DIESEL ENGINE EMISSIONS REDUCTION HISTORY AND FUTURE PROSPECTS

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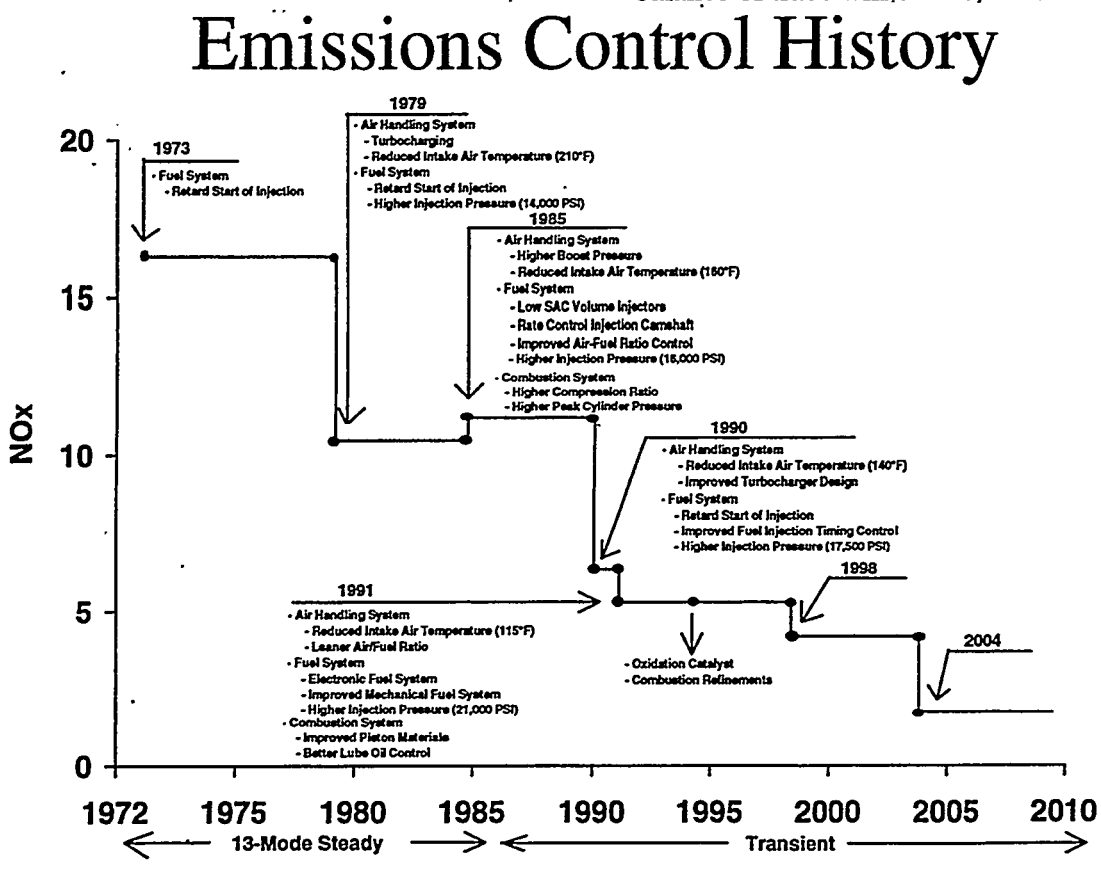
Heavy Duty trucks now achieve about 8-10 mgp, or about 1/2 to 1/3 the vehicle fuel economy of a current full size automobile and 1/8 to 1/10 the vehicle fuel economy of a PNGV automobile. However, on a weigh-specific basis, heavy duty trucks are 4 times more efficient than a PNGV automobile and, on a cargo specific basis, they are 5 to 10 times more fuel efficient.
The Heavy Duty transportation community is driven by economics = fuel consumption.

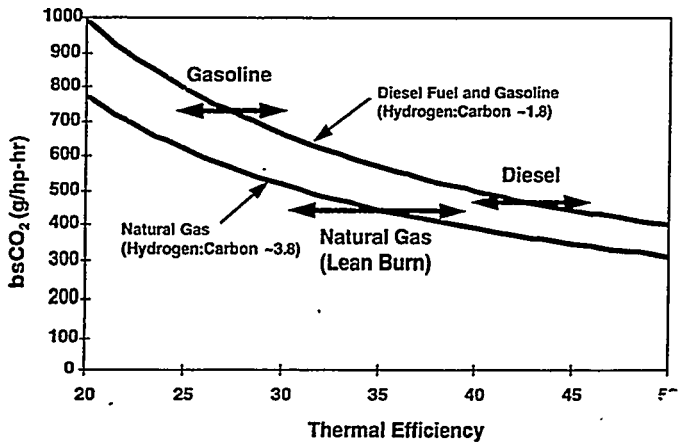
Heavy Duty trucks are 80,000 lb. vehicles, or about 40 times as heavy as a PNGV automobile (at 2000 lbs.).

Heavy Duty trucks carry about 55,000 lbs., or about 50-100 times the cargo of a full size automobile.

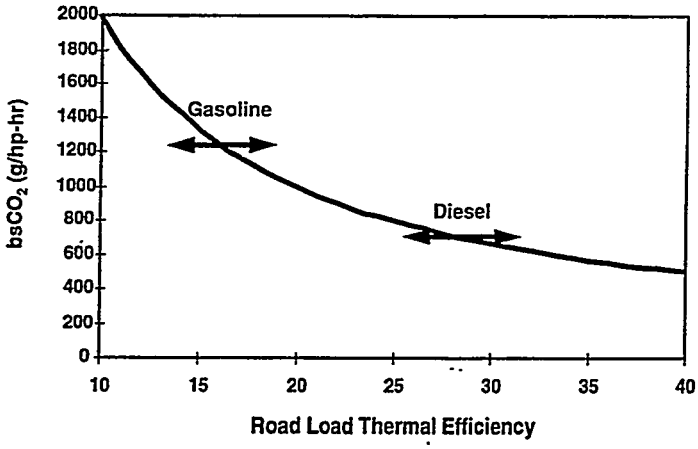
Heavy Duty trucks have become this efficient by very aggressively pursuing the most fuel efficient technology available, and virtually all such trucks are now diesel powered. Diesel emissions reductions from state-of-the-art heavy trucks have directly tracked fuel economy improvements, so that today's diesel engines are very clean. Furthermore, new diesel emissions technology developments are emerging at a rapid rate, and the potential for continued reductions in heavy duty diesel emissions are very good.
Cummins Engine Company believes that our heavy duty diesel technology can be applied to personal transportation vehicles, beginning with sport utility vehicles (now 42% of all new personal transportation), and perhaps extending to PNGV vehicles. If this can be accomplished, the improvements in emissions/air quality, fuel consumption, petroleum independence, and the balance of trade will be very worthwhile.



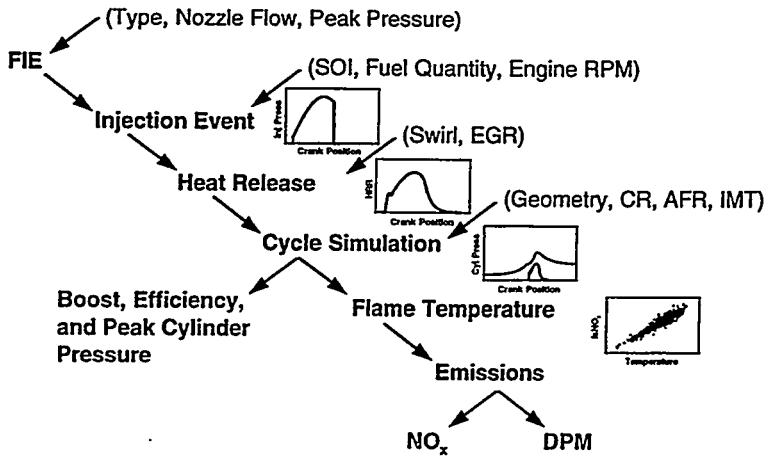
$bsCO_2$ Emissions @ Peak Efficiency



bsCO2 Emissions @ Road Load



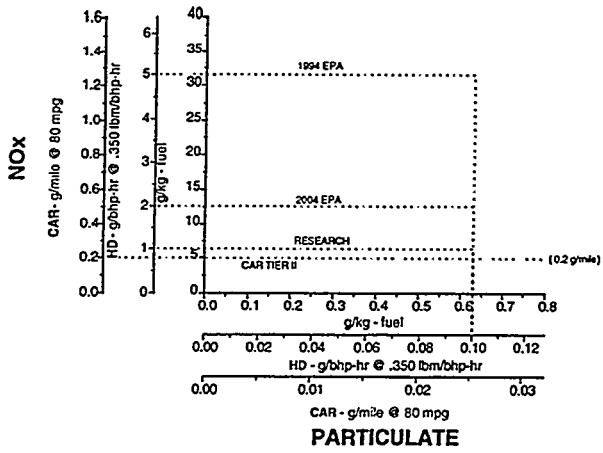
Combustion Modeling Capabilities



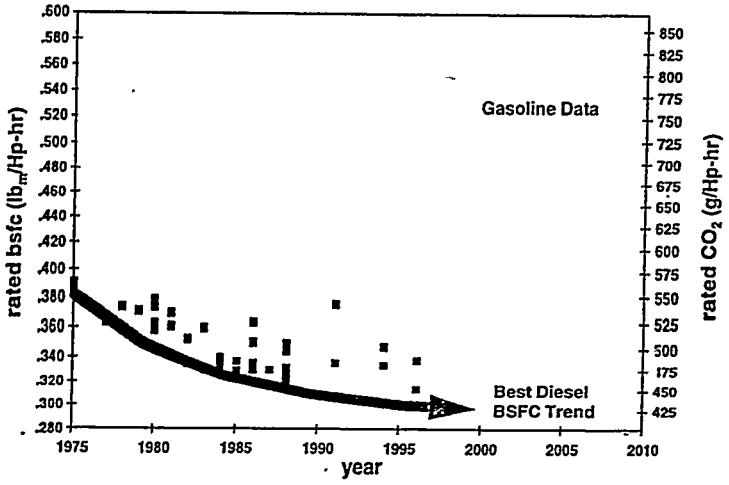
Emission and Performance Goals:

- Exhaust Emission Requirements
  - CO
  - HC
  - NOx
  - Particulate
- Fuel Economy
- Low Noise
- Drivability and Transient Response
- Off Design Performance

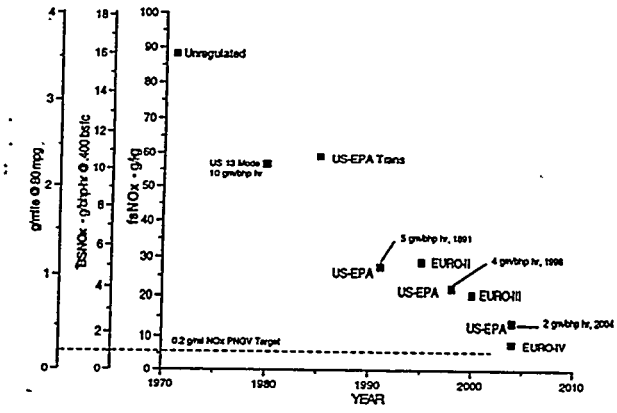
DIESEL EMISSIONS



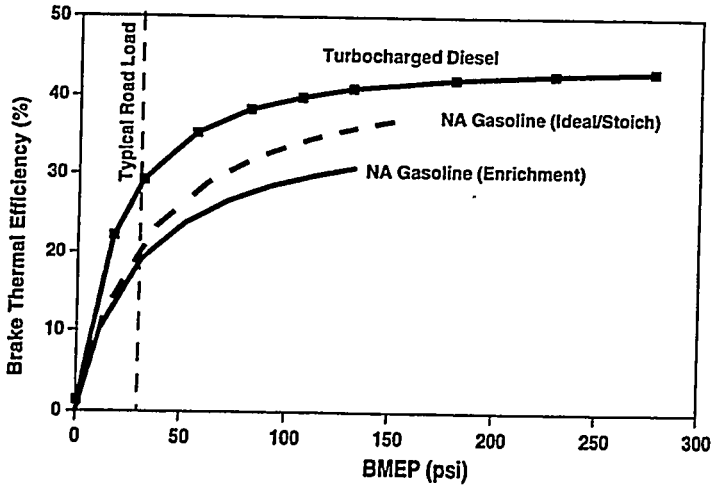
Rated bsfc History



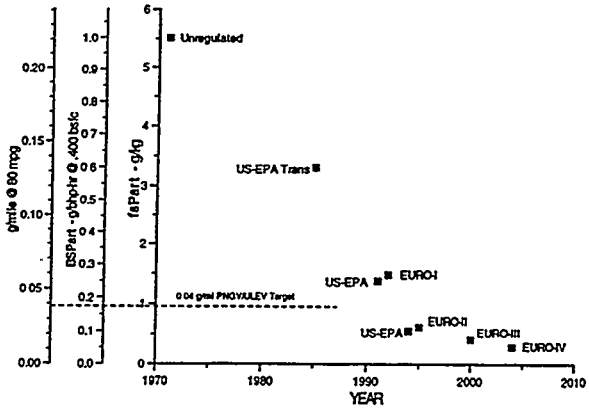
HDD NOx History/Targets



Brake Thermal Efficiency Comparison

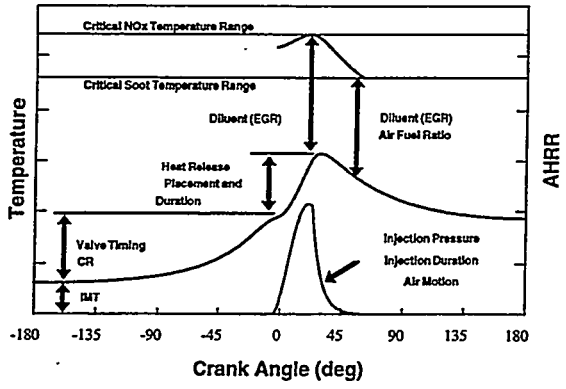


HDD Particulate History/Targets

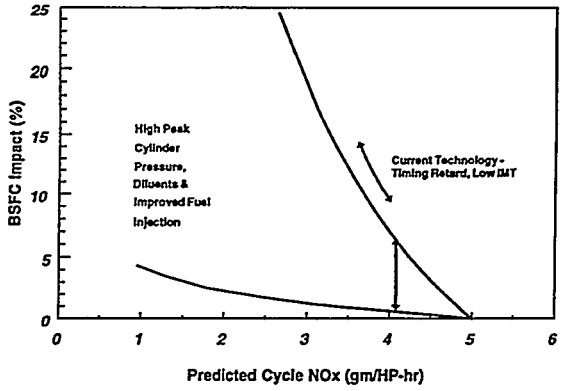


Design Space:

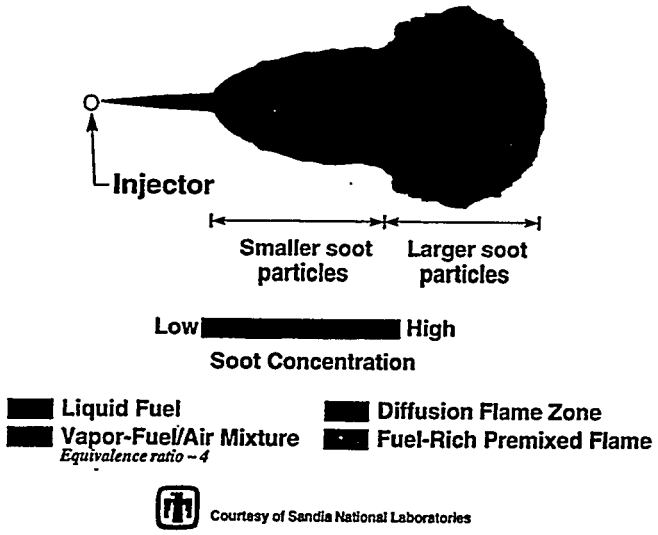
Impact on NOx, Particulate



Application of Technologies:



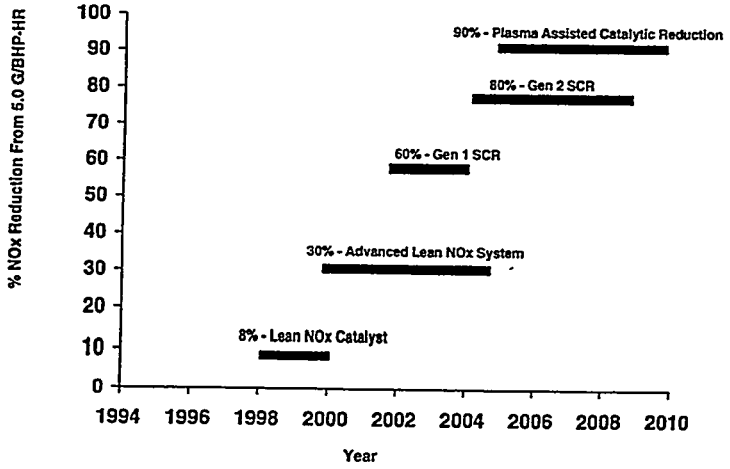
New Conceptual Model of Diesel Combustion



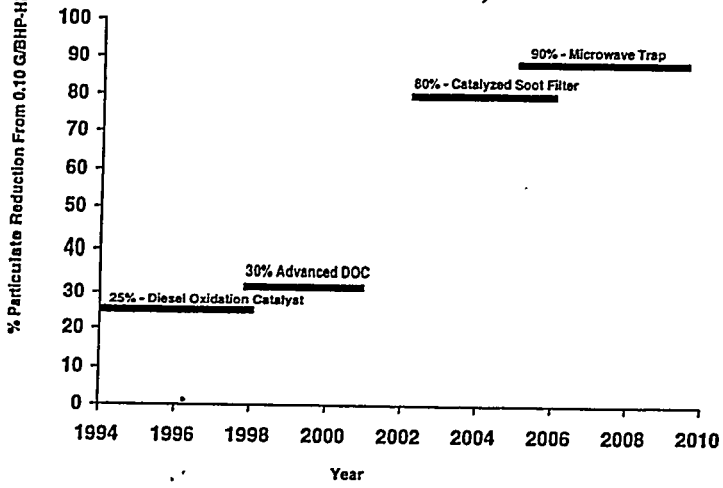
Courtesy of Sandia National Laboratories

Projected NOx Reduction

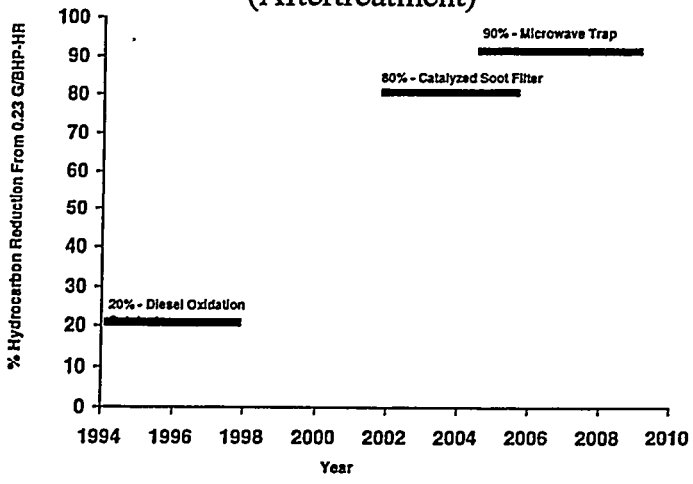
(Aftertreatment)



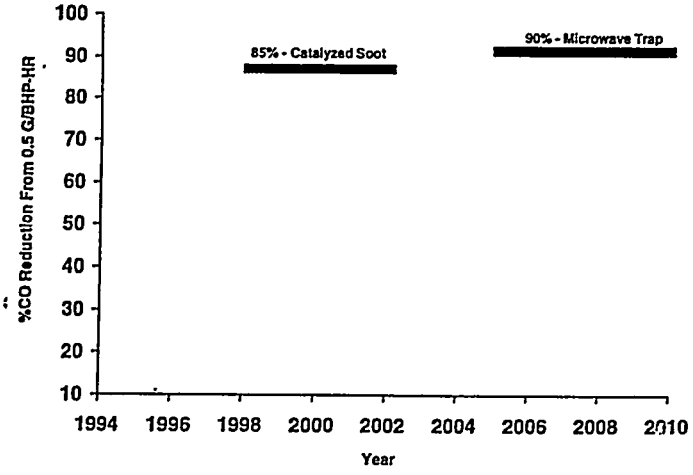
Projected Particulate Reduction
(Aftertreatment)



Projected Hydrocarbon Reduction
(Aftertreatment)



Projected CO Reduction
(Aftertreatment)



Other Technology Opportunities With Diesel Engines

Alternate Fuels

Reformulated Diesel

F.T. Diesel (natural gas and biofuel feed stocks)

CNG

DME

Lean Homogenous Charge Compression Ignition