

REF:NS:SEC:

3rd June, 2019

National Stock Exchange of India Limited
"Exchange Plaza", 5th Floor,
Plot No.C/1, G Block
Bandra-Kurla Complex
Bandra (East), Mumbai 400051.

BSE Limited
Phiroze Jeejeebhoy Towers,
Dalal Street, Fort,
Mumbai 400001.

Bourse de Luxembourg
Societe de la Bourse de Luxembourg
Societe Anonyme/R.C.B. 6222,
B.P. 165, L-2011 Luxembourg.

London Stock Exchange Plc
10 Paternoster Square
London EC4M 7LS.

**Sub: SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015 -
Presentation made to the Analyst/Institutional Investor**

This is further to our letter bearing REF:NS:SEC dated 31st May, 2019 wherein we had given you an advance intimation of the upcoming Analyst or Institutional Investor Interactions in terms of Regulation 30(6) of the Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015.

We wish to inform that the Company today conducted Group Meeting - Knowledge Sharing Session on BSVI with Several funds/Investors/Analysts in Mumbai and the Presentation which was made to them is attached herewith for your records.

Kindly take the same on record and acknowledge receipt.

Yours faithfully,
For MAHINDRA & MAHINDRA LIMITED



NARAYAN SHANKAR
COMPANY SECRETARY

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DEMYSTIFYING BS VI

Agenda

- **About BS-VI**
- **Technology Overview**
- **Customer Perceptive**
- **Product Portfolio**
- **World-class Ecosystem**
- **Key Success Factor**

Outline

- **About BS-VI**
- Technology Overview
- Customer Perceptive
- Product Portfolio
- World-class Ecosystem
- Key Success Factor

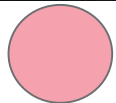
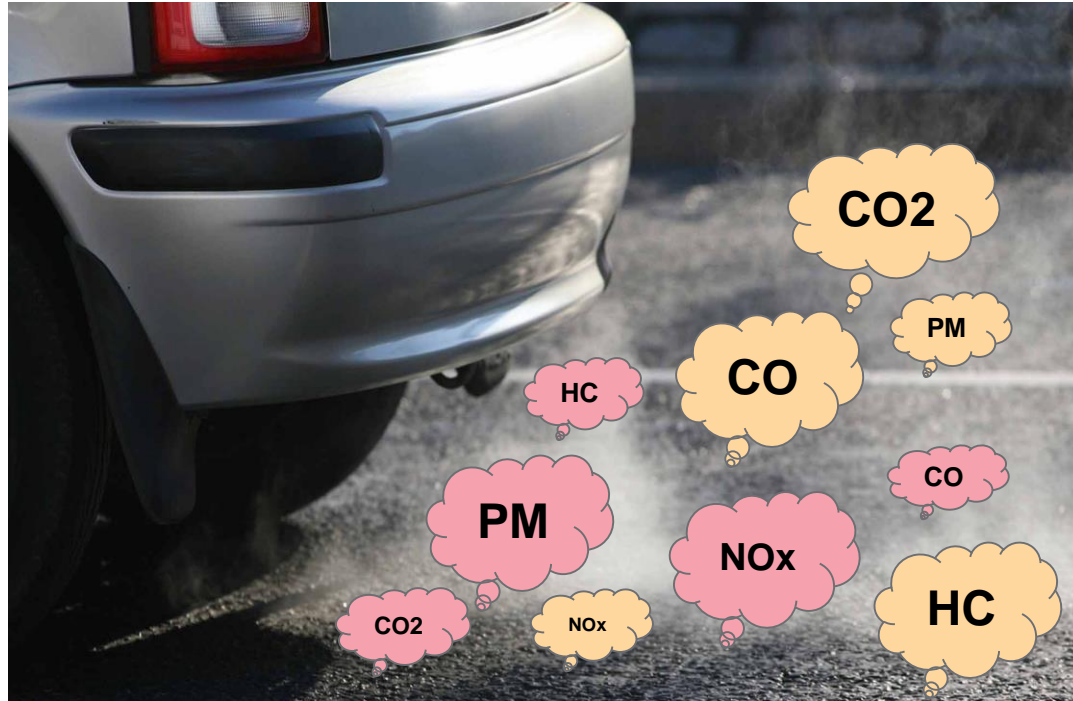
Demystifying BS VI



- **Pollutants & Legislation**
- **Technologies & Electronics**
- **Fuel upgrade**
- **Advanced Engine Management**

Automotive Emissions

Key pollutants



DIESEL



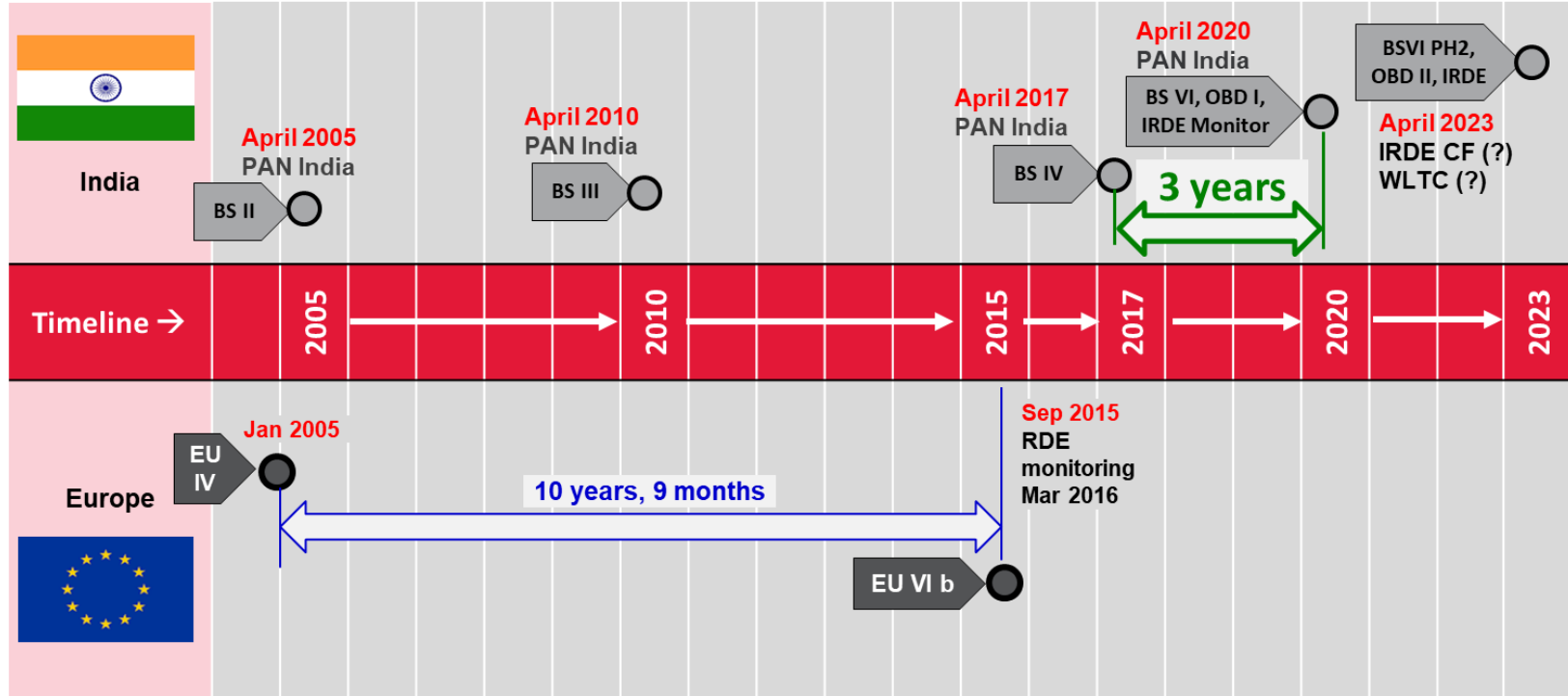
GASOLINE

Key Pollutants:-

- Diesel – PM & NOx
- Gasoline – CO , HC & CO2
- Gasoline emits 20-25% higher CO2 than Diesel

Legislation Overview

Legislation Roadmap : India & Europe



Stage 4 to Stage 6 Emission Migration, Europe in over 10 years and India in 3 Years

BS4 to BS6 : (Both PM and NOx reduction together)

First country to skip an emission standard (BS-V)

BS4 [mg/km]
NOx – 250
PM – 25

DIESEL

NOx – 68 %
PM – 82 %

BS6 [mg/km]
NOx – 80
PM – 4.5

BS4* [mg/km]
CO – 833
HC – 83

GASOLINE

CO – 20 %
HC – 8.5 %

BS6* [mg/km]
CO – 667
HC – 76

* thru Deterioration Factor

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Technology Overview

BS4 to BS6 : Major Technology Migration (Engine & Exhaust level)

Engine Level Changes

Electric EGR +
Gen 2 cooler

Gen 2 Plunger
Pump

Gen 6+
e-Actuated
turbo

Gen 2 Injector
Nano sac

Intake throttle

Latest Generation Engine
Management System

BS VI

DOC / LNT

cDPF / sDPF

Differential
pressure sensors

T21 Sensor

T3 Sensor

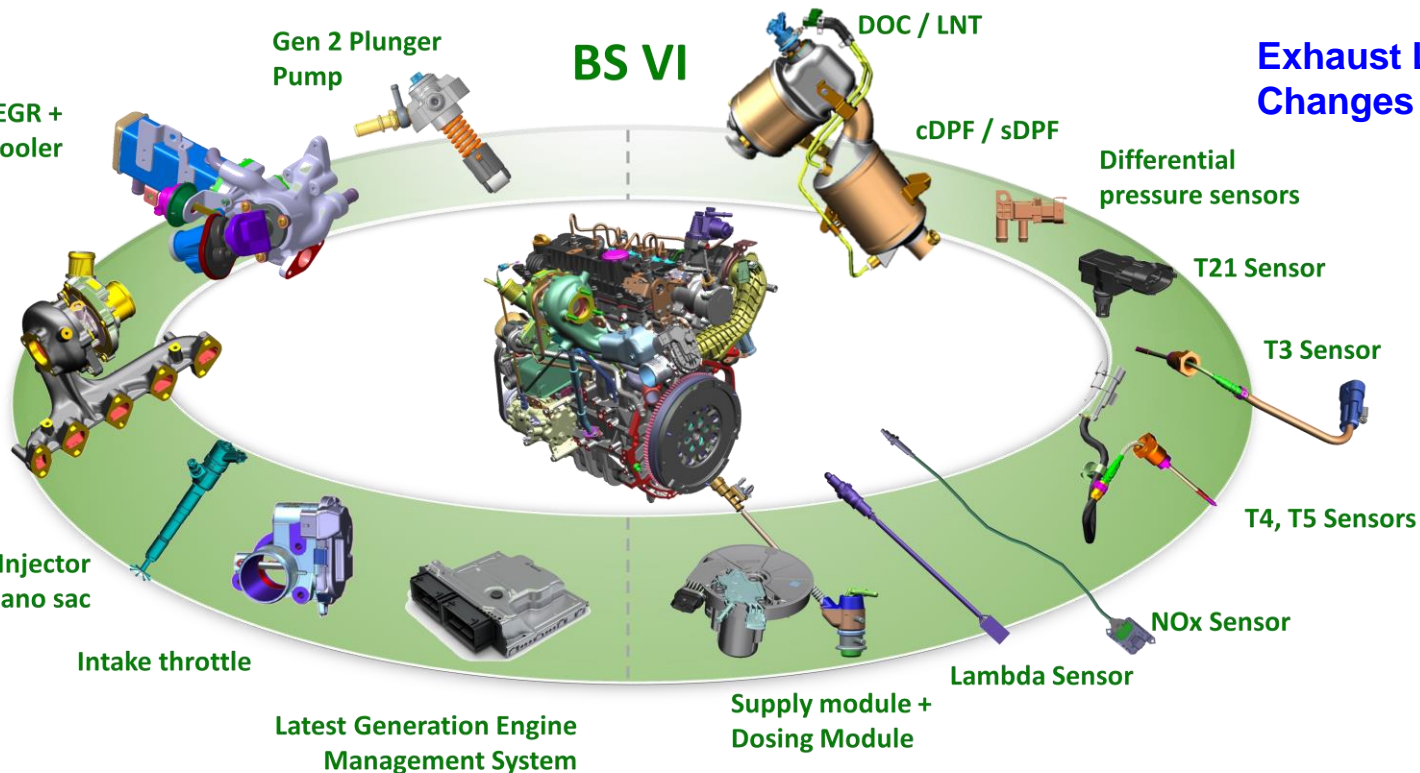
T4, T5 Sensors

NOx Sensor

Lambda Sensor

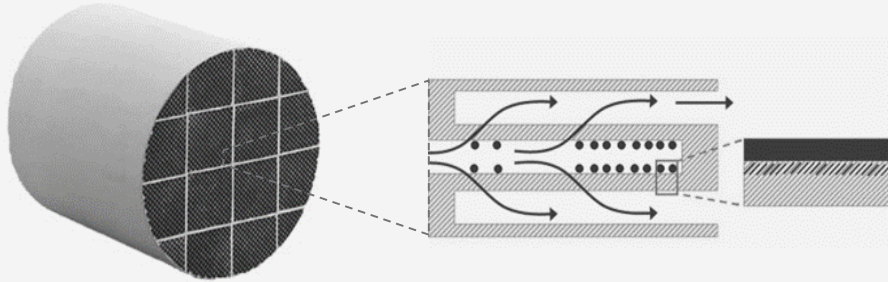
Supply module +
Dosing Module

Exhaust Level Changes

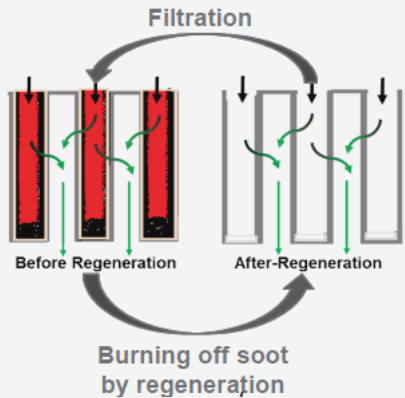


Technology Overview

Diesel Particulate Filter : Particulate Matter / Soot reduction



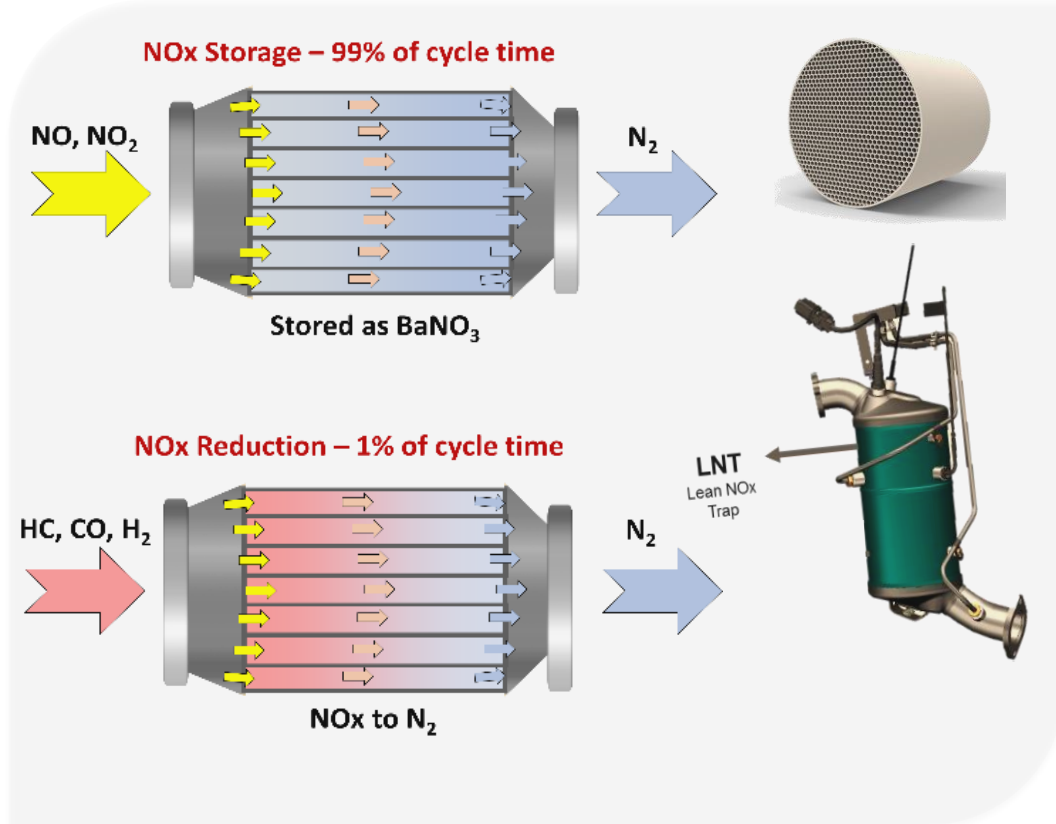
Regeneration Process



- Filtration of Particulate Matter (PM / Soot) from exhaust gas through porous walls.
- Soot accumulates and makes filter full
- Filter is regenerated by burning the soot
 - Active / Passive
- Managed by computer through calibration
- Complex development cycle

Technology Overview

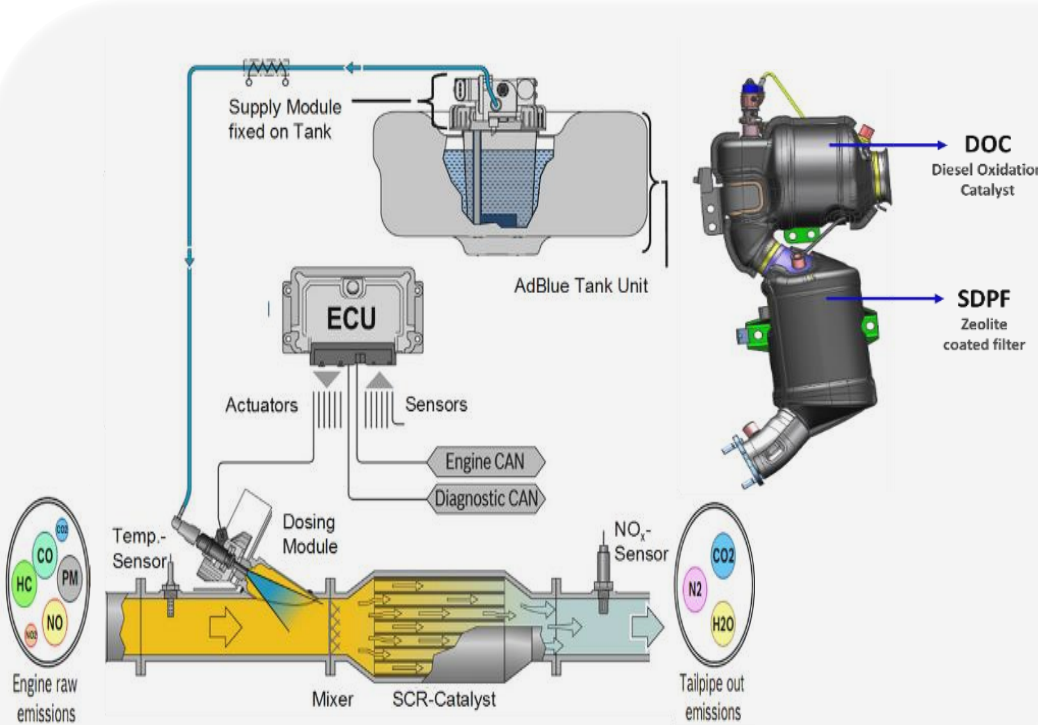
a. Lean NOx Trap (LNT) / NOx Storage Catalyst (NSC) : NOx Reduction



- NOx stored in the catalyst
- Once its full, it is regenerated through Rich Fuel Pulse in Engine
- Simple system and less expensive
- Used for Low power density vehicles

Technology Overview

b. Selective Catalytic Reduction : NO_x reduction



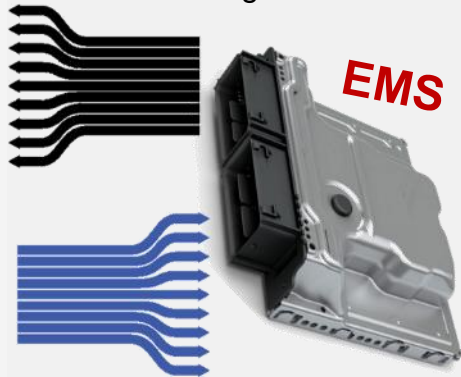
- NO_x conversion by ammonia in catalyst through dosing Urea
- Complex system and more expensive
- More efficient, used for High power density vehicles

Technology Overview

Engine Management System(EMS) – Controls & Monitors

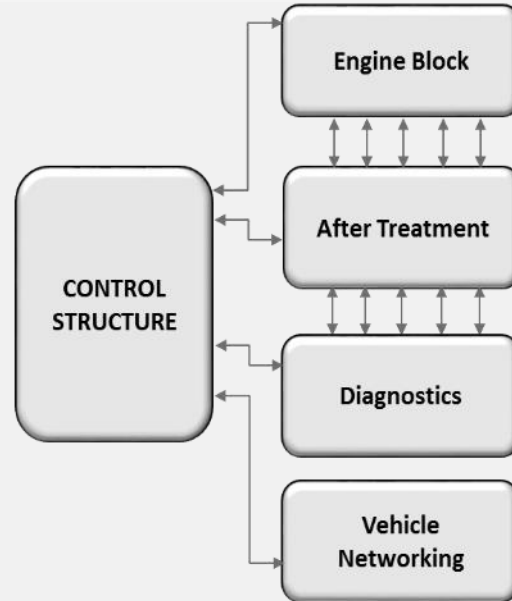
ACTUATORS

- Injector
- AdBlue dosing
- Turbocharger etc



18 SENSORS

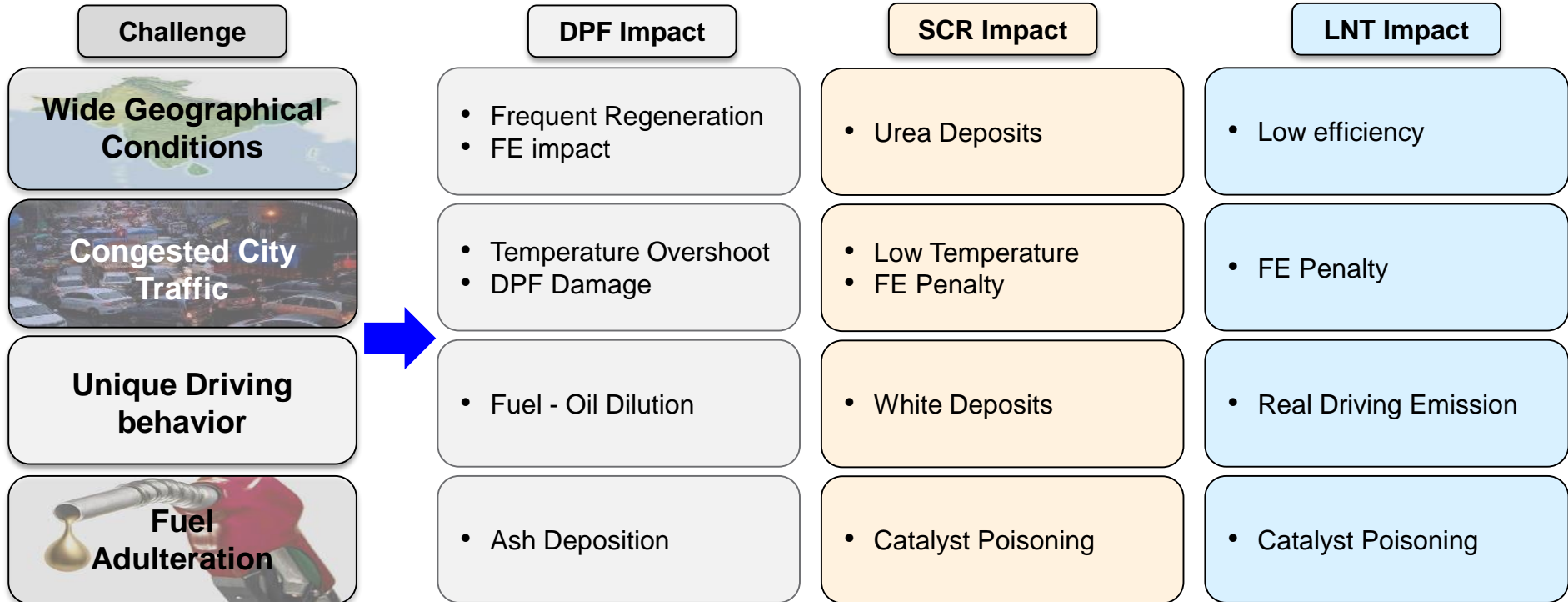
- Pressure
- Temperature
- Flow etc



- Control structure connects various functions such as
 - Engine
 - After treatment
 - Diagnostics
 - Vehicle Networkingand the output is given to actuators.
- Calibration : Complex , lengthy and fine programming for system to perform

Technology Overview

DPF, SCR, LNT : India specific key challenges



Proven European technologies becomes sub optimal | Needs India specific development

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BS VI : Impact to Customer

Key Challenges

**Performance
Driveability**



- Heavy exhaust system & Drivability deterioration

NVH



- Increased fuel pressure & fuel injection in favor of emission

Fuel Economy



- High exhaust pressure drop & after treatment tuning

Price



- High initial cost and cost of ownership due to technology

BS VI : Impact to Customer

Converting BS VI challenges to opportunity

**Performance &
Drivability**

NVH

Fuel Economy

Cost



**Innovation in
Turbocharger**

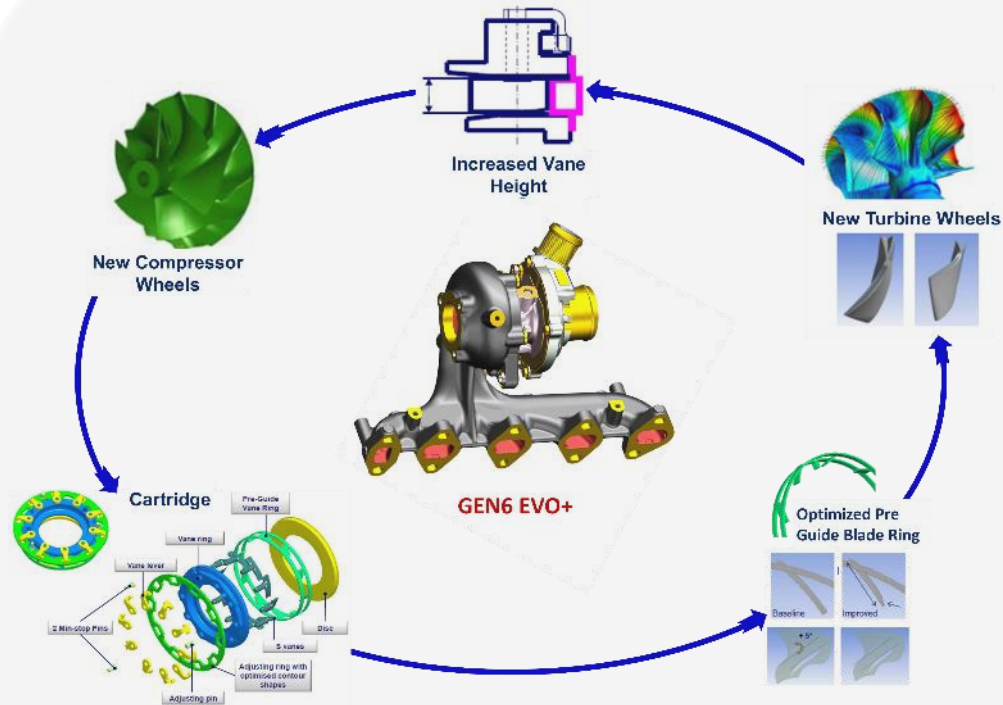
**Fuel Systems & EGR
Module**

**Friction Reduction
Technology**

**New Generation
Engines**

Customer Perspective

Innovation in Turbocharger – Benefit in Performance and FE



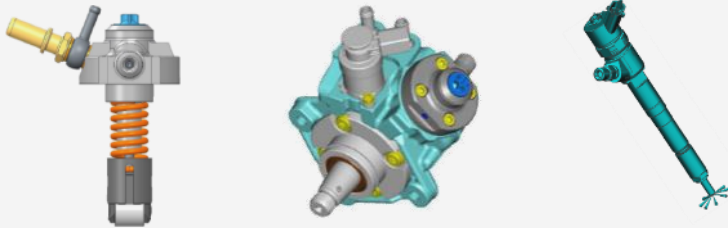
- Integrated Exhaust Manifold
- Electric Actuator for Wastegate / VGT
- Gen VI EVO+ Technology

Customer Perspective

Fuel Systems & EGR Module – Benefit in NVH and FE

Fuel Injection System

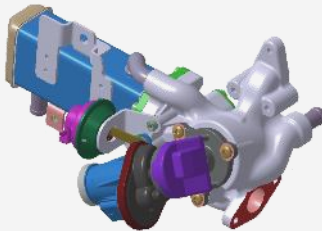
92% Hydraulic Efficiency



- Improved & efficient fuel injection system
- More efficient EGR system

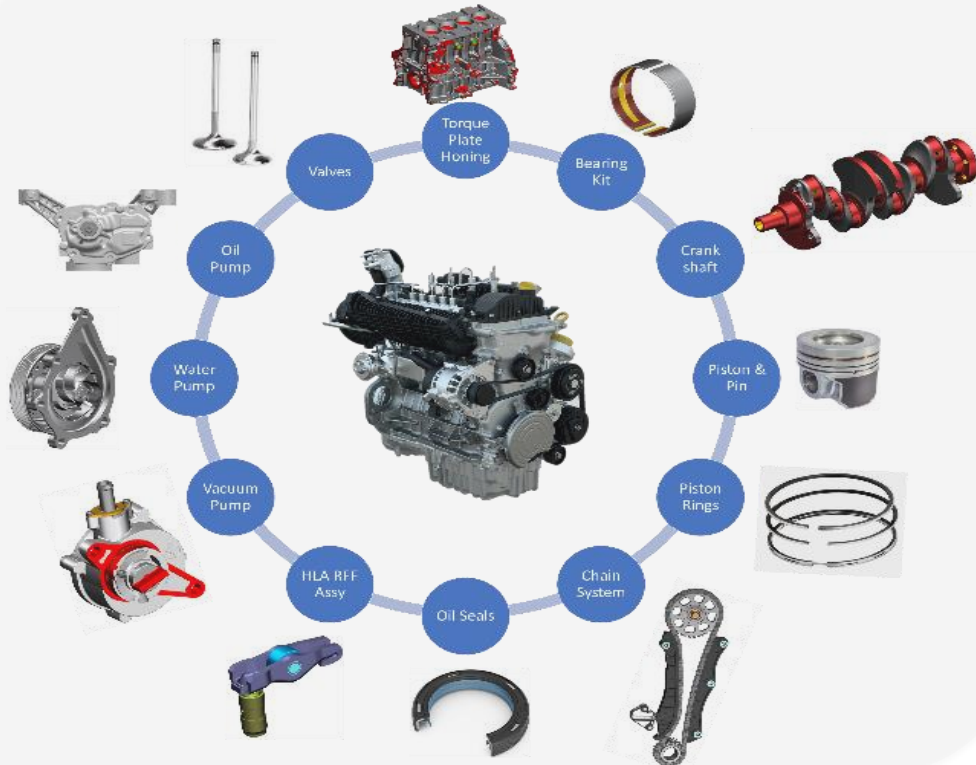
EGR System

85% efficiency & modular concept



Customer Perspective

Global Friction Reduction Technology – Benefit in FE



- All engines are upgraded to state-of-art friction technologies
- Key initiative over emission to retain customer benefit

BS VI : Challenges turned to Opportunities

Customer Values protected through Innovative Technologies

Performance Driveability



NVH



Fuel Economy



Price

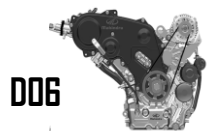


Outline

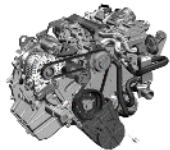
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BS VI Portfolio – Diesel

Engine and Vehicle Platforms



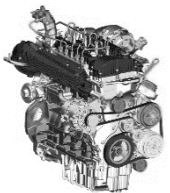
D06



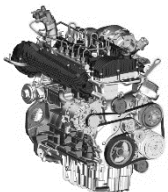
D09
NA & TC



3 D15



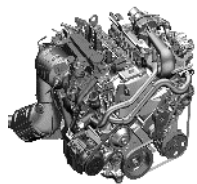
4 D15
DELPHI



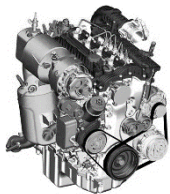
4 D15
BOSCH



D25



Eagle I



Future

8 ENGINES

16 PLATFORMS

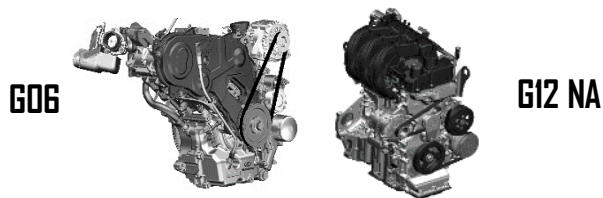
38 VARIANTS

Globally unique
Many platforms | Shortest time



BS VI Portfolio – Gasoline

Engine and Vehicle Platforms



8 ENGINES



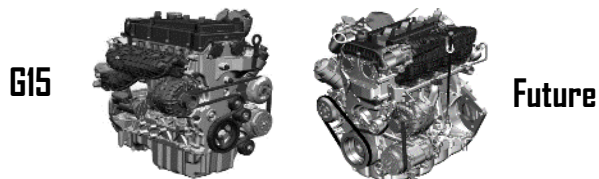
G12 TCMPFI / TGDI



8 PLATFORMS



12 VARIANTS



Complete range



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Delivering World-class Experience

Mahindra Research Valley



MRV - PDC



Power train Infrastructure



Performance T/B (22)



Engine Preparation



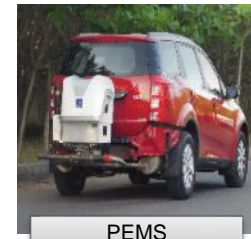
NH3 Analyzer



Functional Test



Durability T/B



PEMS



Chassis Dyno



Transmission Rig



Index Rig

Delivering World-class Experience

Technology Partners - Perennial Source of Latest Technology

Consultants



Key Suppliers

Outline

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Key Success Factor – “*The Team*”

Current Development Status: Expedition

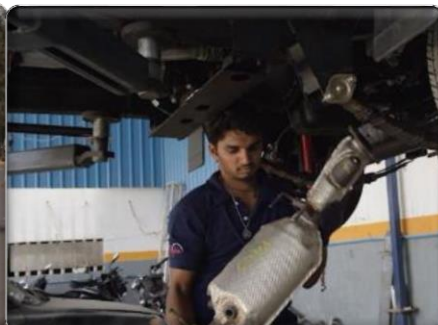
2 Summer and 2 Winter Expedition completed

- Coimbatore, Ooty, Chandigarh, Manali
- 64 vehicles
- 80 Engineers
- 20 Consultants
- Jury members

and still going on...

Key Success Factor – “*The Team*”

Start of On-time Fleet validation



Key Success Factor – “*The Team*”

Manufacturing Builds as per time line





... and miles to go before we sleep

Our Rise



AV

Thank You

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