



Mahindra Group & Products

Product Challenges

Hardware Selection

Results & Achievements

Achievements

Mahindra Group

US\$ 14.4 Billion (FY 2011-12)

Conglomerate with diversified interests

Global excellence at dramatically lower costs

Sustained leadership across the sectors

A very strong corporate brand



EVERY 2 MINUTES A MAHINDRA IS BORN. We call it Rise.

THE ONLY COMPANY HERE TO MAKE EVERYTHING FROM 2-WHEELERS TO TRUCKS.



Mahindra
Rise.

Mahindra
Rise.

Automotive Sector

Moving Force In India's Progress...





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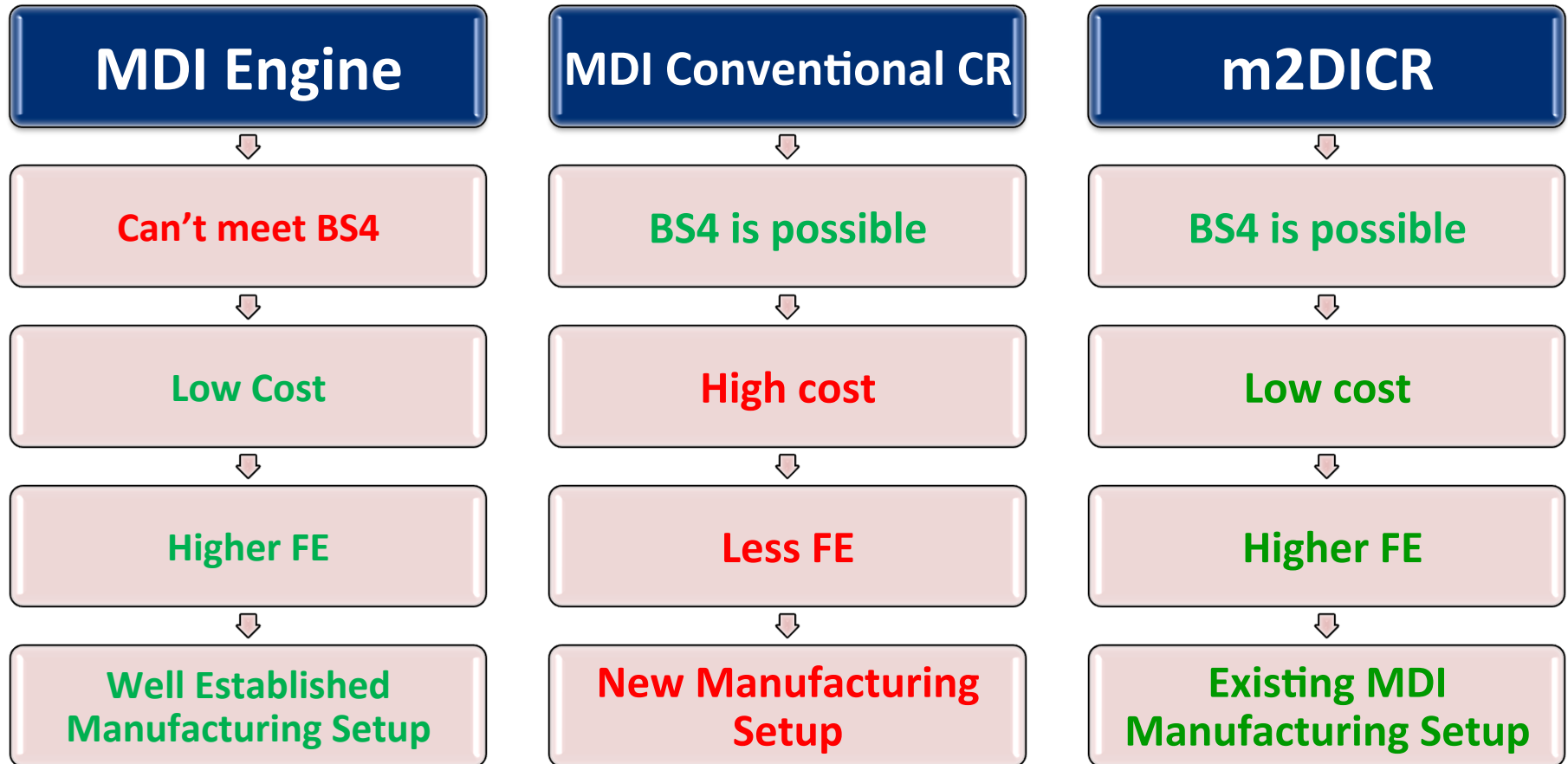
Product Challenges

Hardware Selection

Testing & Verification

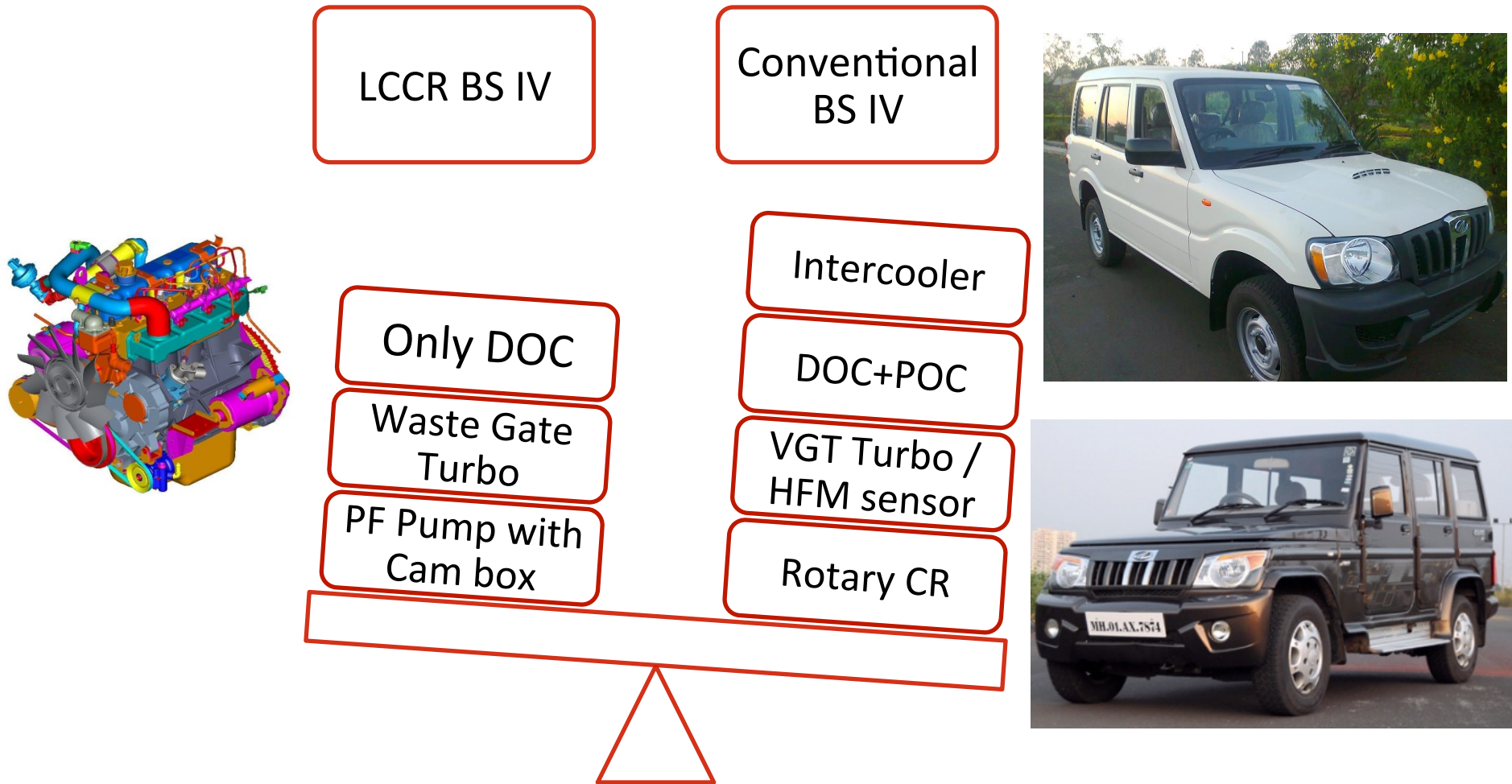
Achievements

Meeting BS4 Emission Norms with MDI DNA



MDI : Is well know M&M Engine driving UV, MPV, Pick Ups, LCV

Approach





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Product Challenges

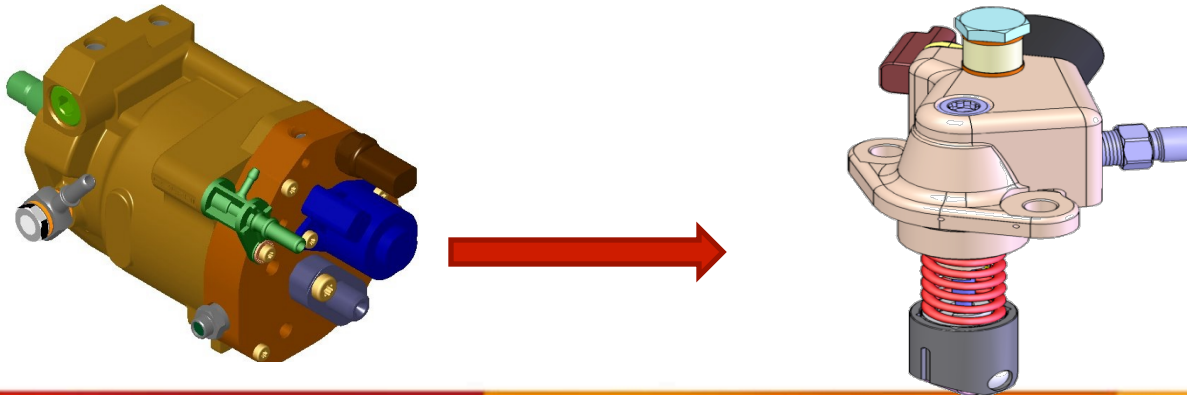
Hardware Selection

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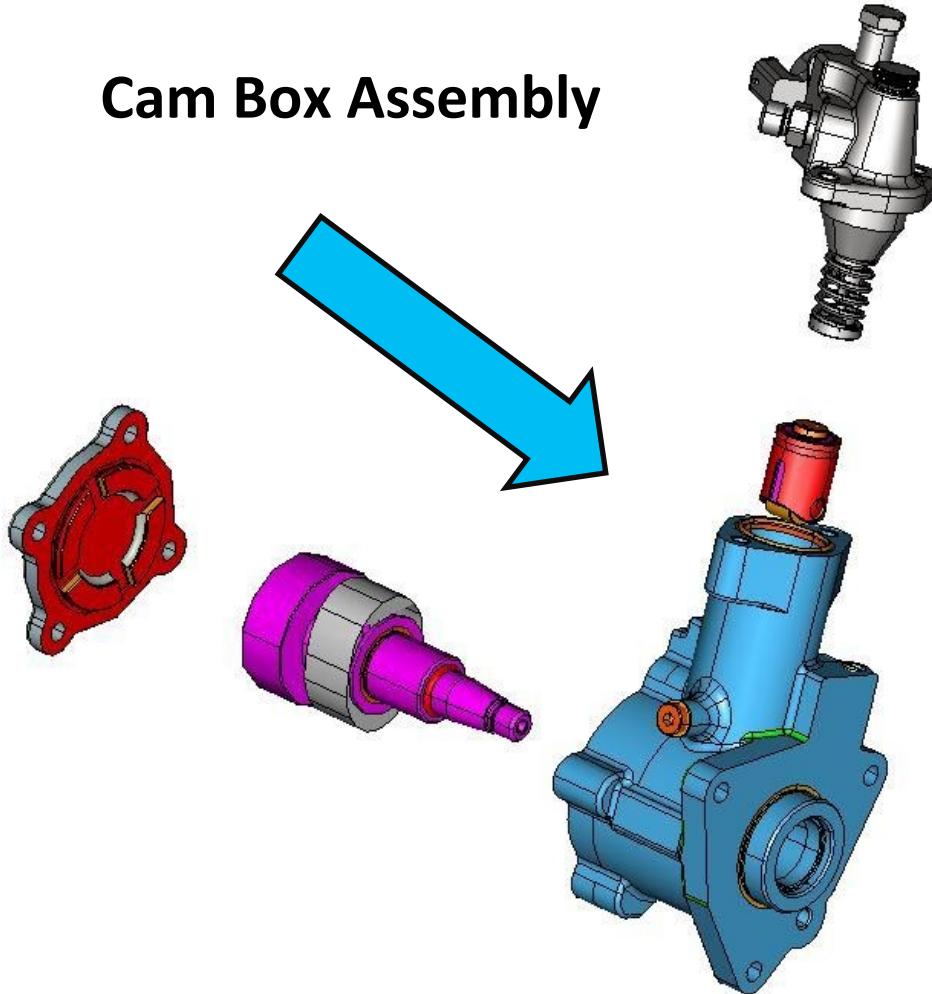
PF Pump Selection

Sr. No	Parameter	Rotary CR	PF Pump: m2DiCR	Remarks
1	Maximum Rail Pressure	1600 bar	1600 bar	No impact
2	Pumping Chamber	Two Plunger Single cam lobe	Single plunger Two Lobe cam	No impact
3	Drive Torque	40 N-m	57 N-m	Better for F.E
4	Minimum Rail Pressure	230 bar	230 bar	No impact
5	Quantity Balance	50 mg/st	50 mg/st	No Impact



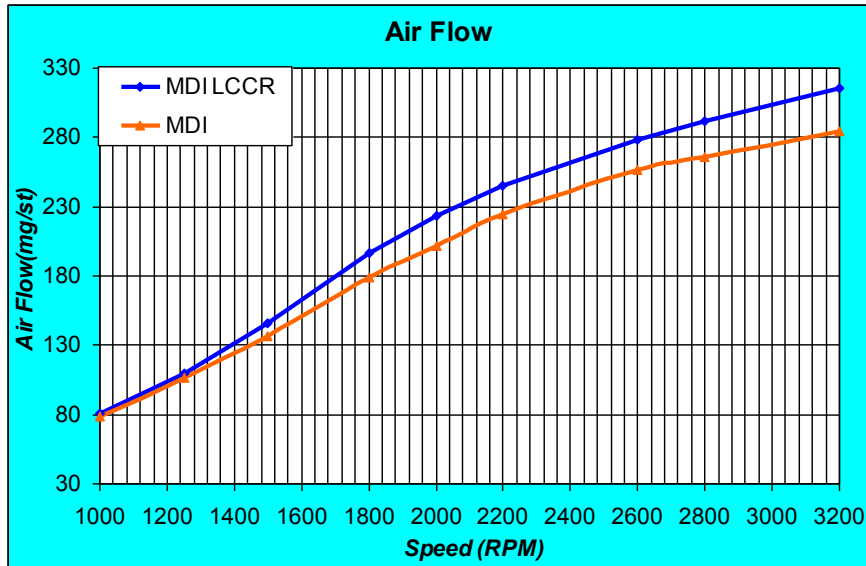
Cam box Design

Cam Box Assembly



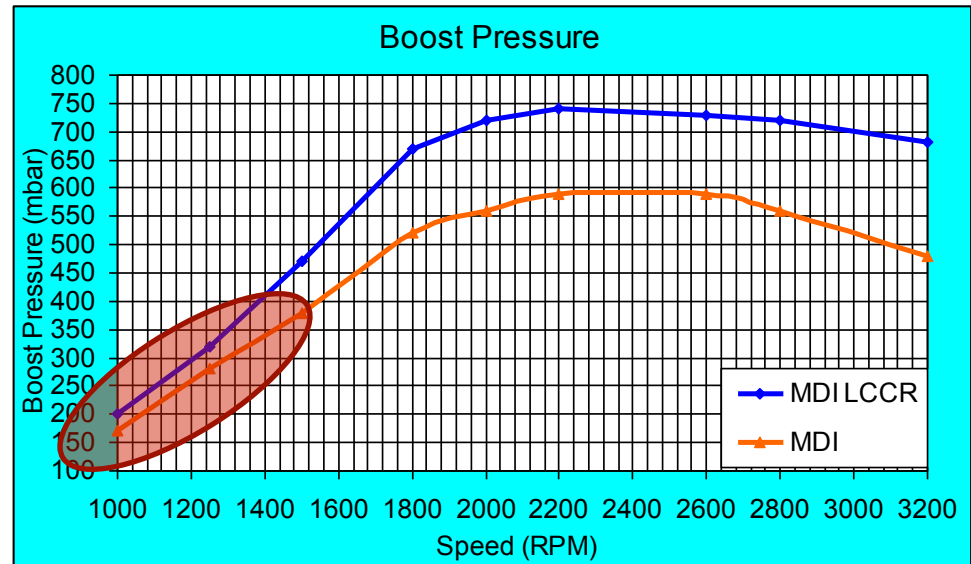
- Low Cost Common Rail System.
- Development of CR using traditional PF Pump.
- Use of Inlet metering to have better FE and Performance.
- Use of same MDI GD for 4 variants.
- **Cam Box Design Patented under M&M Flagship.**
- **First time in World, PF pump for 4 Cylinder engine.**

Turbocharger Optimisation



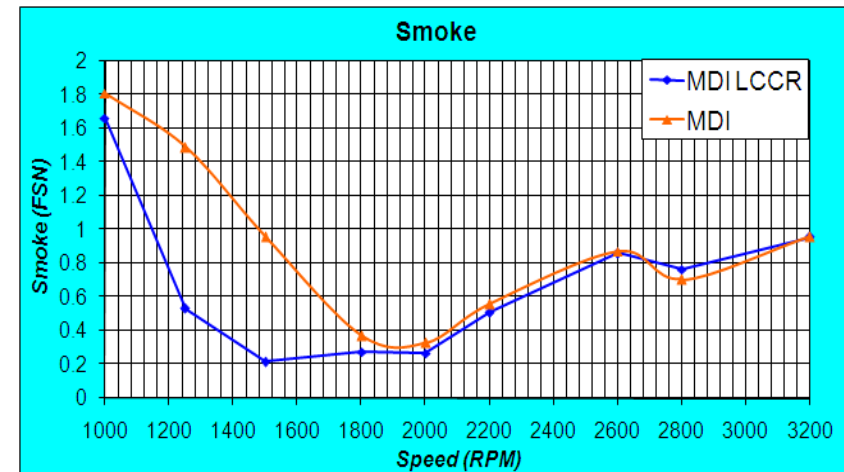
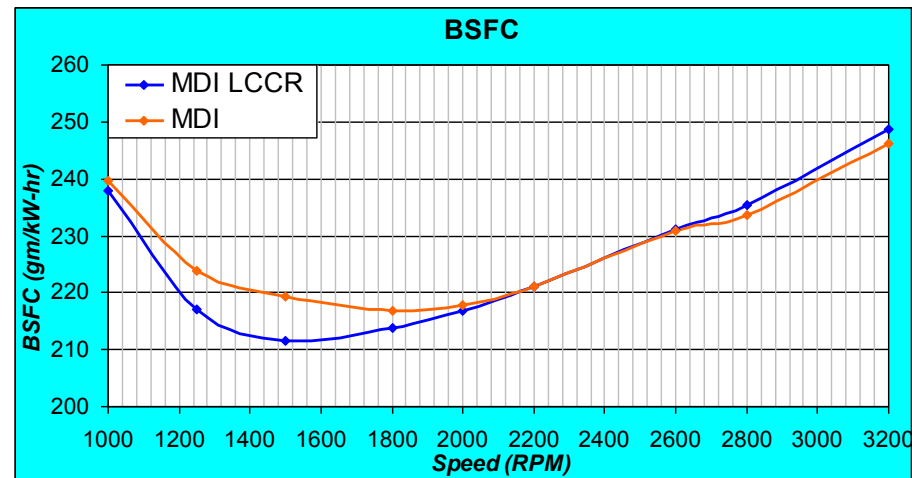
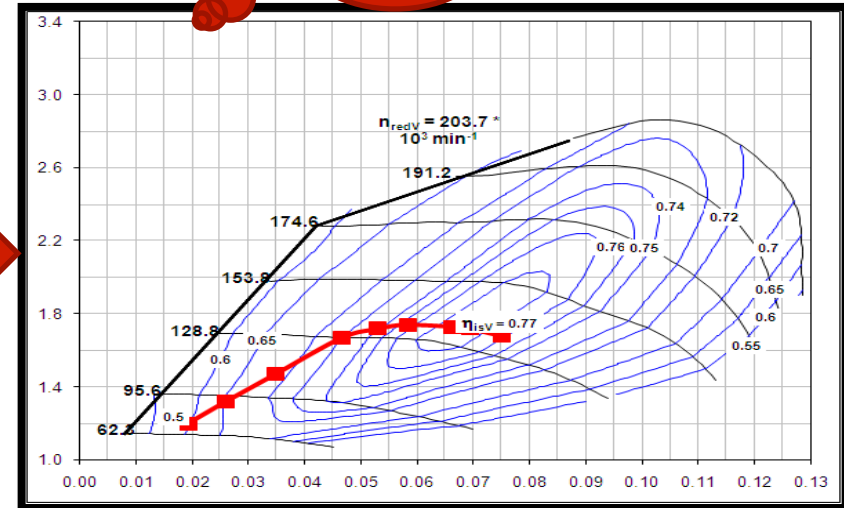
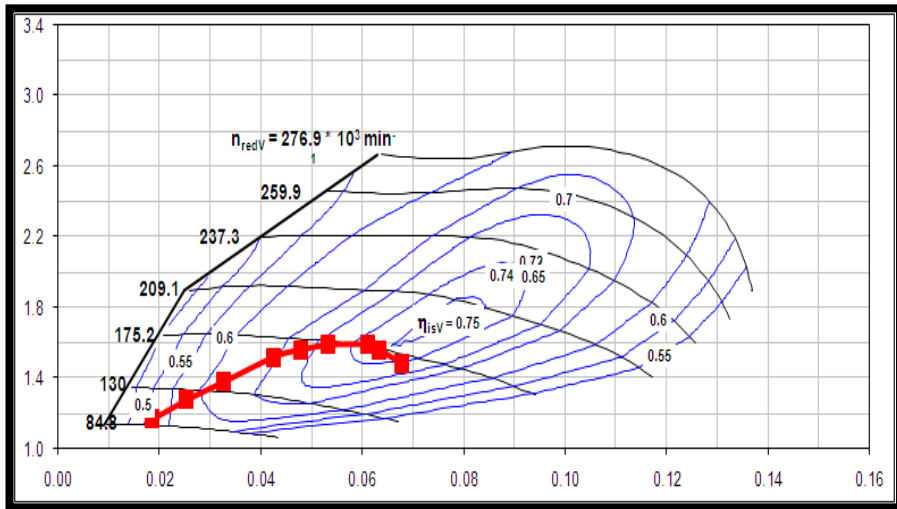
Air flow & Boost Pressure was improved with the Same power rating

Achieved thru' Proper optimisation of housing and compressor.



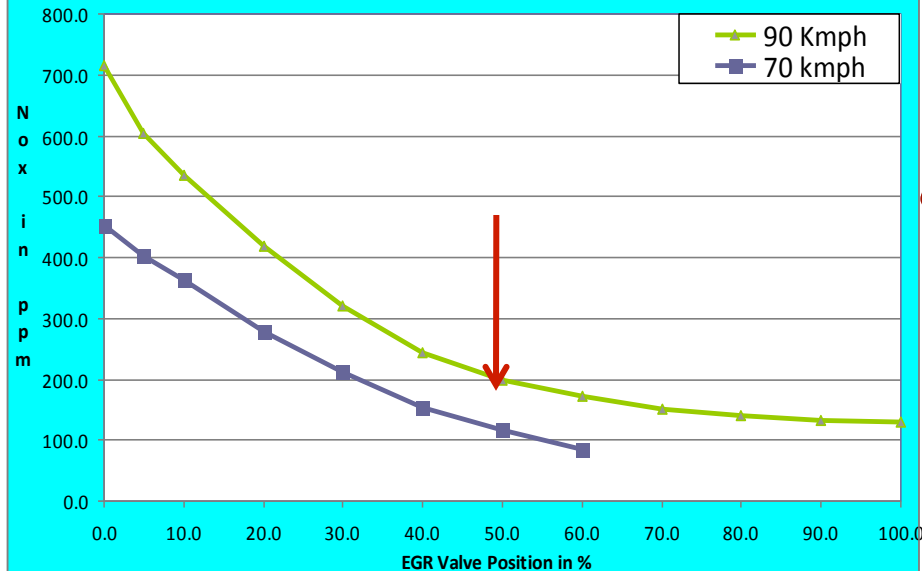
Turbocharger Optimisation

Better Efficiency
which confirms
the FE & Smoke
Improvement



EGR Cooler Selection

Nox Emission

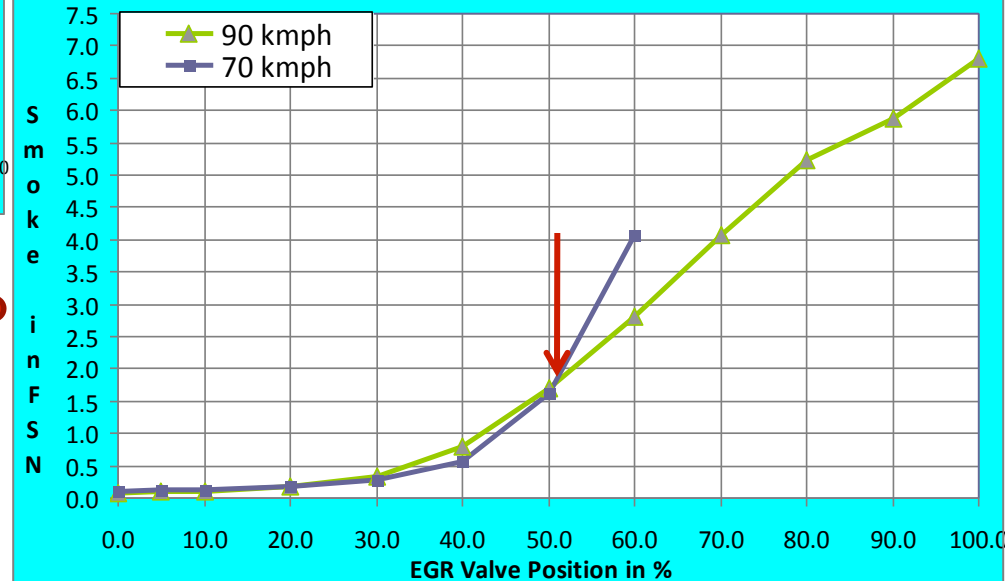


Best Trade
off
Achieved

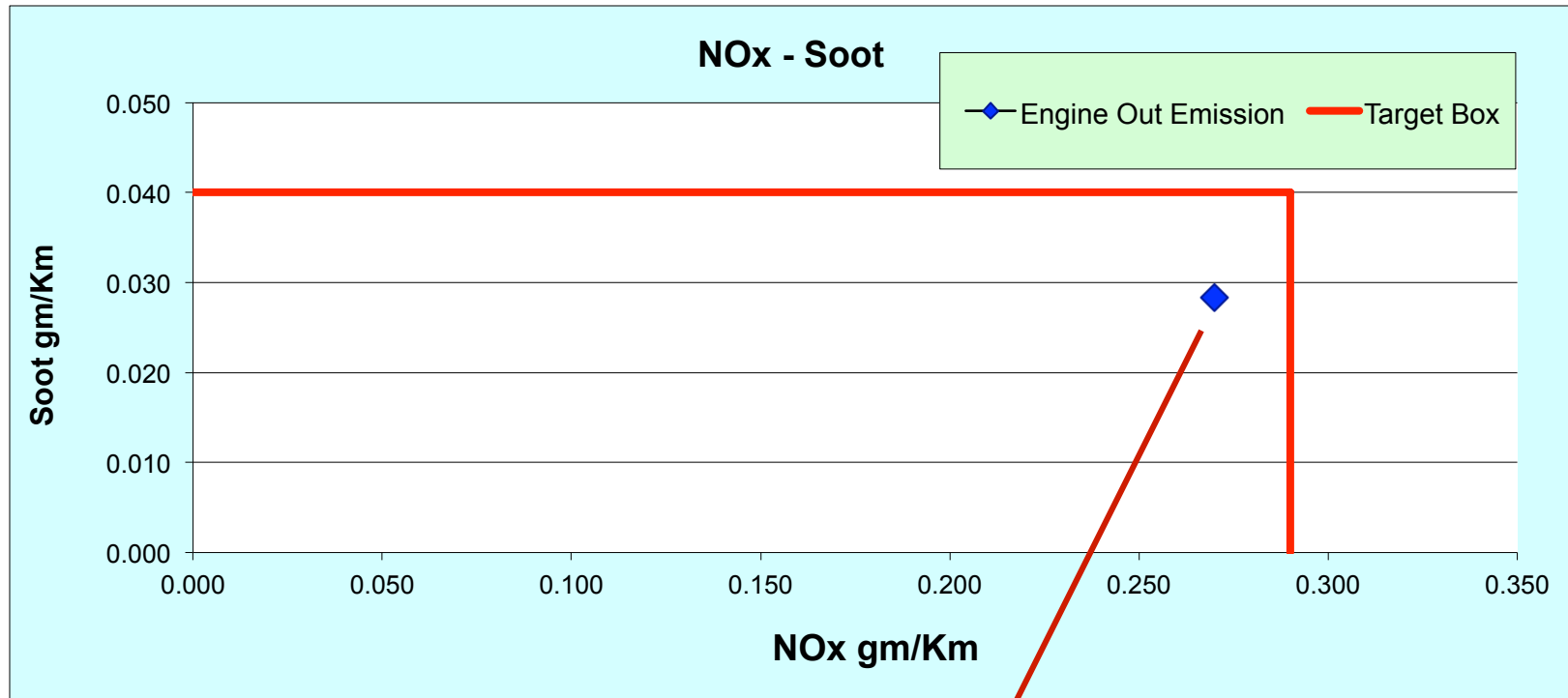


Less significant effect
in smoke emission
which is supporting IC
Removal

Smoke

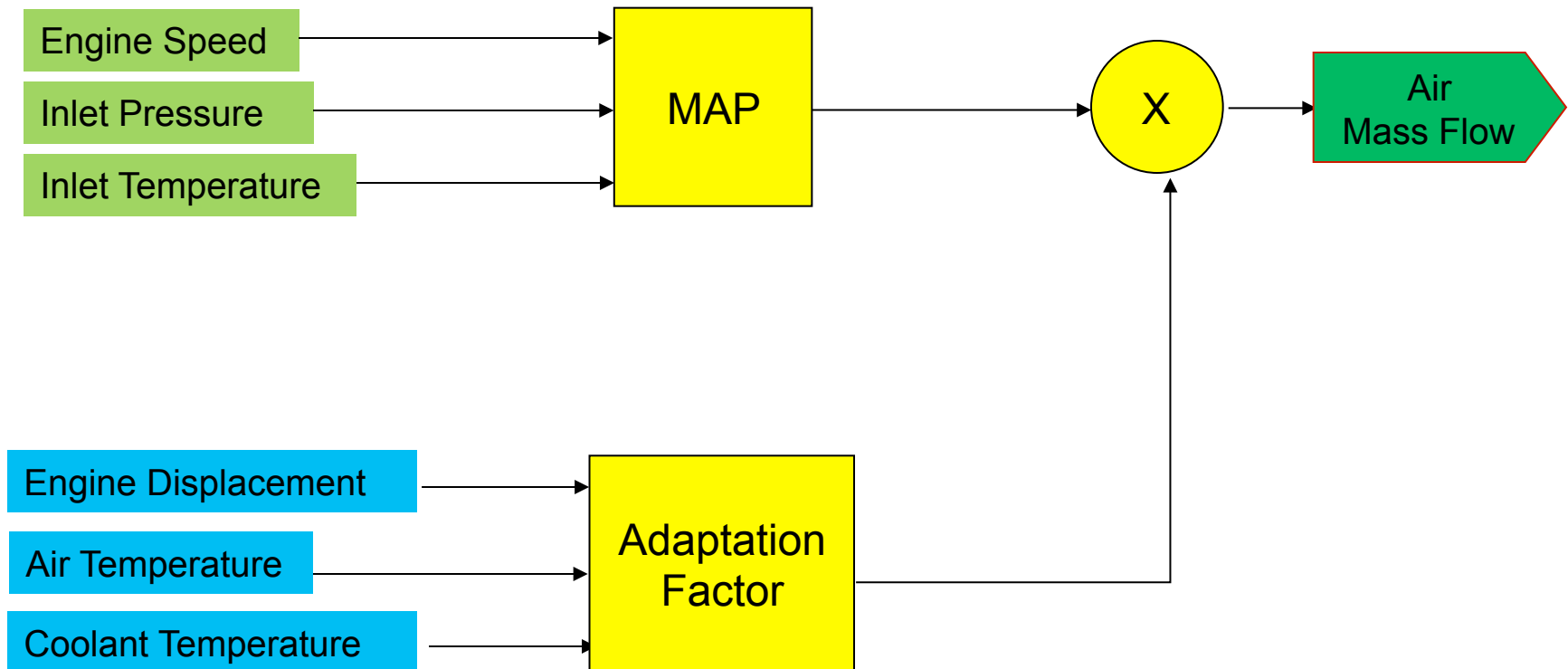


After Treatment Selection:

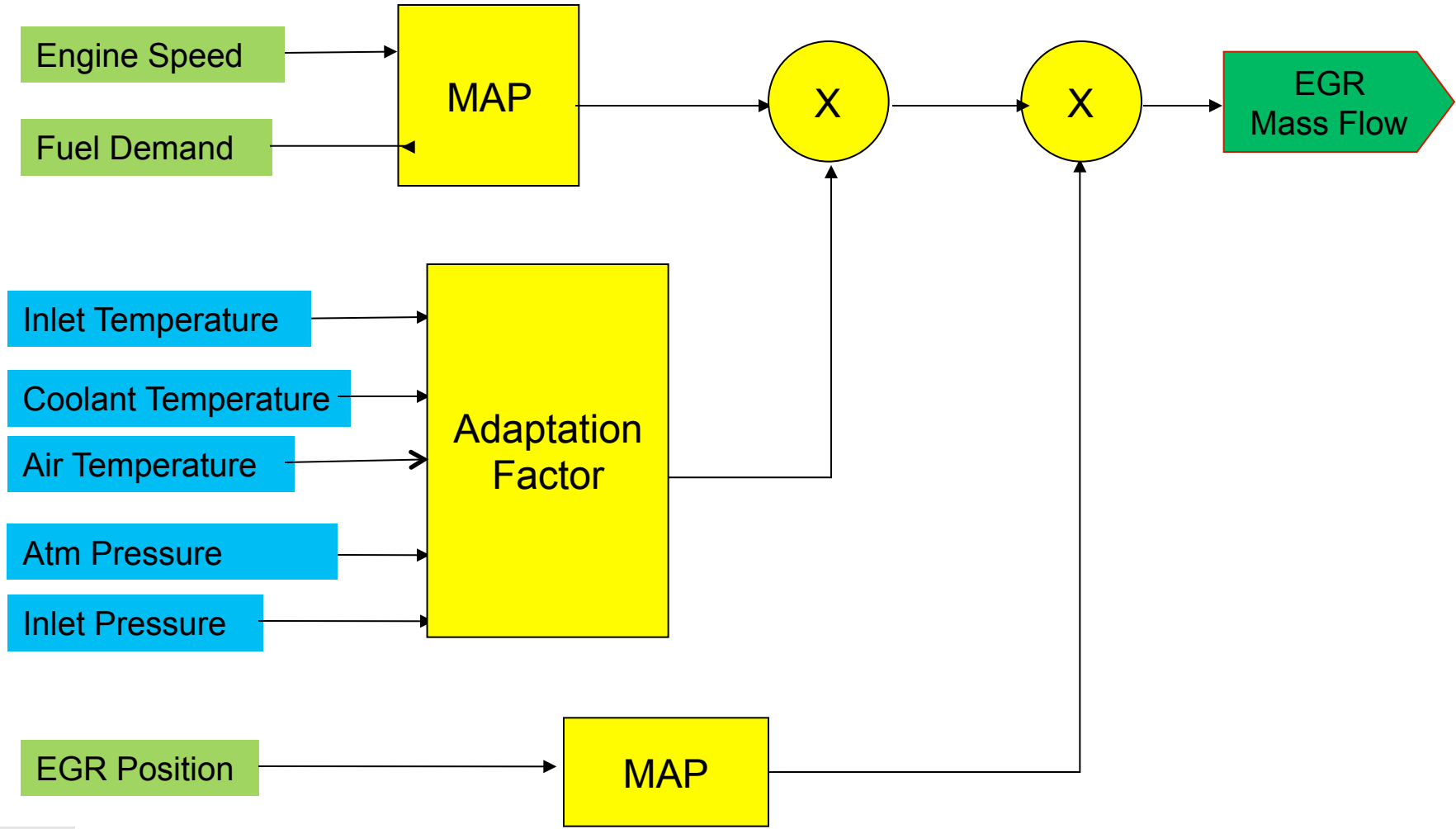


DOC POC

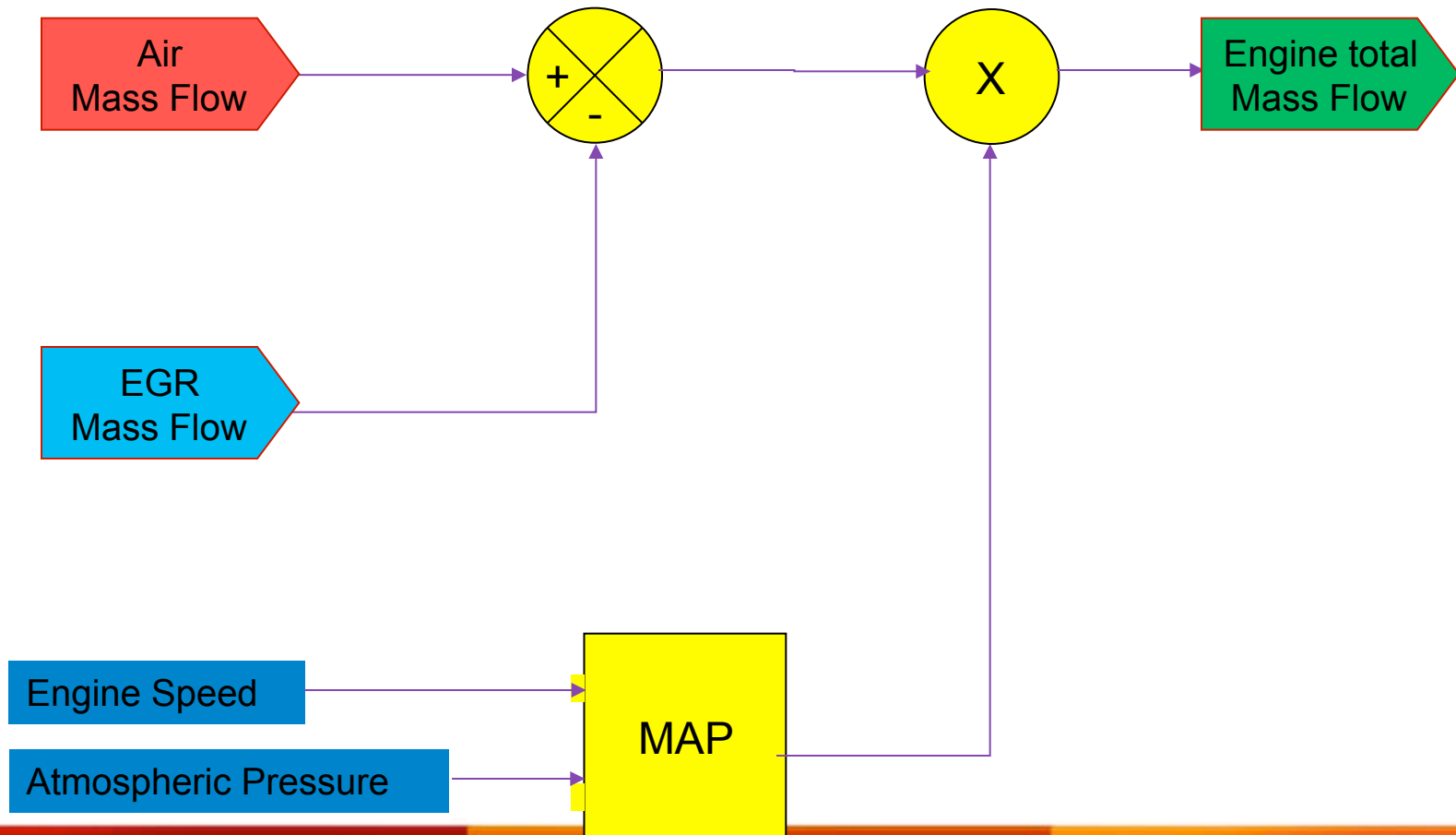
Model Air Strategy: Air Mass Flow computing



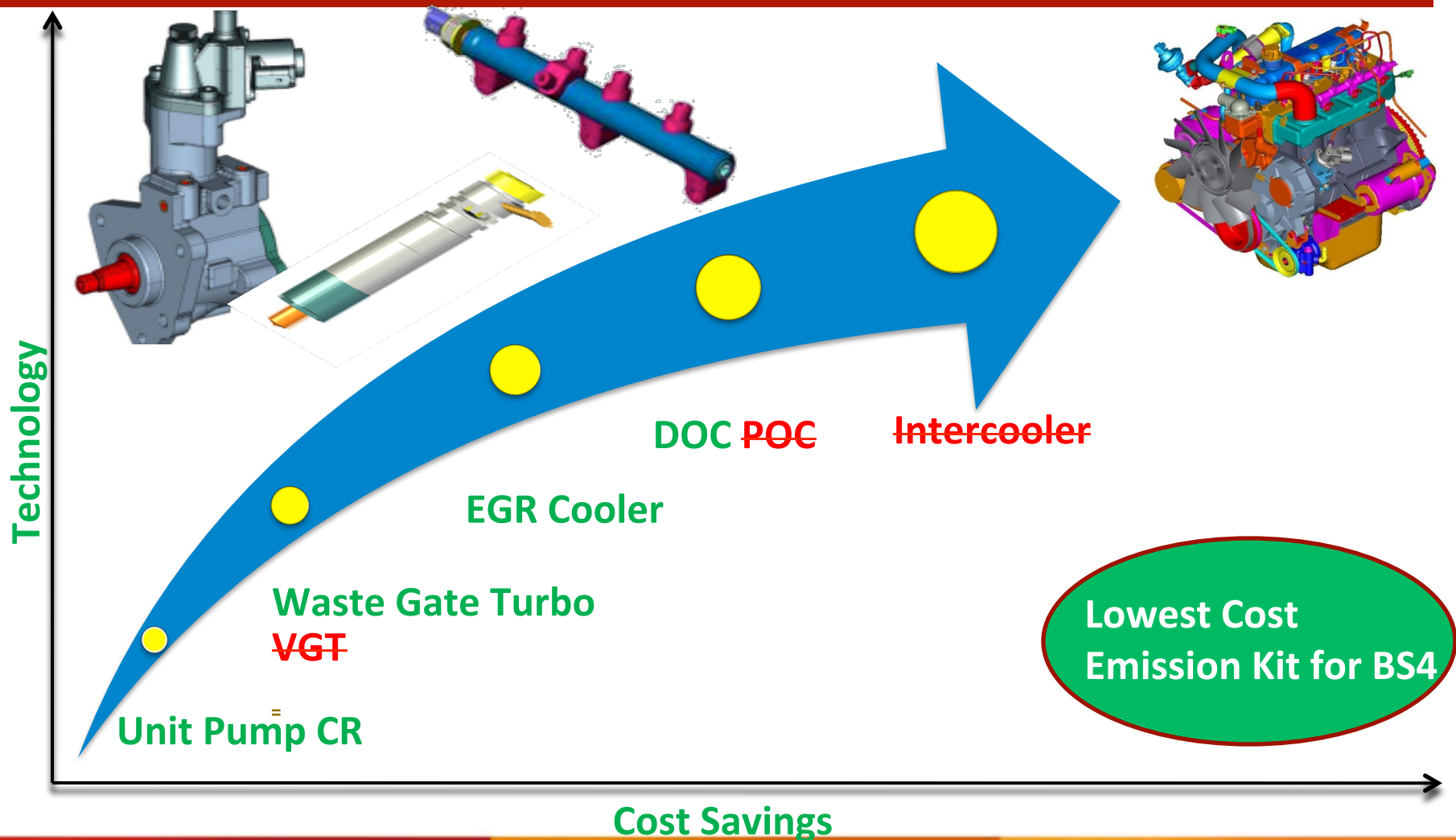
Model Air Strategy: EGR Mass Flow computing



Model Air Strategy: Total Mass Flow Computing



Selection : Emission KIT m2DiCR BS4





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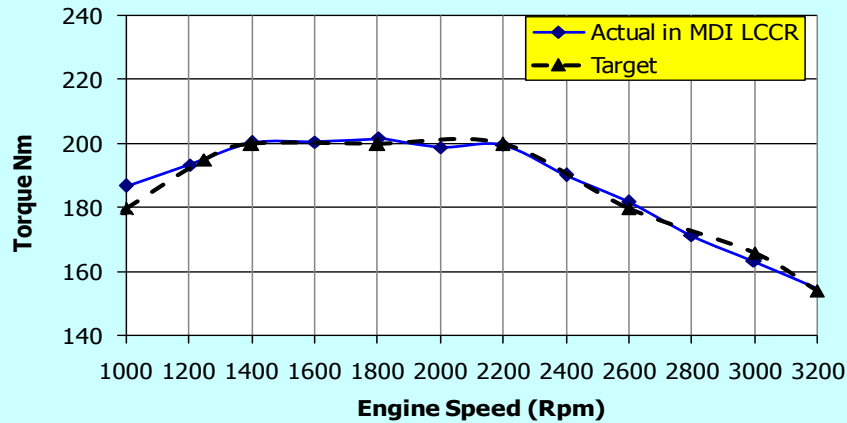
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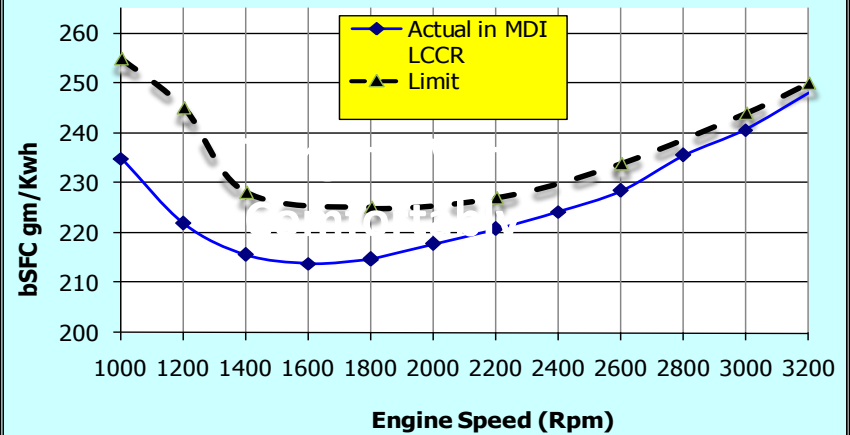
Achievements

Engine Test Results

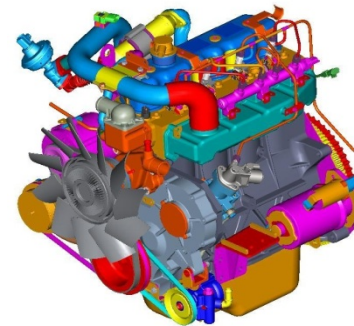
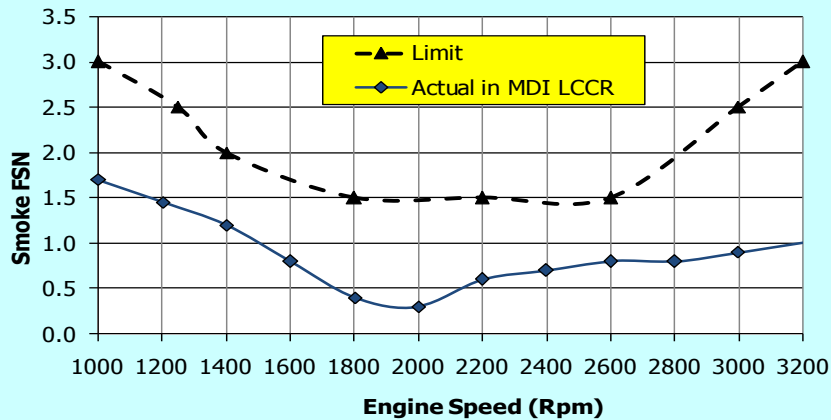
Engine Torque



BSFC



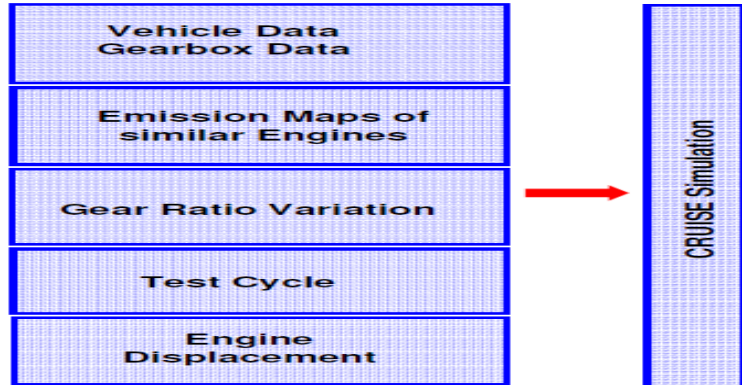
Smoke



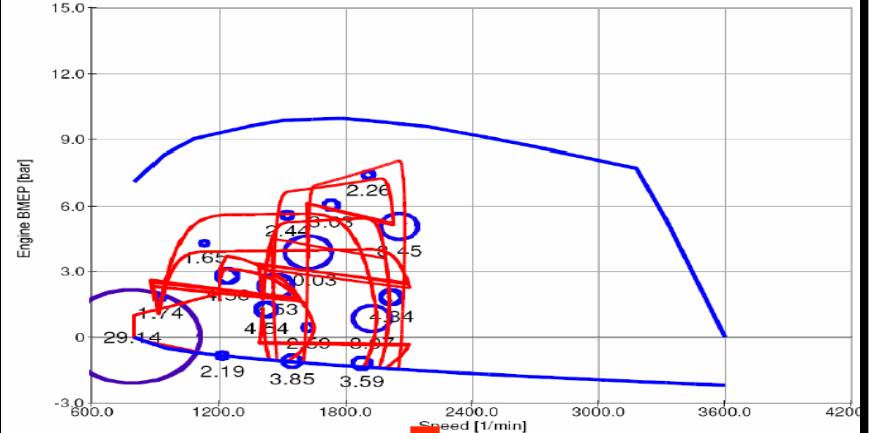
Targets met comfortably

Vehicle Test Results

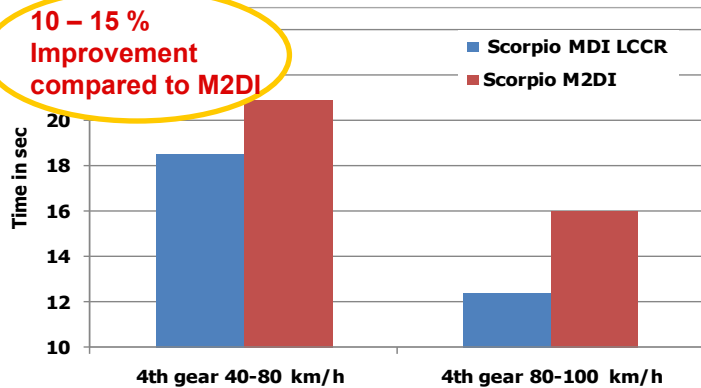
Steady State Test Bed Prediction of 14 Mode Points with



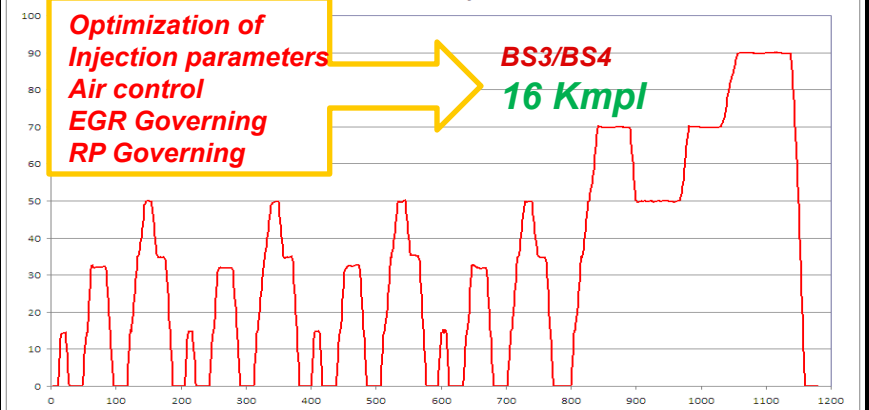
Results – Speed Vs Bmep Distribution



Veh performance _ In gear



Emission Cycle



Test in Real World

- ✓ Composite Cycle Durability testing, to save the time w/o affecting the Quality.
- ✓ Vehicle evaluated in all environmental condition. (Sea Level, High altitude Summer & Winter)
- ✓ RWFP (Real World Failure Pattern Validation) initiated before launch of the product (Jaipur and Vishakhapatnam)





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Benefits accrued post Implementation

Cost Reduction

- Intercooler Deletion : Rs. XXXX/ Veh
- Waste gate Turbo charger in place of VGT : Rs. XXXX/Veh
- Low Cost Common rail : Rs. XXXX/Veh
- Electrical Fan Deletion : Rs XXX/veh
- Intercooler Tooling cost savings : XX,XX,XXX

Additional Volume

- Scorpio : 50 % / Month
- Bolero : 15 % /m

Weight

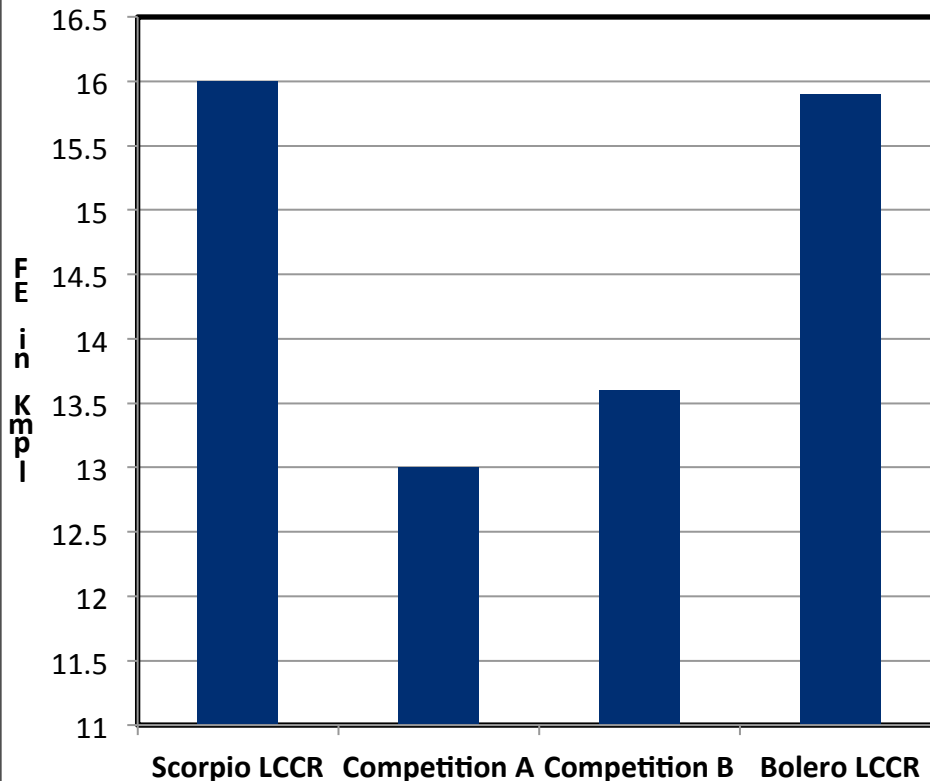
- Fuel Economy
- Reliability of MDI along with lower emission
- Better NVH, 15% better drive ability/ Performance Feel.
- Theft protection
- Lower smoke
- Cold start ability till -5 Deg C

No change in Manufacturing setup

Key Achievements



FE Comparison : BS4 (Cold NEDC Cycle)



- ❖ World' First 4 Cylinder engine with PF Pump.
- ❖ Scorpio, Bolero LCCR are only BS4 SUV/MPV without Intercooler, In India.
- ❖ Highest FE in the SUV/MPV segment in BS4.
- ❖ MDI Engine life extension for next 10 years.
- ❖ Standardization across 4 MDI platforms (Scorpio, Bolero, BMT, LCV)
- ❖ Metro market opening for Low End (Scorpio MDI, Bolero MDI, BMT).

Thank you

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