deeper analysis of test data received from Labs.
- c) To study comparative analysis of test procedures.
- d) To do analysis to identify best possible approach.
- e) Short term approach.
- f) Mid/Long term approach .
- g) Technology gap- analysis for achieving higher FE.







"save fuel today, secure your tomorrow" Thank You