Cleaner liquid fuels and improved vehicular technologies

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Powering Business Worldwide

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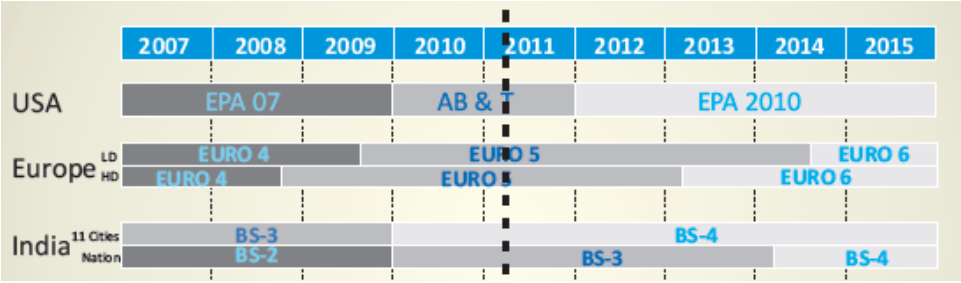
Cleaner Liquid Fuels

The growing demand for clean fuels to meet stringent emission requirements of today and the future (ref. table), has led the petroleum and automotive industry to make continued advances in technology that can enable sustainable progress. Oil and gas companies have formed cooperative partnerships with the automotive sector to reduce the impact of hydrocarbon fuels on air quality and to develop cleaner, more efficient fuel/vehicle systems.



Some of the key technological advancements in cleaner liquid fuels are mentioned below:

Unleaded petrol:

- No addition of anti-knock agent tetra-ethyl lead
- Necessitated by the implementation of catalytic converters.
- Parameters regulated are lead, sulphur content (50ppm), benzenes, Reid Vapor Pr., aromatics and Olefins.

Ultra Low Sulphur Diesel:

- ULSD is a cleaner-burning diesel fuel that contains 97% less sulphur than low-sulphur diesel (LSD).
- ULSD was developed to allow the use of improved pollution control devices
- Parameters regulated are sulphur content (10ppm), density, flash point and cetane number.

Cleaner Liquid Fuels

Bio diesel:

- A vegetable oil or animal fat-based diesel fuel consisting of long-chain alkyl esters.
- Bio diesel in India is primarily made from non-edible oils of Jatropha and Karanja.
- The current specification in permits up to 5% blending in conventional diesel.

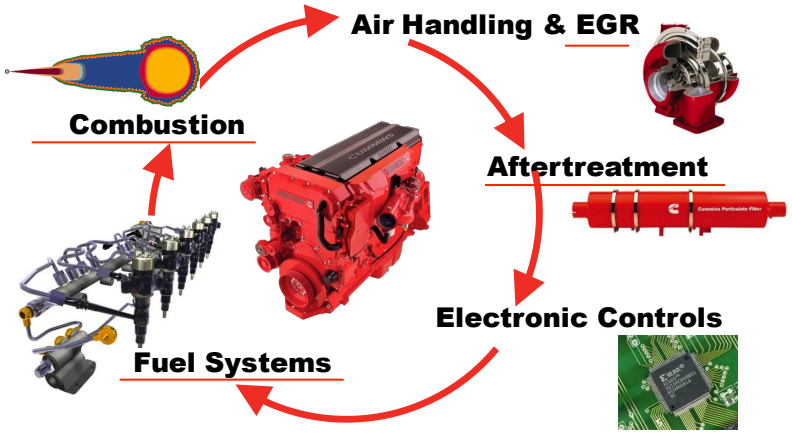
Synthetic diesel (Gas to Liquids, Biomass to Liquid, Coal to Liquid):

- Synthetic diesel can be produced from carbonaceous materials.
- Significantly cleaner-burning, lower toxicity, superior cold weather performance and fuel system lubricity.
- The high cetane rating provided for better performance over traditional diesel.

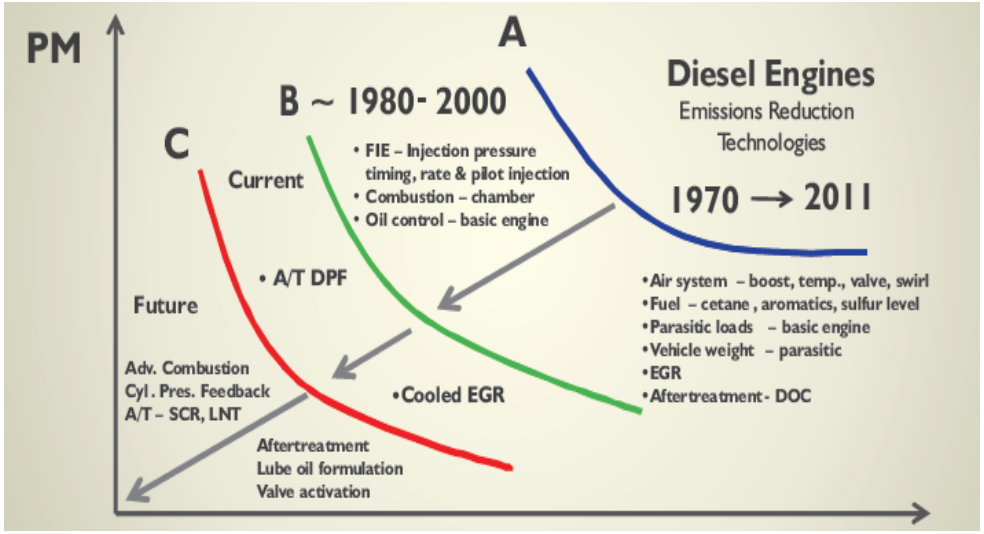
Ethanol petrol blends:

- The corrosive nature of ethanol limits the blend % (5-10%) with petrol.
- For deriving maximum benefits, a much higher compression ratio should be used.
- Neat ethanol engines are ~20-30% less fuel efficient than petrol-only engines.

Improved vehicular technologies



Modern architecture of an engine & systems affected by liquid fuel



NOx – PM trade-off roadmap

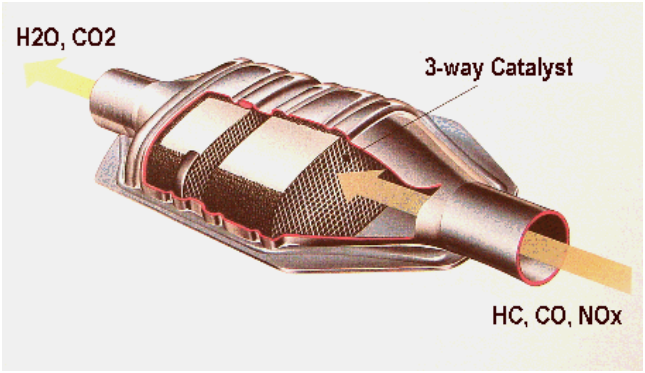
Technologies using cleaner liquid fuels in Aftertreatment:

1) Catalytic Converter

• A catalyst stimulates a chemical reaction in which by-products of combustion are converted to produce less harmful/inert substances.

• Widespread adoption commenced with the introduction of unleaded petrol.

• 3 way catalytic converters are preferred over 2 way due to the ability to control NOx



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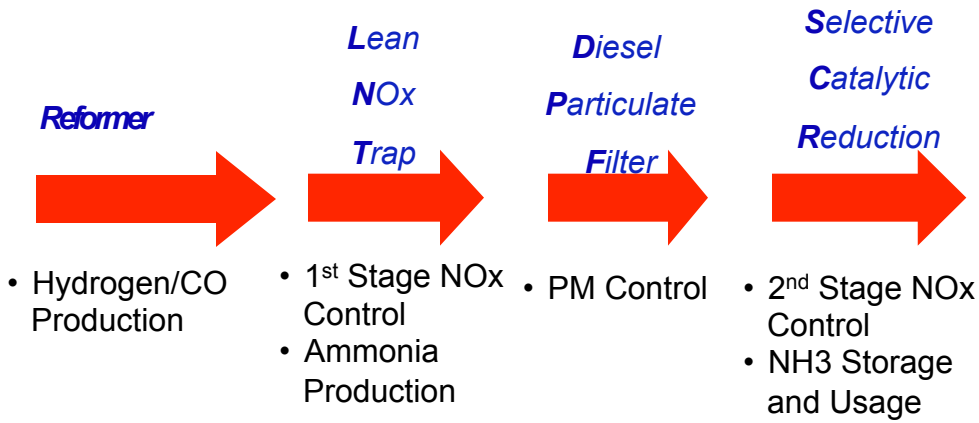
2) Aftertreatment

• The LNT undergoes controlled periodic regeneration, releasing the NO_x as N_2 & NH_3.

• Released NH_3 is collected and used in the SCR to continuously treat the remaining NO_x.

• DPF traps PM and undergoes periodic regeneration.



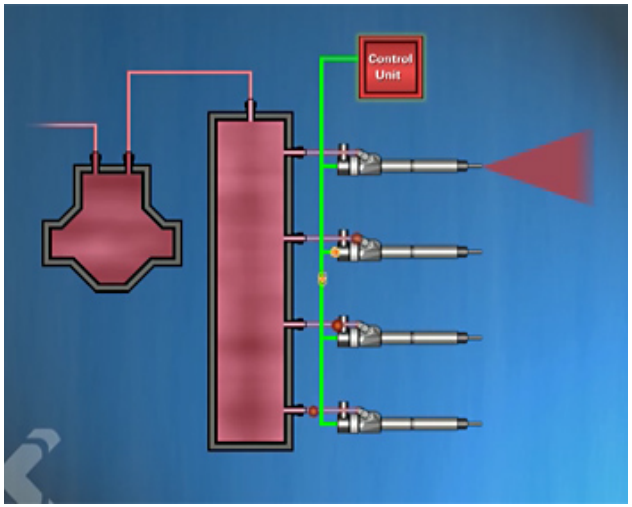
Technology using cleaner liquid fuels in Fuel Systems:

Common Rail Diesel Injection:

• Delivery of a more controlled quantity of atomized fuel leads to better fuel economy and a reduction in exhaust emissions.

•The accumulator (rail) is a common reservoir for fuel held under a consistent controlled pressure, separate from the fuel injection points.

• For future emission norms the trend is towards high injection pressure(3000bar) with multiple injections.



Improved vehicular technologies

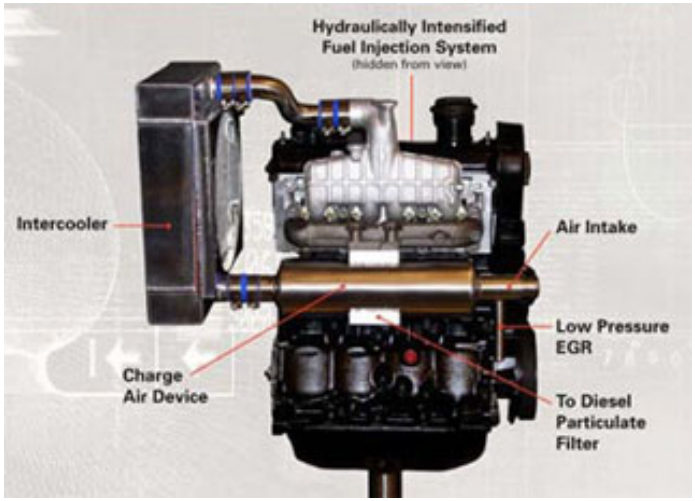
Technologies using cleaner liquid fuels in Combustion:

1) Clean Diesel Combustion technology

• A combination of improvements in diesel fuel injection, refinement of turbo-charging systems and improved combustion system.

• Potential to meet future emissions standards without NOx after treatment.

• Offers diesel's performance with 25-40% fuel economy benefit over petrol engines.

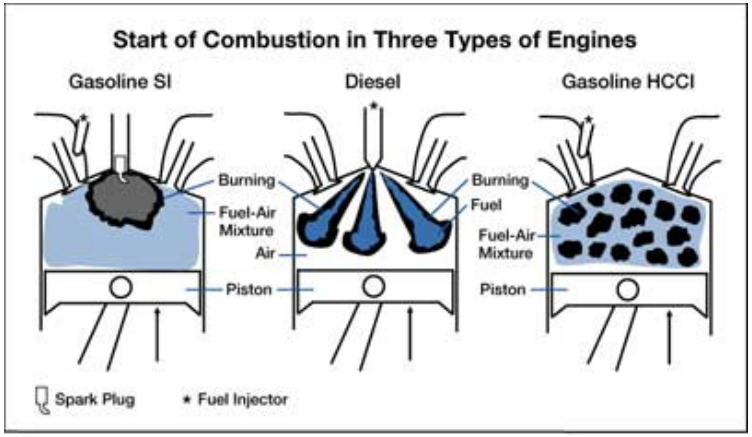


2) Homogeneous Charge Compression Ignition (HCCI)

• A mix of spark-ignition and compression ignition technology.

• Offers diesel-like high efficiency without having to deal with NOx and PM.

• Compatible with petrol as well as ethanol fuel.

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