

Leapfrogging to Bharat VI

Level	NO _x (g/kW-h)	PM (g/kW-h)
Euro I	8.0	0.36
Euro II	7.0	0.15
Euro III	5.0	0.10
Euro IV	3.5	0.02
Euro V	2.0	0.02
Euro VI	0.4	0.01

decision and will help India leapfrog to much cleaner emissions,” CSE Executive Director Anumita Roychowdhury said in a statement. “This will reduce the time lag with Europe to six years in 2020 and lower the pollution impacts of the new vehicle fleet considerably.”

The Indian automotive industry, which includes two, three and four wheelers, is likely to grow to between U.S. \$252 billion and \$295 billion by 2026 from approximately \$73 billion in 2015, according to industry body Society of Indian Automobile Manufacturers. The CSE said the shift to BS-VI standards will reduce particulate matter (PM), which affects air quality and human health, by 82 percent and NO_x emissions by 68 percent in cars. In two-wheelers, PM would reduce by 89 percent and

NO_x emissions by 76 percent. Similarly, in heavy-duty vehicles such as trucks and buses, PM and NO_x emissions will drop by 50 percent and 89 percent, respectively.

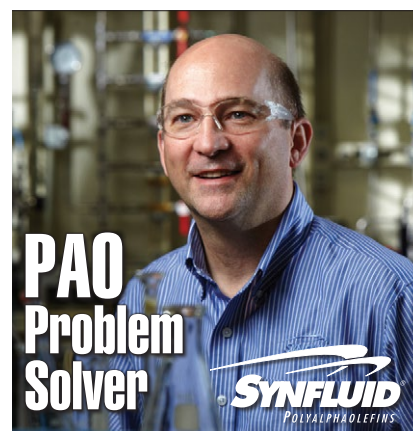
The opportunity to reduce emissions, however, is not without its share of obstacles given the operating conditions in India, said S.K. Raghuram, country director at Infineum India Additives Pvt. Ltd. “BS-VI represents a very serious challenge, mostly because the Indian situation is very complex. The conditions are not as conducive as one would see in Europe or other parts of the world. Traffic is a big problem here,” he added.

Technological Requirements

Transition to BS-VI with fuel economy regulations will require

Lubricant challenges to meet BS VI norms for gasoline engines

Lubricant Issues	Impact
High fuel dilution high end of fuel & ethanol	<ul style="list-style-type: none"> Oil thickness due to oxidation Deposits & sludge formation
Deposits on hot surfaces & sludge formation	<ul style="list-style-type: none"> At TC bearing housing - failure Sludge block filter & oil gallery - oil starvation
Particulates for TGDI	<ul style="list-style-type: none"> PF required - need low SAP oil Particulates increase cam chain wear
Increased wear of parts	<ul style="list-style-type: none"> New additives with enhanced anti wear properties
Low speed pre-ignition LSPI	<ul style="list-style-type: none"> Oil additives to be used to control LSPI Oil grades addressing LSPI to be used

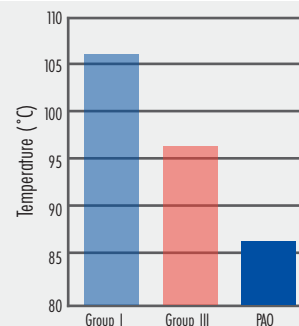


with Ken Hope, Ph.D.

Q: I have heard the specific heats of mineral oils and PAOs are different. Is this important?

A: In short, yes. The specific heat of a final formulation is dominated by the base oil contribution in the blend. PAOs have inherently higher specific heats, so it will absorb more heat allowing the PAO-based lubes and the parts that they lubricate to run cooler.

The chart below illustrates the relative effect base oils have on the operating temperature in a modified four-ball instrument. In large part due to higher specific heat, the PAO runs 10°C cooler than a Group III base stock.



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This lower operating temperature, along with the superior oxidative stability of PAO-based lubes can aid in increasing the service life of the lubricant and decrease the generation of corrosive agents that can damage your lubricated system.

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