

# BS VI and its impact on the supply chain

Three years from now, India aims to achieve BS VI compliance across the automotive spectrum. How does the emission technology upgrade impact stakeholders across the automotive value chain? **Rajiv Bajaj and Ashim Sharma** analyse the implications for automakers, suppliers, service networks and also oil marketing companies.

**W**ith BS VI emission norms mandated for launch from the year 2020, players in the Indian automotive industry are deeply engaged in perfecting their solutions to meet the deadline. While lots has been said about the cost impact on passenger cars as a result of the upgrade, the cost implications are manifold across stakeholders in the automotive value chain – the OEMs, component suppliers, oil marketing companies, petrol and diesel stations, service network / dealers and of course end consumers. The exercise is also expected to lead to gains on account of reduced costs of healthcare and mortality associated with pollution.



COST IMPACT ON VEHICLE SEGMENTS IN INDIA		
Heavy trucks	Rs 175,000 to Rs 225,000	SCR + DPF make up around 80 percent of the cost increase
Diesel cars	Rs 65,000 to Rs 95,000	DPF + LNT make up around 70 percent of the cost increase
Petrol cars	Rs 8,000 to Rs 12,000	Cost increase spread out across in-cylinder and after-treatment measures
Two-wheelers	Rs 3,500 to Rs 6,000	Cost increase spread out across in-cylinder and after-treatment measures

ozone. In other words, with the advent of BS VI, the air coming out of the tailpipe will in fact be cleaner than

the air we normally breathe within our homes in cities! (just that it won't have any oxygen in it).

## WHAT WILL IT COST OEMS?

The ways to achieve BS VI vary depending on the engine type i.e. diesel or petrol. In addition, the solutions and associated challenges are different based on the type of vehicles – passenger cars, commercial vehicles or two-wheelers. However, across all categories, players are focused on two distinct areas:

**In-cylinder measures:** Making the combustion more efficient to reduce the amount of pollutants generated – significant efficiencies in this area were also achieved in the run-up to BS IV.  
**After-treatment control:** Neutralising the pollutants generated (even after the efficient combustion process)

## IMPACT ON CARS

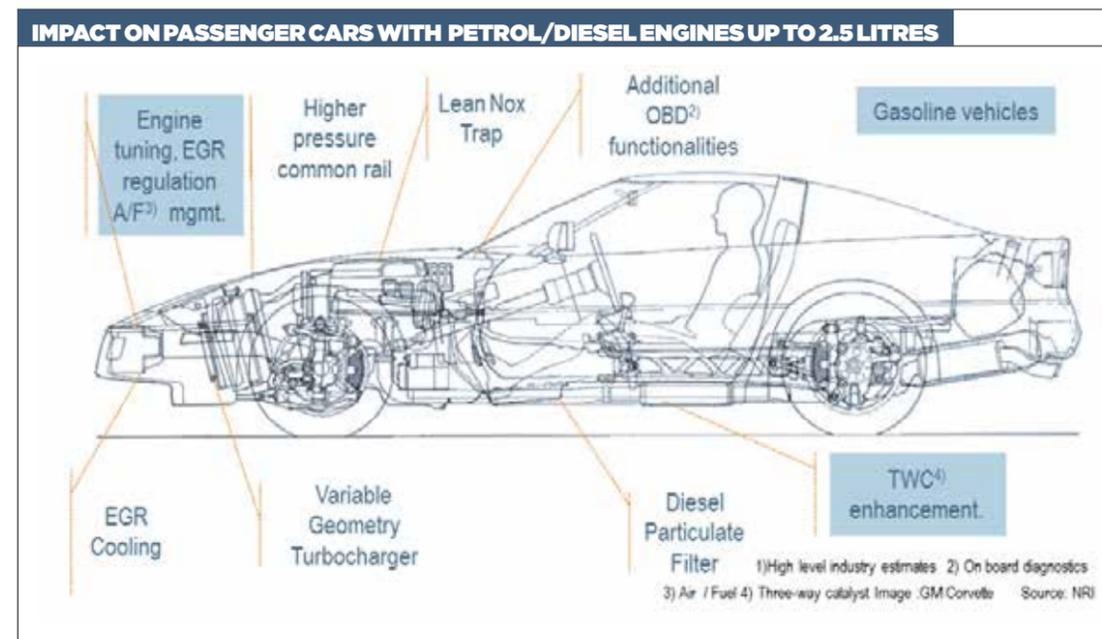
In case of petrol (spark ignition engines), the focus areas for in-cylinder measures would be reduction of hydrocarbons (HC) i.e. unburned fuel, carbon monoxide (CO) i.e. partially oxidised fuel and NOx. This would primarily be achieved using fuel injection technologies e.g. sequential Multi Point Fuel Injection (MPFI) which ensures effective fuel mixing and closer to stoichiometric air / fuel ratio for HC and CO reduction.

NOx control would be achieved by reducing in-cylinder combustion temperatures using faster burn combustion chamber designs and EGR. After-treatment controls for BS VI will focus on enhancement of the Three-Way Catalyst (TWC) e.g. double-layered TWC.

For petrol cars, the cost impact is far lower than their diesel counterparts as NOx reduction over BS IV levels is modest and particulate matter is not an issue except for engines equipped with Gasoline Direct Injection (GDI) which would need a Gasoline Particulate Filter (GPF) to meet the Particle Number (PN) limits. Since we currently do not have CO<sub>2</sub> / fuel economy regulations in place, OEMs will have a lesser tendency to use GDI.

Diesel (compression ignition) engines run lean i.e. with excess air, therefore, HC and CO are not a major issue for them. The main pollutants in diesel are particulate matter (PM) which is created primarily because of sudden ignition of fuel giving very limited time for air-fuel mixing and causing carbon particles to grow by aggregating with other organic and inorganic particles inside the cylinder and NOx which is formed due to higher temperatures and pressures in the engine along with excess oxygen. The in-cylinder measures, therefore, would focus on fuel injection pressure increase over BS IV levels for better atomisation of fuel as well as multiple injections in the combustion cycle i.e. pilot, main and post injections to have an optimal balance between PM and NOx reduction.

PM reduction would also be carried out through variable air intake using variable geometry turbochargers that ensures right amount of air under varied operating conditions of the engine. NOx control in BS VI would need cooled and variable



## EMISSION REDUCTION WITH BS VI

	BS IV	BS VI
Petrol	PM reduction	Particulate Number (PN) regulation
	NOx reduction	20-25%
Diesel	PM reduction	80-95% + PN regulation
	NOx reduction	60-70%
CVs	PM reduction	50 - 70% + PN reduction
	NOx reduction	85-90%
Two-wheelers	PM reduction	PM regulation
	HC reduction	Tailpipe HC + HC evaporative emission limits
	NOx reduction	70-85%

EGR. After-treatment controls would focus on Diesel Particulate Filters (DPFs) for PM reduction. NOx control will be achieved through use of Lean NOx trap (LNT) for diesel cars

with up to ~ 2.5-litre engine displacement (LNTs are catalysts that adsorb NOx and need periods of rich fuel mixture to regenerate the catalyst by converting NOx to oxides of Nitrogen).

## IMPACT ON COMMERCIAL VEHICLES

For commercial vehicles, the measures for in-cylinder combustion improvement as well as after-treatment would be similar to diesel cars. However, the higher displacement volume of the engines leads to a higher exhaust volume which in turn needs a larger LNT catalyst for NOx removal. Since catalysts use Platinum Group Metals (PGMs), LNTs would become expensive for use in larger engines thereby making them shift towards Selective Catalytic Reduction (SCR) technology.

Additionally, commercial vehicles have availability of space for packaging the ammonia tank and SCR system which is an issue in case of diesel cars. SCR uses an ammonia-based solution for NOx treatment and calls for the addition of an ammonia tank as well as an ammonia slip catalyst to check excess ammonia coming out of the exhaust. The small commercial vehicle segment is expected to use versions of the solutions developed for diesel cars.

**IMPACT ON TWO-WHEELERS**

The two-wheeler segment is the vehicle category with the largest parc and sales in India. For two-wheelers, the changes would be limited to use of electronic fuel injection (EFI) becoming a standard across categories in order to enhance in-cylinder combustion. For exhaust after-treatment, Three-Way Catalysts (TWC) will be necessary to meet the NOx limits. Some complexity would arise due to the need to package the TWC closer to the engine in order to achieve early light-off.

**HOW WILL SUPPLIERS BE AFFECTED?**

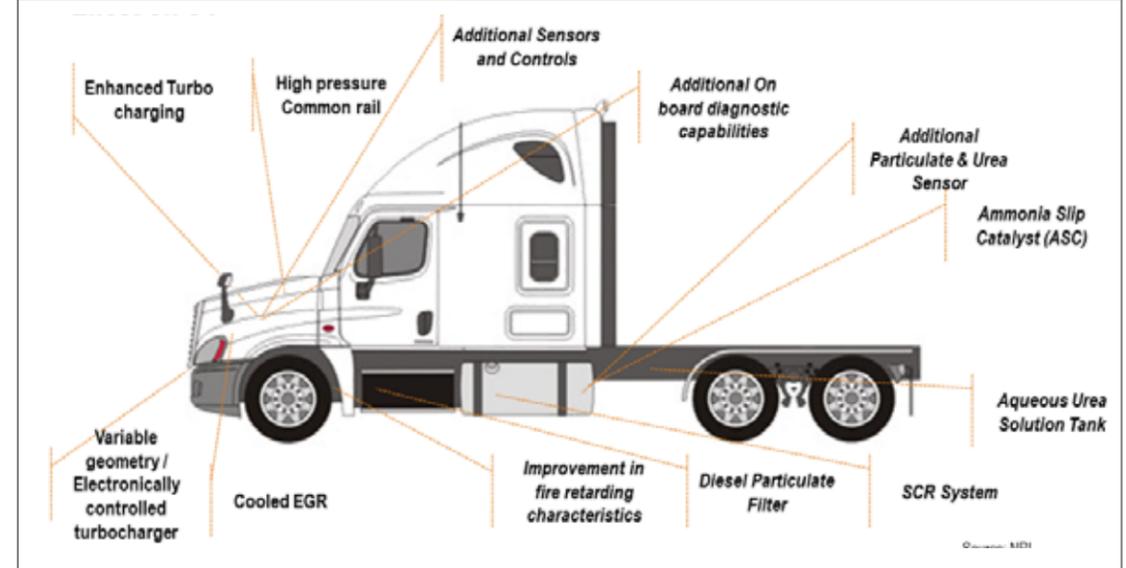
Vehicle costs are expected to see increases not only on account of BS VI but also due to mandatory safety packages coupled with competitive forces making offering more and more infotainment and comfort features necessary for OEMs.

The effect for suppliers would be varied based on the product categories catered to by them. Players involved with supplies of additional / modified components needed for BS VI, safety and infotainment / comfort would see a jump in revenues and profits. However, with OEMs unable / unwilling to pass on the entire cost burden of BS VI onto customers, the incumbents could face considerable cost headwinds.

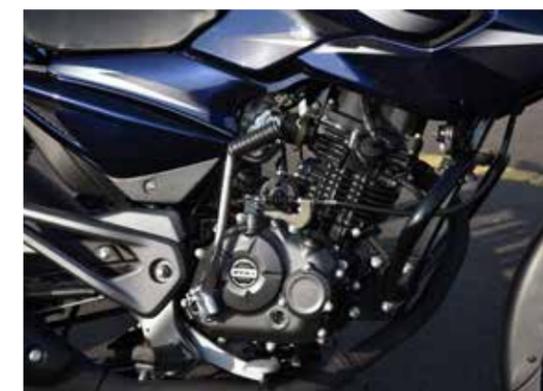
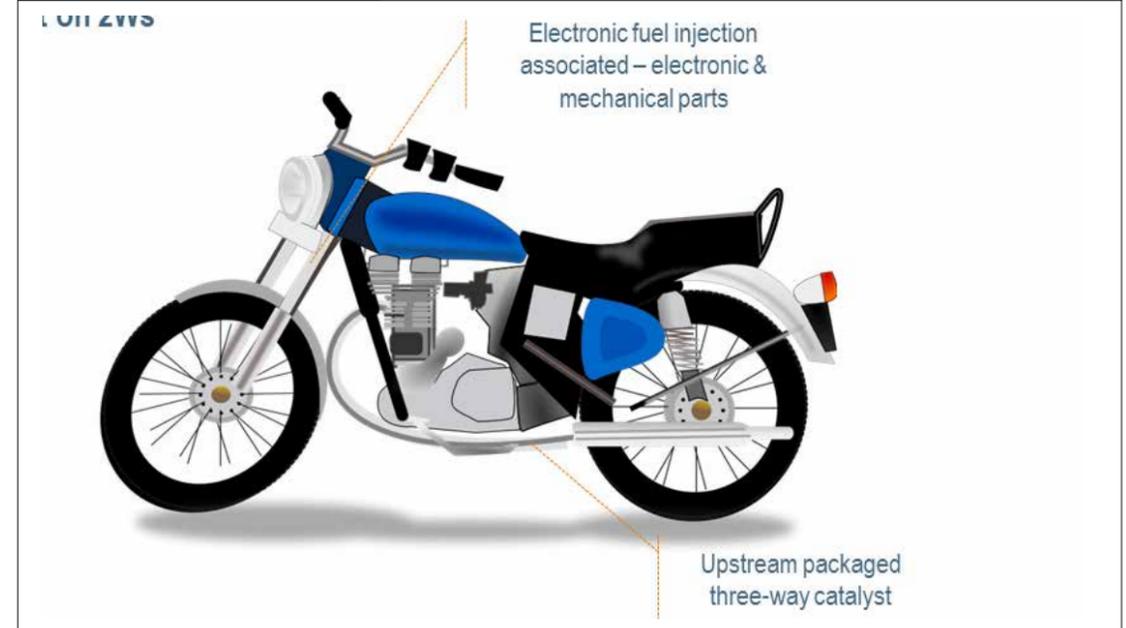
**WHAT CHANGES FOR THE SERVICE NETWORK / DEALERS?**

The BS VI regulation has provisions of in-service conformity of emissions using portable emissions measurement systems (PEMS). While currently there is proliferation of Pollution under Control (PUC) certification centres in the country, regulations on use and upkeep /

**IMPACT ON COMMERCIAL VEHICLES**



**IMPACT ON TWO-WHEELERS**



periodic calibration of testing equipment as well as on adherence to guidelines during testing will cause some consolidation in favour of organised players' i.e. OEM/ independents service centre chains and large fuel stations.

With the advent of OBD – II, there is a provision for moving the vehicles into 'limp-home' mode in case of malfunction of emission control devices.

With unorganised roadside mechanics unable to repair such vehicles, there will be need for OEMs to make their service networks widespread and also be able to direct such vehicles to service stations and / or divert service station staff to such vehicles using GPS / telematics-based solutions. This requirement will be more pronounced in case of commercial vehicles.

While the organised

sector may catch up over 3-4 years after introduction of BS VI, the initial years do present a sizeable opportunity for OEMs to increase service retention share of their UIOs (Units in Operation).

**IMPACT ON FUEL SPECIFICATIONS**

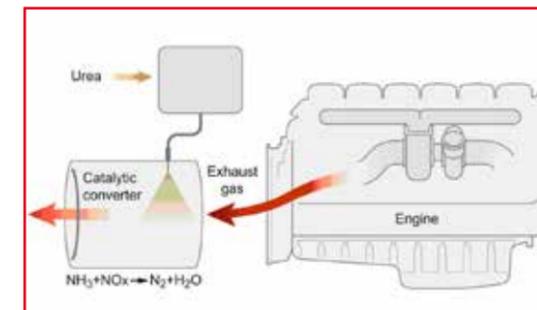
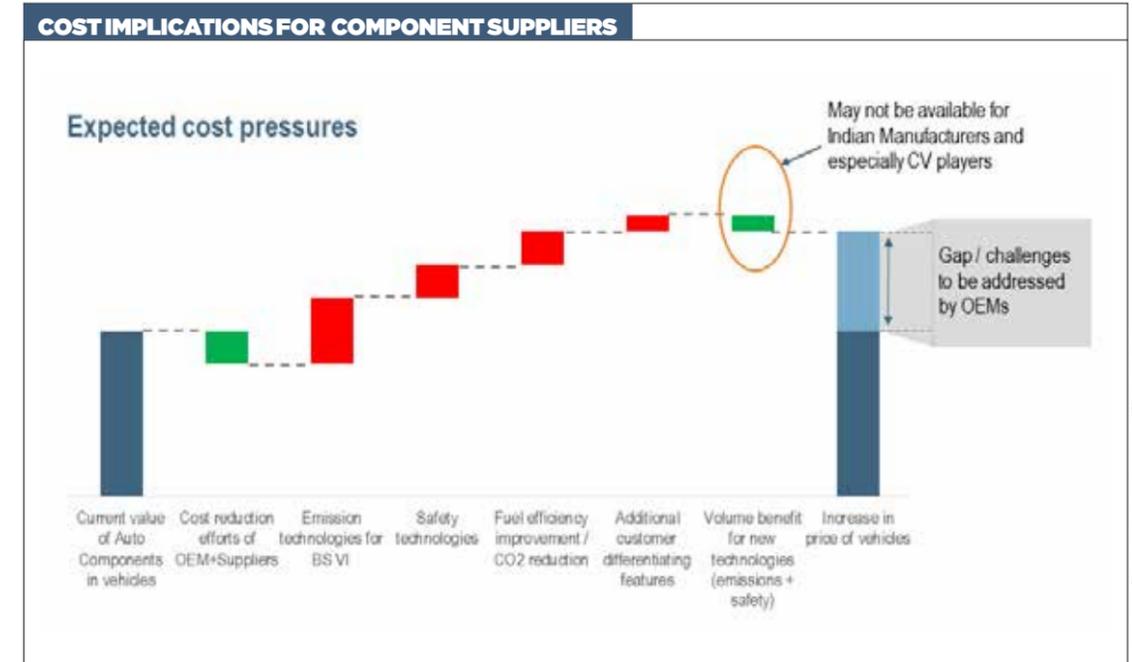
The use of ULSF (Ultra Low Sulphur Fuel) i.e. fuel with sulphur levels below 10 ppm would be needed for the after-treatment system to function effectively. This shall call for upgrades at all refineries in the country. As per estimates, the BS VI fuel when launched in 2020 could cost see a cost increase of Rs 1.40 per litre of petrol and Rs 0.68 per litre of diesel.

Also for commercial vehicles fitted with the SCR system, petrol pumps will have to start dispensing 'Ad-Blue' (Aqueous Ammonia Solution) which will need periodic re-filling for the SCR system to work.

**HEALTH BENEFITS**

The early introduction of BS VI will ensure lowering of PM and NOx levels starting from 2020 and extending over the next decade. The effect would be higher in the first 5-10 years of introduction and will reduce gradually with most of the vehicle parc getting replaced by BS VI. Scrappage incentive schemes for existing vehicle owners could hasten the process of cleaning the air over the initial 2-3 years.

As per current TERI (The Energy and Resources Institute, New Delhi) estimates, the total savings in healthcare and mortality costs could be to the tune of \$55 billion to \$100 billion just because of PM reduction with NOx reduction contributing further to the number. However, other sources of pollution in our cities e.g.



**AdBlue is the commercial name of a mixture of water and urea. It is a non-toxic aqueous urea solution that chemically reduces NOx emissions from diesel-fuelled engines. When dissolved in water, it is non-toxic and easy to handle. With selective catalytic reduction technology, an additional tank is required for the urea solution.**

loose construction dust must also be reduced to realise health benefits in their entirety.

**SUMMARY**

The impending BS VI regulation brings a set of challenges and opportunities for stakeholders across the automotive value chain. OEMs could use the opportunity to develop innovative solutions that work better in the Indian context and also have additional benefits of better performance and fuel efficiency. OEMs and dealers would also

be able to increase their aftersales revenues on the back of specialised service requirements. Suppliers, on the other hand, must review their portfolios to ensure they either make components that will get added with the new BS VI / regulations or the ones that will see technological upgrades. Incumbent suppliers should innovate to ensure their components become

more competitive either through innovation-led VA/VE or value additions such as significant lightweighting (which is expected to remain a focus area). Finally, all oil marketing companies have their task clearly cut out and they must meet the BS VI fuel refining upgrade deadline to ensure the efforts of the auto industry can bear fruit in time. ■

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*NRI Consulting & Solutions is part of Global Nomura Research Institute (NRI), a leading global management consulting enterprise head quartered in Tokyo. It works extensively in automotive value chain, across OEMs, suppliers and dealers in strategy and performance improvement area with an objective to improve their top and bottom lines.*