

Conference on the Development and Promotion of Environmentally Friendly Heavy Duty Vehicles such as DME Trucks

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Development of a Heavy-Duty DME Truck in EFV21 Project



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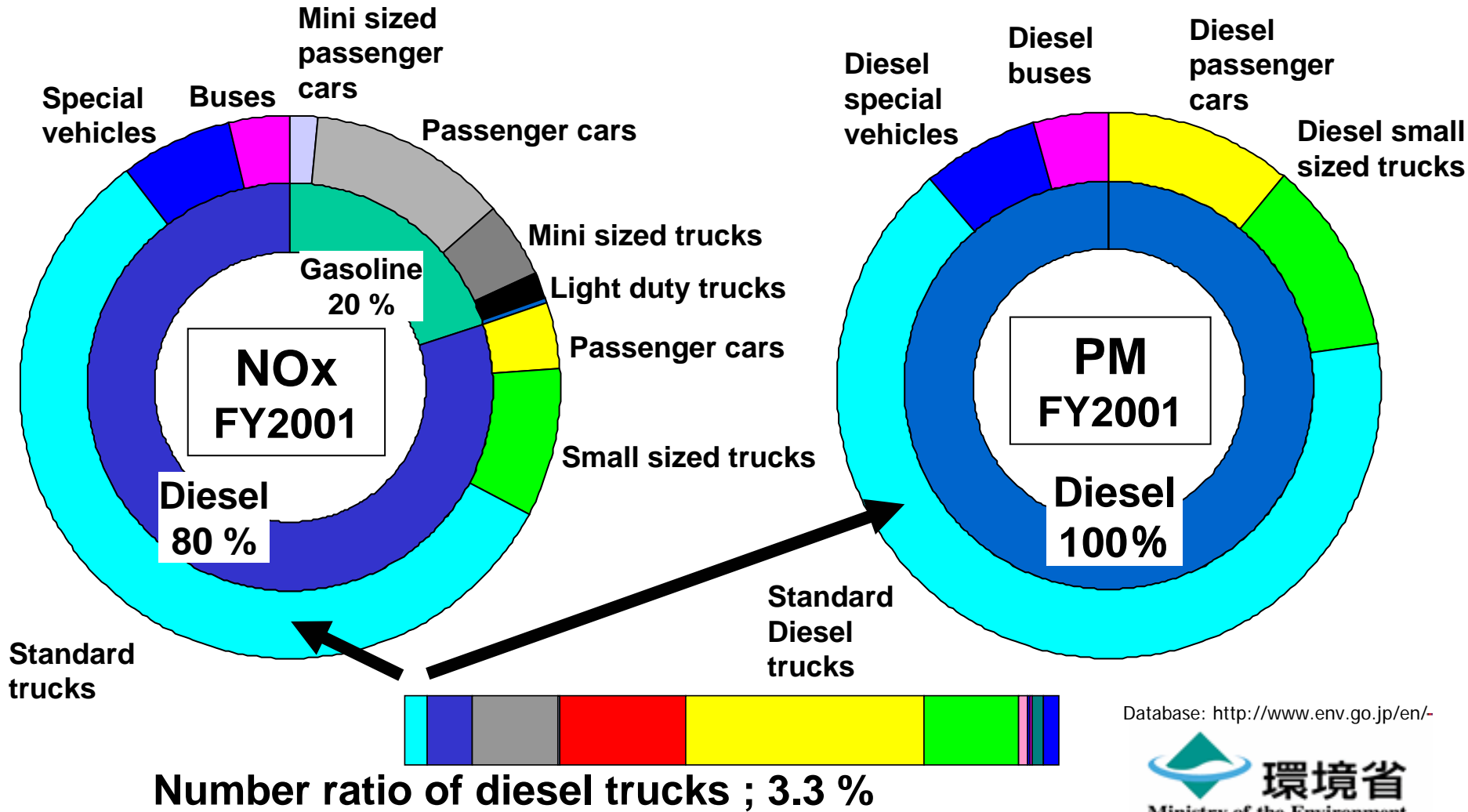
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 - Large volume Exhaust Gas Recirculation (EGR)
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Environmental impact of diesel trucks

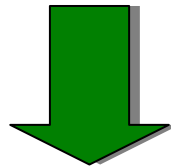


Task of EFV21 project

- from the Action Plan of Clean Vehicles (METI, MLIT, MOE, Jul. 2001)
- from the Working Group Report (MLIT, Dec. 2001)

“The Next-Generation Low Emission Heavy-duty vehicles”

- ***Drastic reduction of exhaust emission maintaining good fuel efficiency***
- ***Improvement of practical use***
Output, Fuel economy, Cruising distance



Environmentally Friendly Vehicles 21
“EFV21” Project

Basic data of EFV21 project

- Time period:
 - 3 years, from April 2002 through March 2005
- Subjects:
 - Completion of prototype vehicles by March 2005, and evaluation of the vehicles' performance
- Prototype vehicles and engine:
 - DME fueled truck, Ultra-Clean CNG fueled truck, Series H/B diesel bus, Parallel H/B diesel truck, Ultra-Clean diesel engine
- Development budget:
 - Support from Ministry of Land, Infrastructure and Transport (MLIT)
 - Total budget included all vehicles for 3 years; Approximately 5 billion yen (approximately 42 million dollars)

Development targets for DME truck

- Exhaust emissions (JE-05 mode, 2005):

 - NOx = 0.5g/kWh or less

 - PM = 0.0g/kWh (nearly zero)

 - CO = 2.22g/kWh or less

 - NMHC = 0.17g/kWh or less

- Fuel consumption:

 - Equivalent to base diesel engine

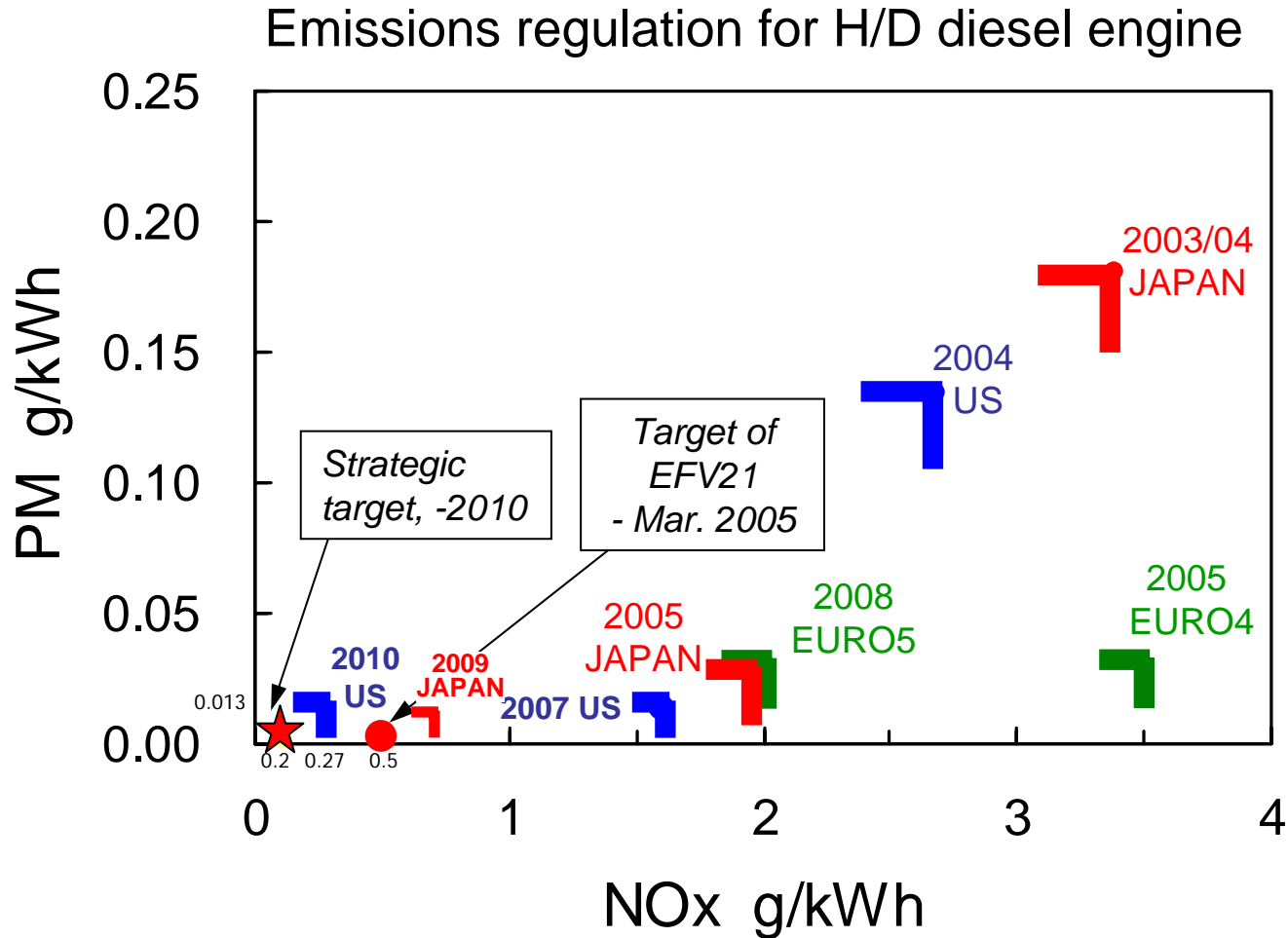
- Engine power:

 - Equivalent to base diesel engine

- Cruising distance and load capacity:

 - Equivalent to base diesel truck

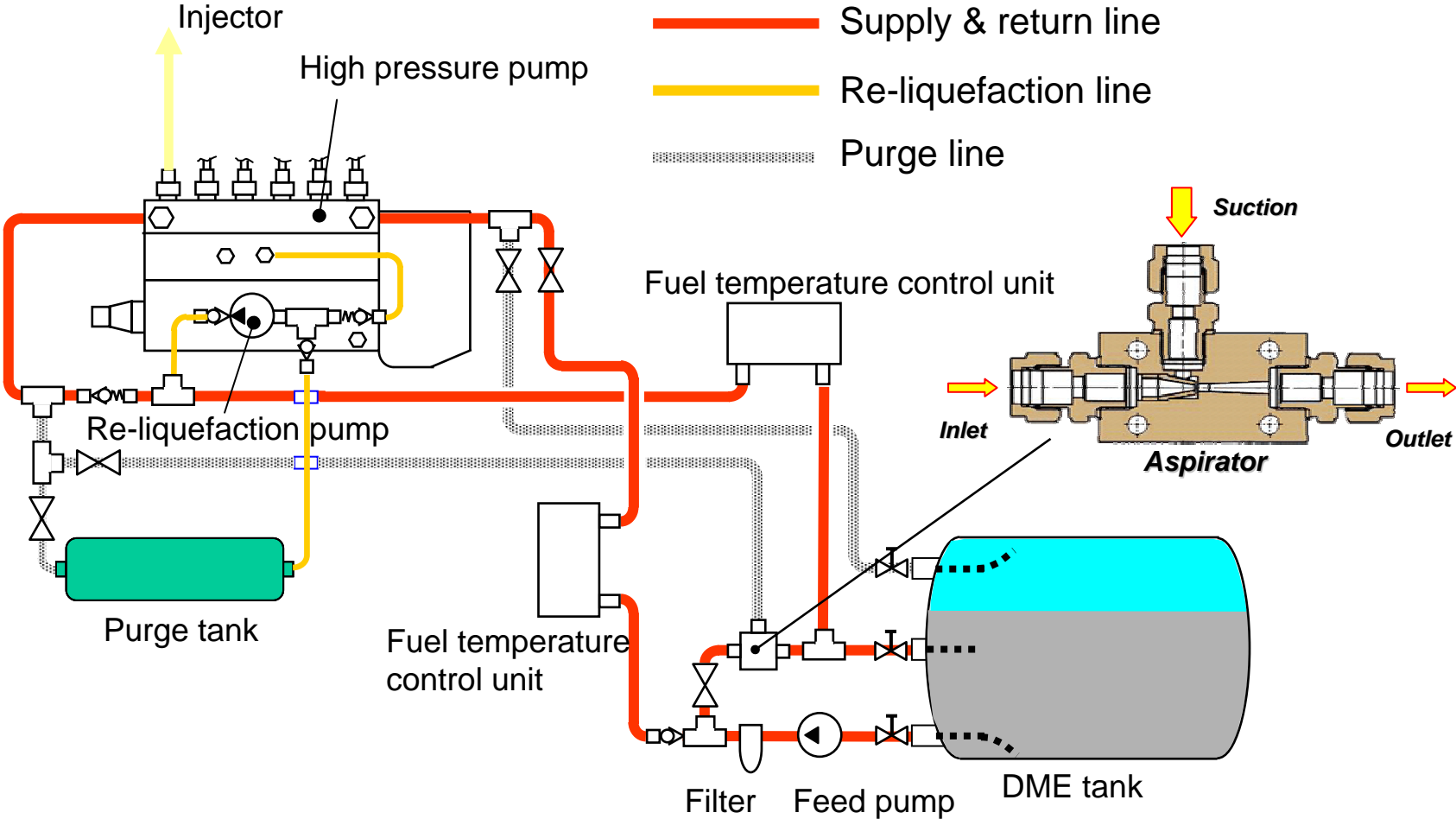
Emissions target of EFV21 project



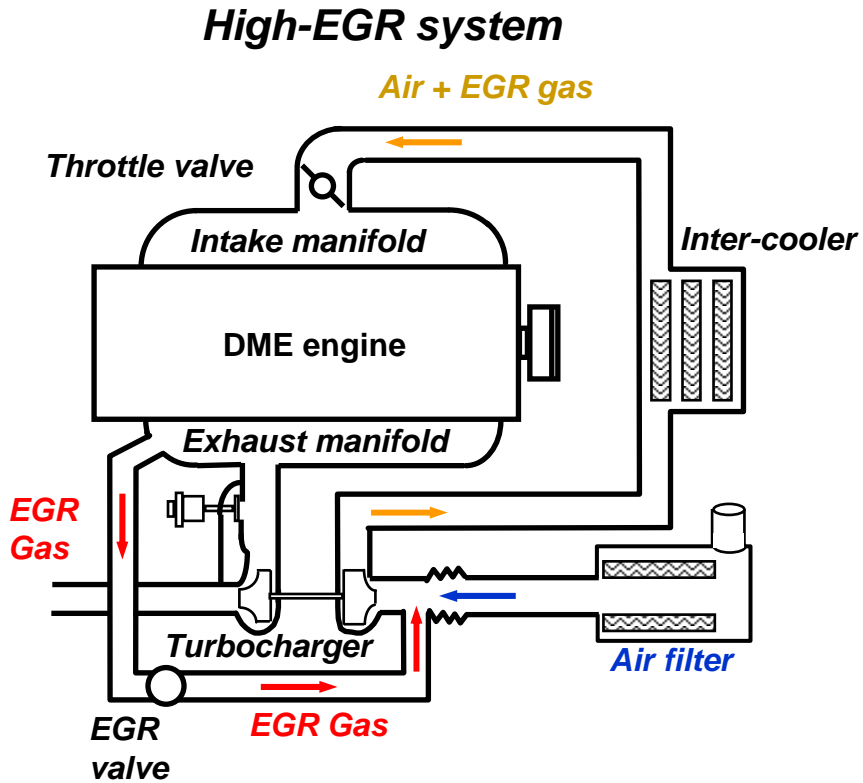
Specifications of DME engine

Base engine	NISSAN DIESEL FE6T
Cylinder	L6
Valve system	OHV (2 valves per cylinder)
Bore / Stroke	108 / 126
Displacement	6,925cc
Compression ratio	17.5
Swirl ratio	1.9
Charge type	Turbocharger with intercooler
Fuel injection system	Jerk type In-line injection
Achieved max. output	199kW at 2700rpm
Achieved max. torque	750Nm at 1100rpm

Fuel system for DME vehicles

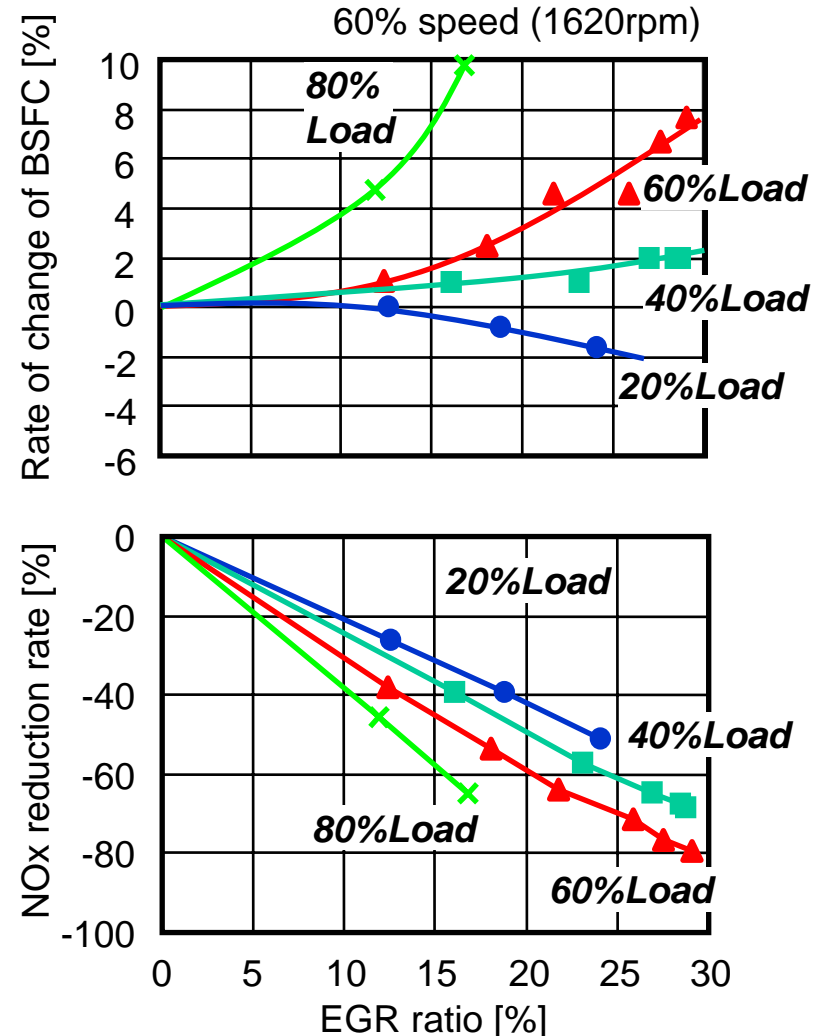


NOx reduction by large volume EGR

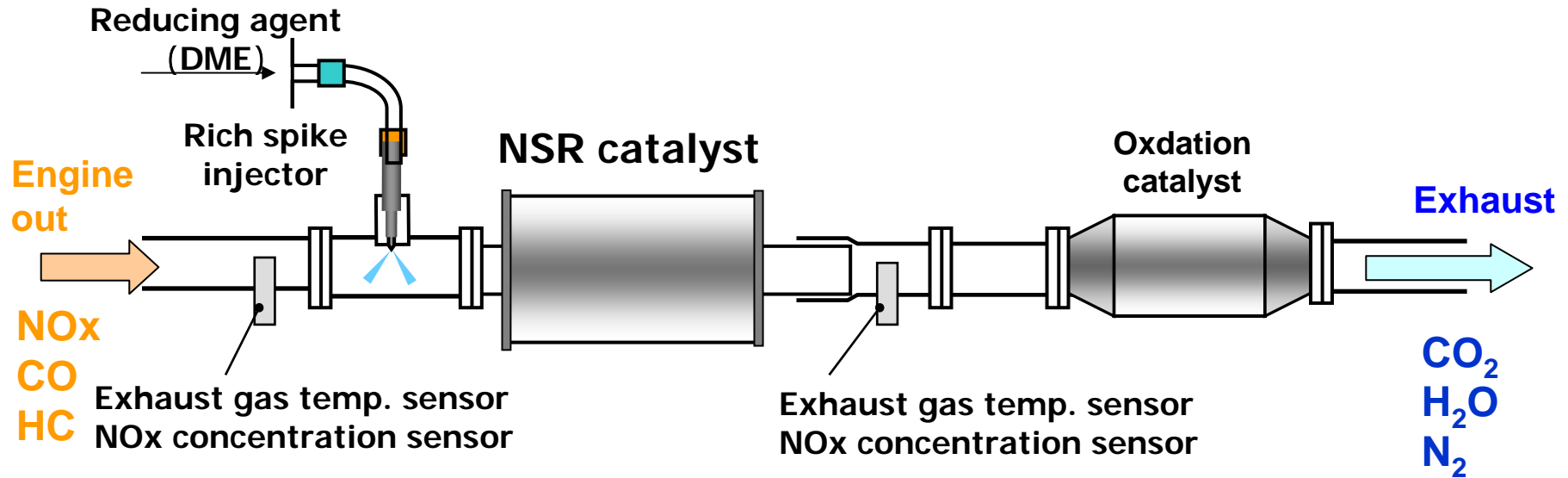


**High-pressure to
Low-pressure EGR**

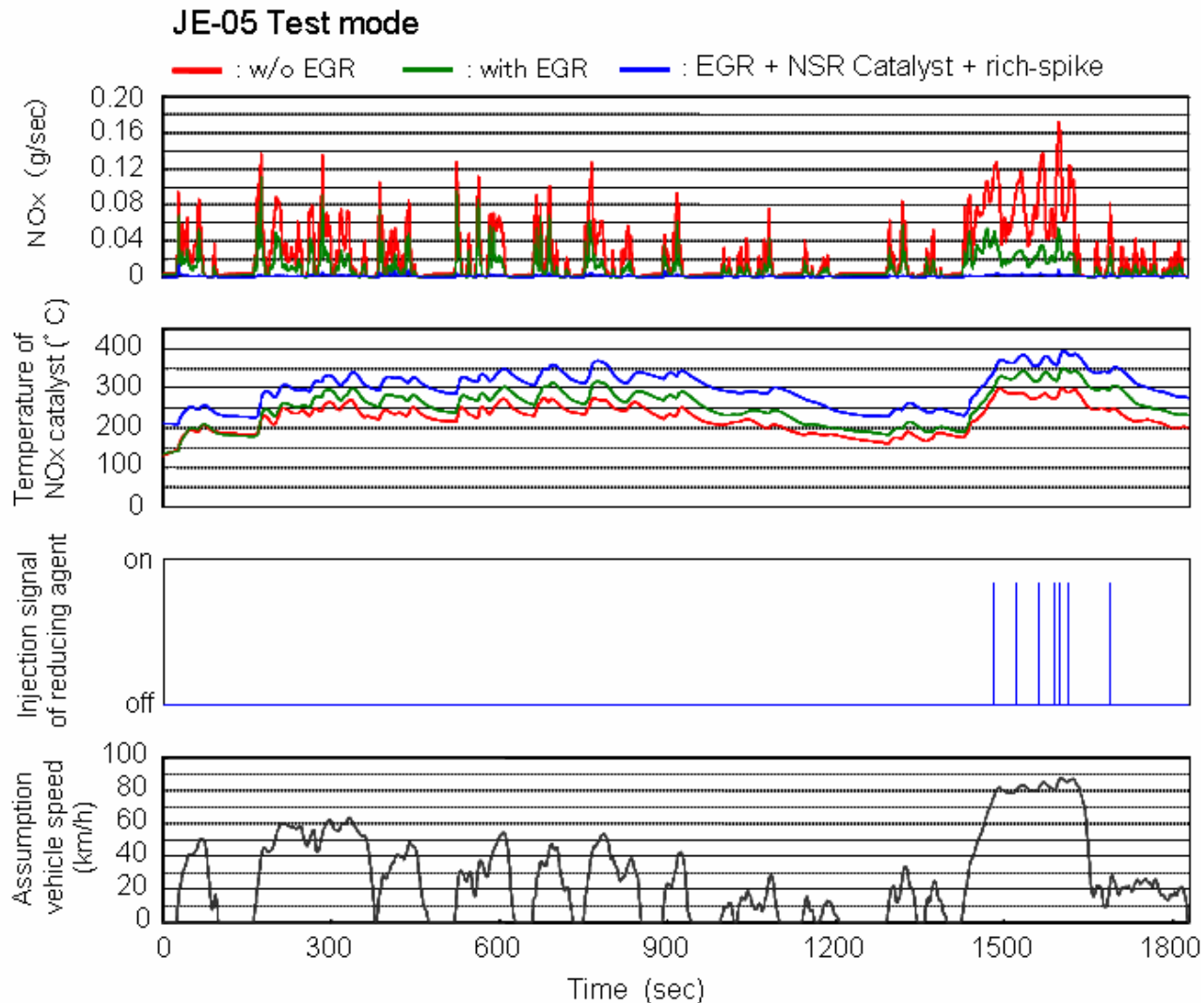
Effect of EGR at 1620rpm



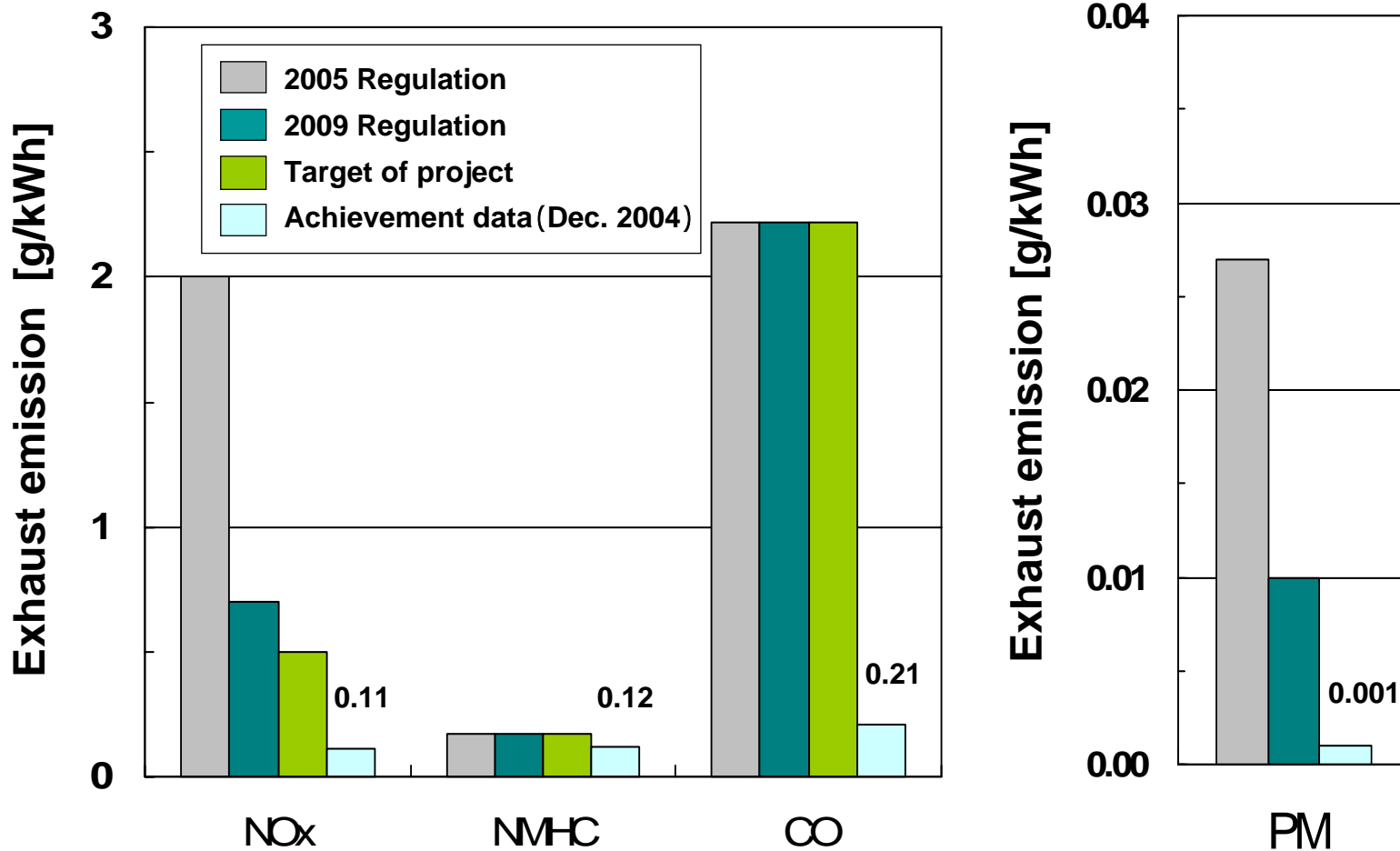
NOx storage reduction catalyst system



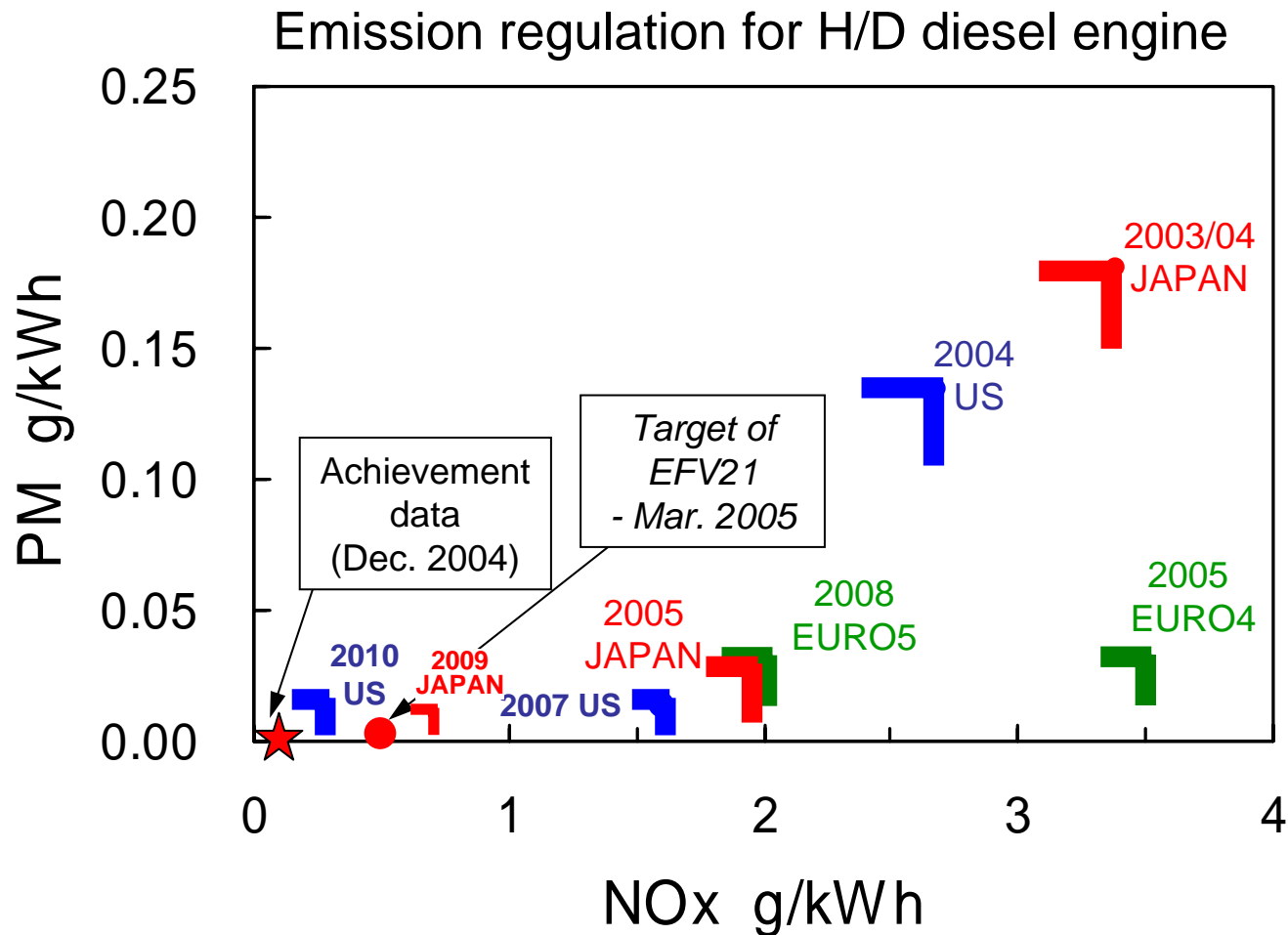
NOx behavior in emissions test



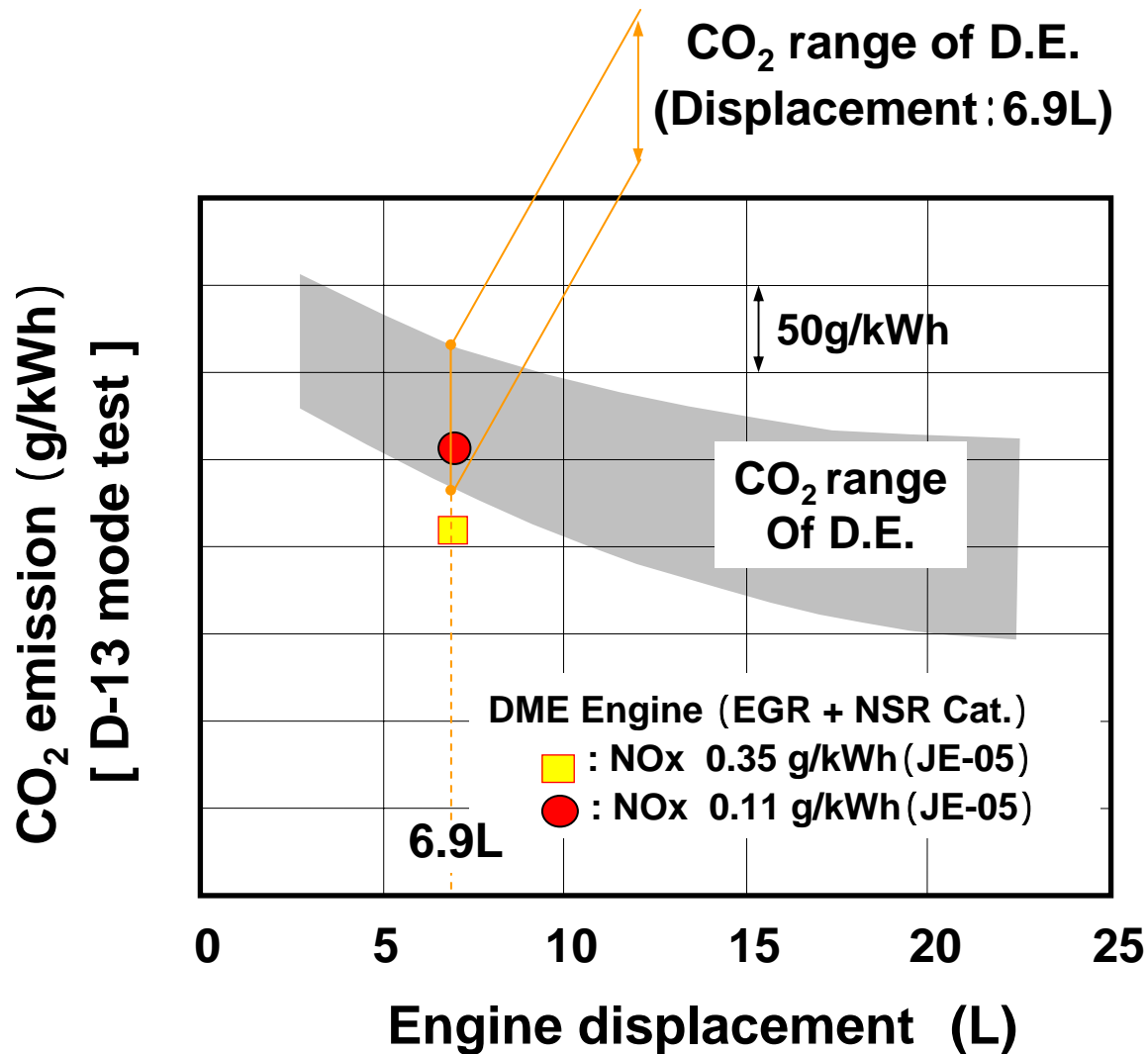
Exhaust emissions result



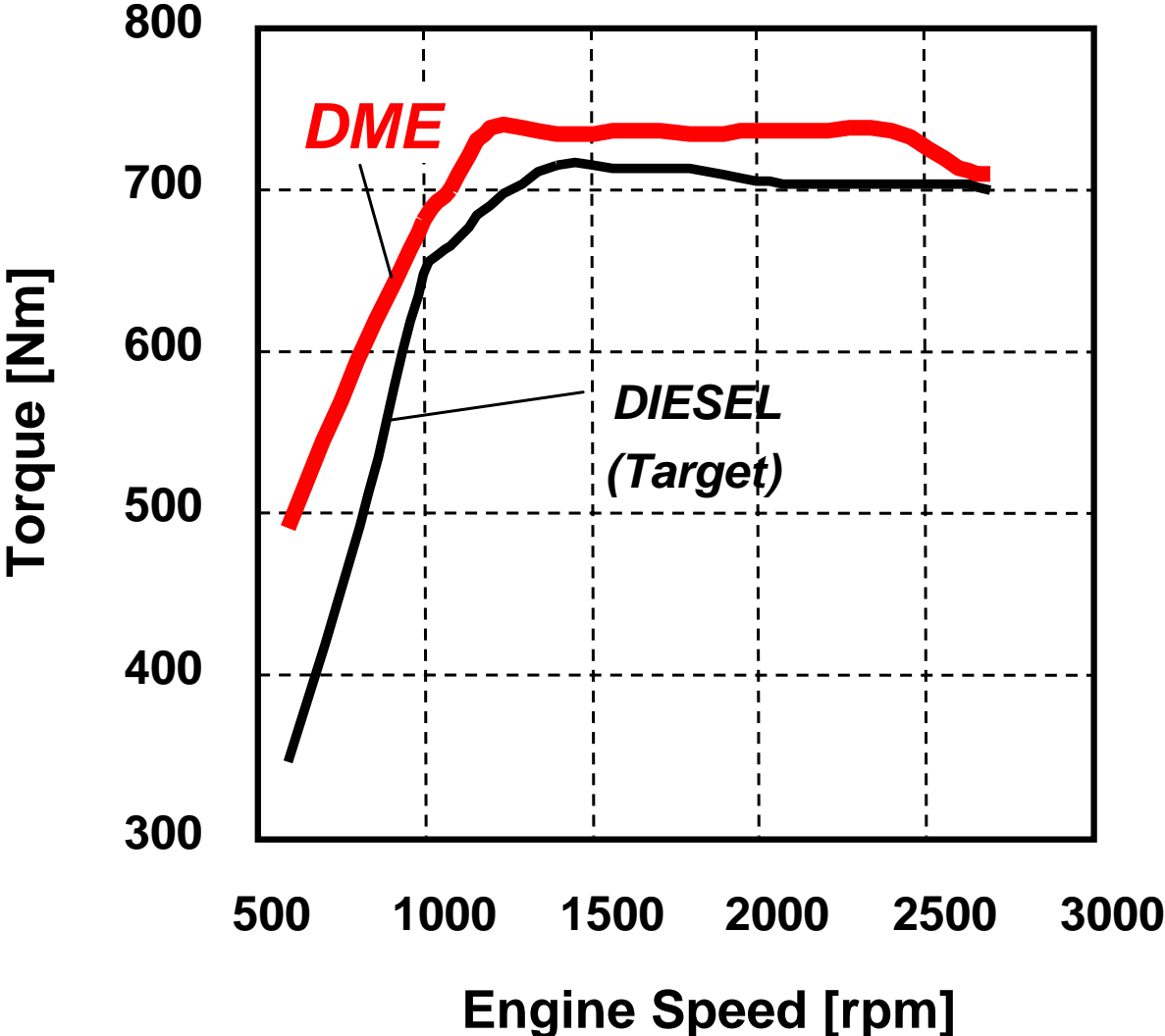
Emissions profile



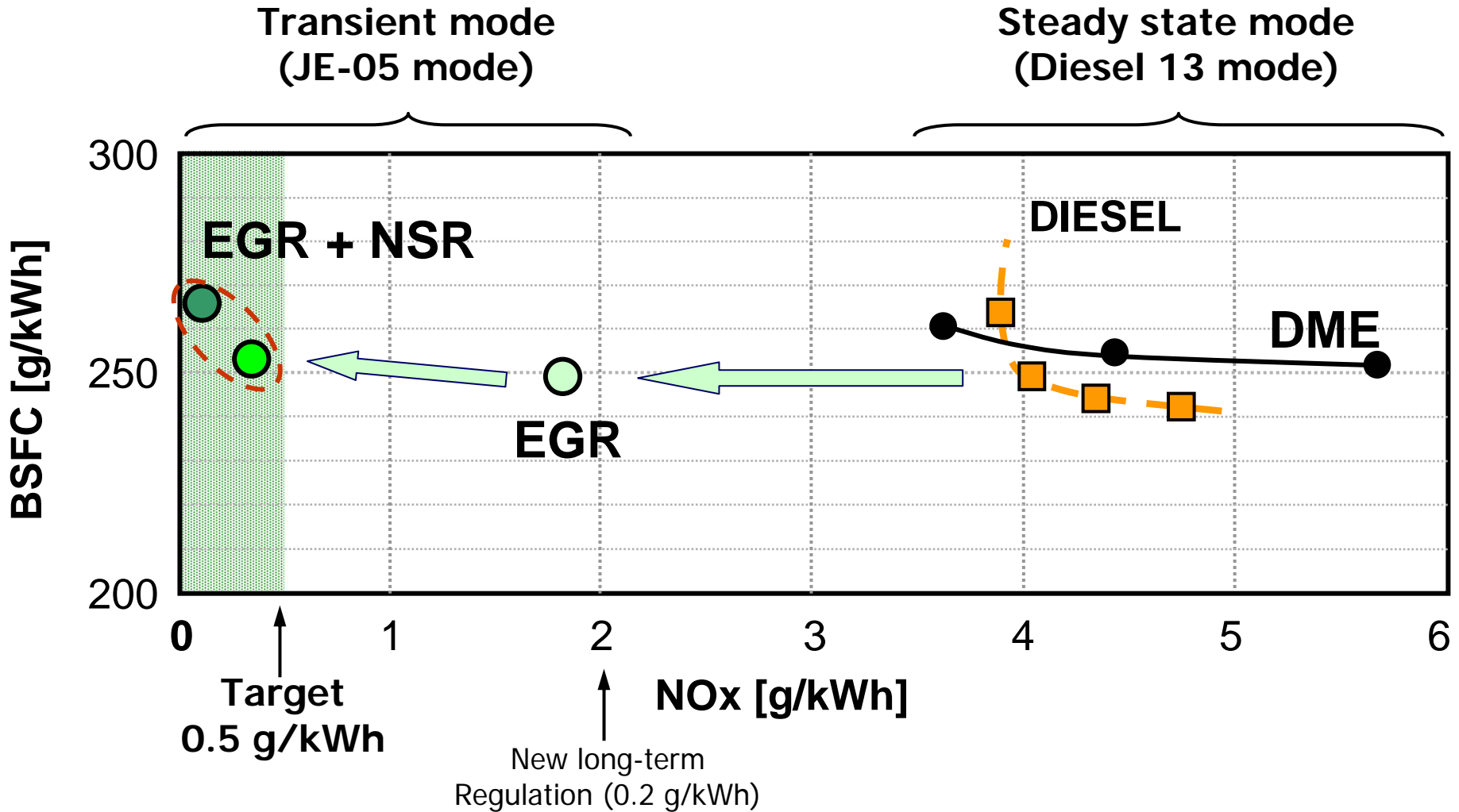
CO₂ emission characteristics



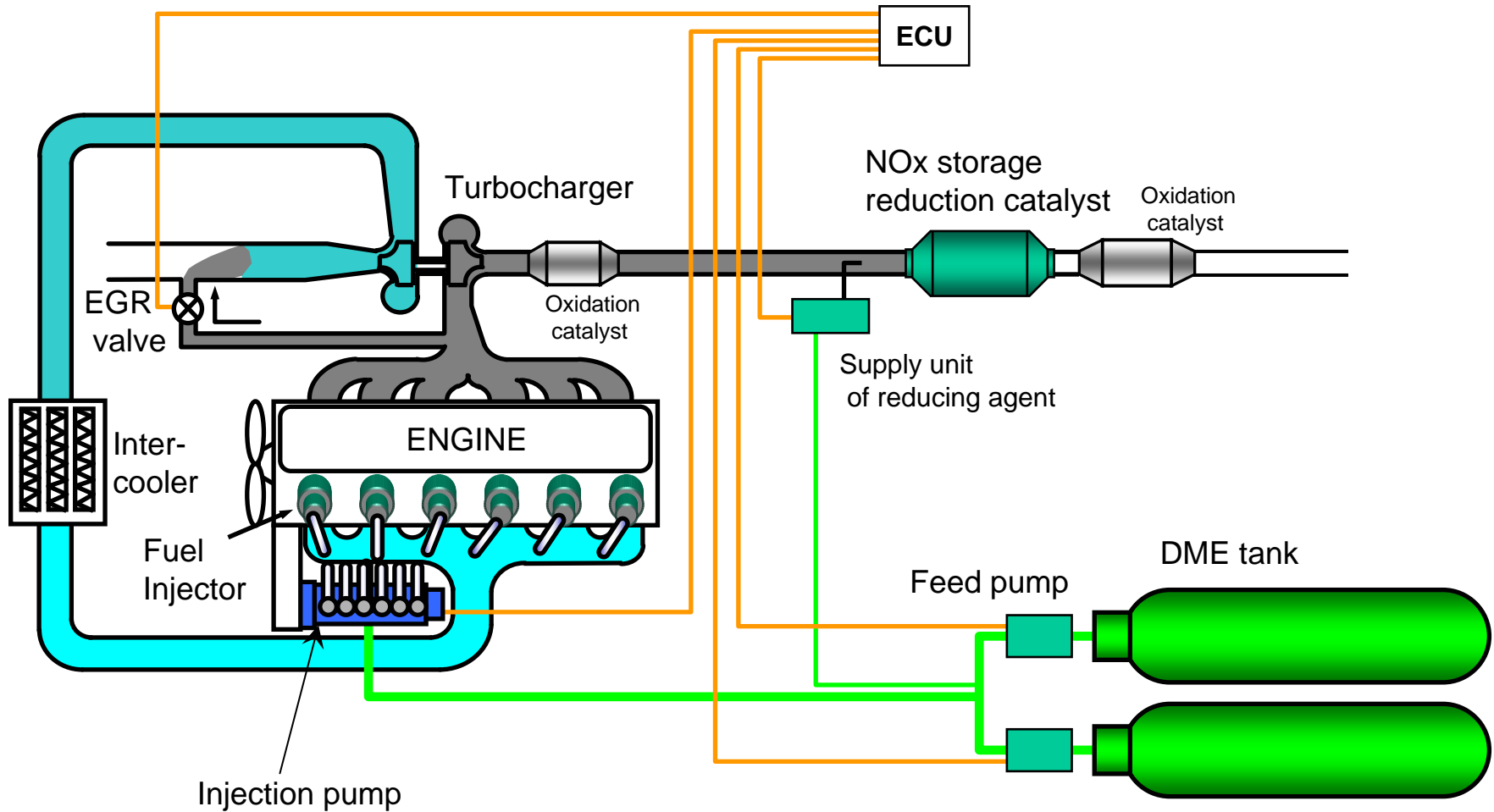
Output of DME engine



Fuel consumption profile



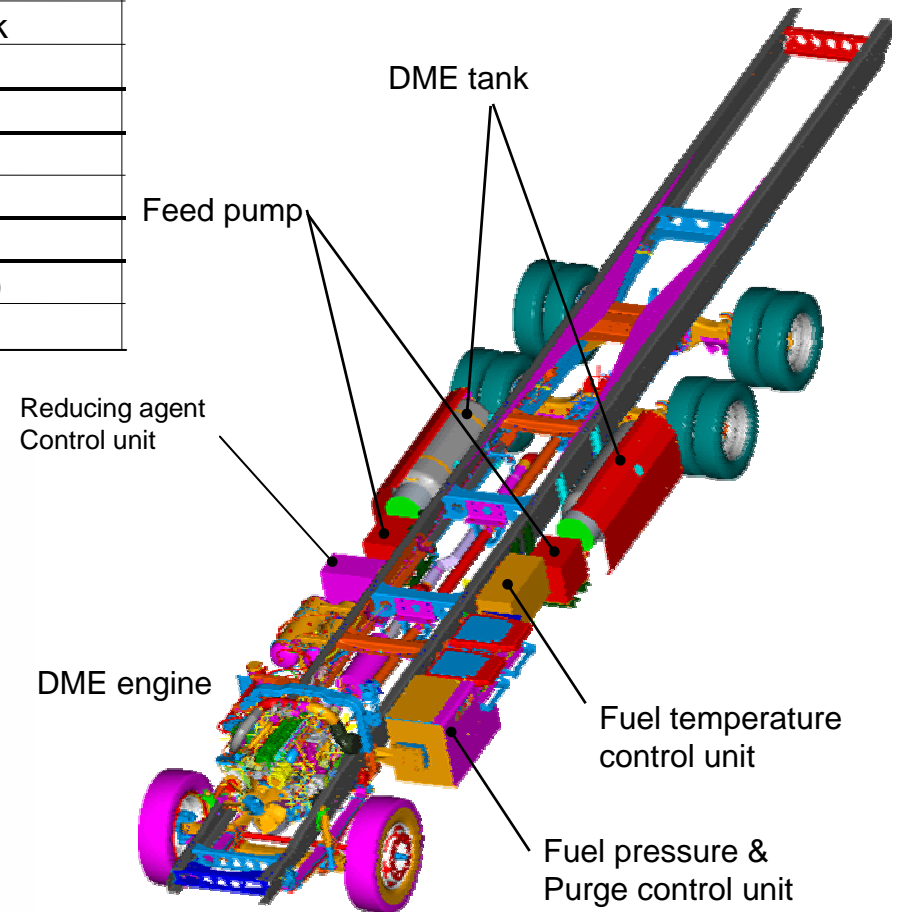
Fuel and emissions system



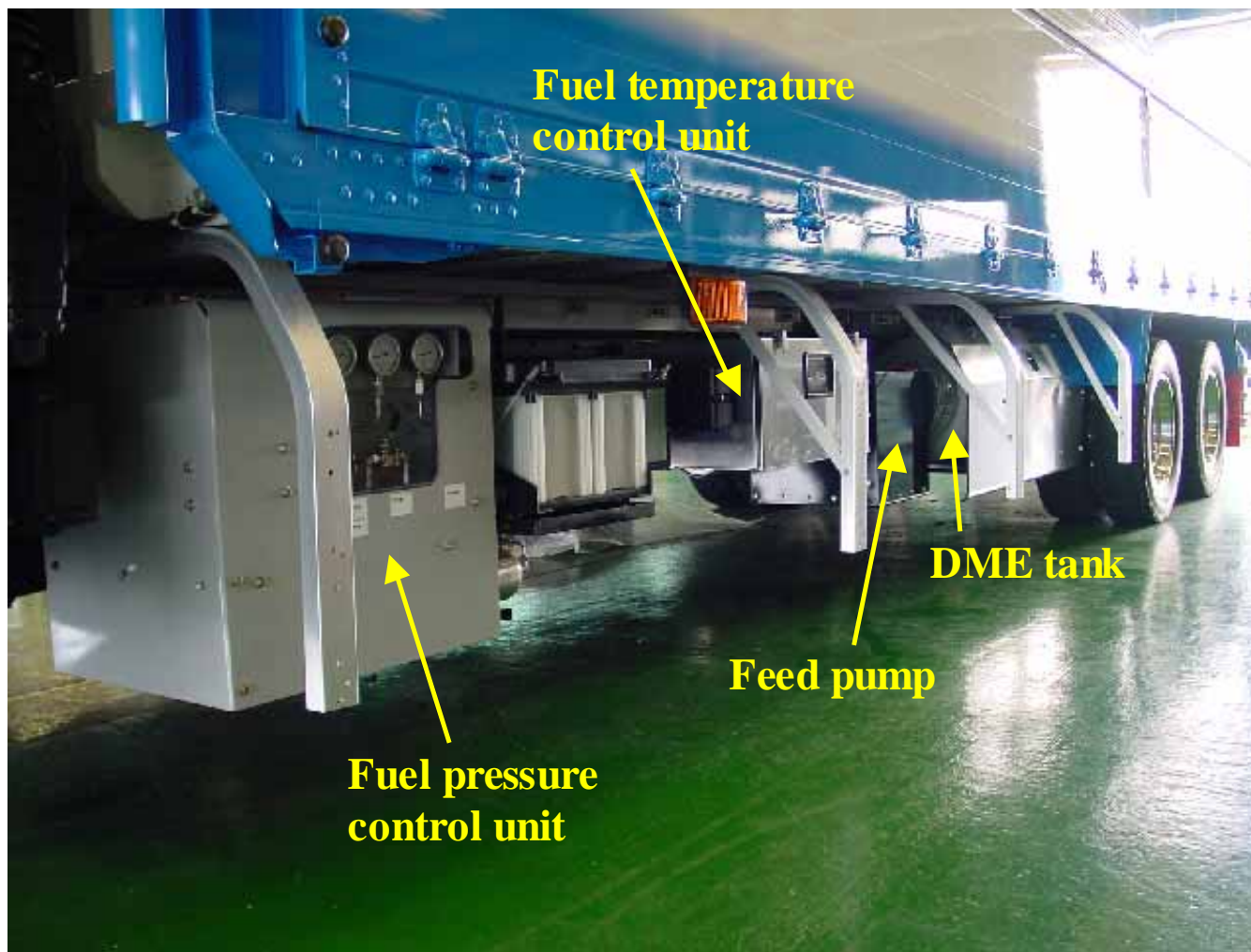
DME truck specifications

Base truck	NISSAN DIESEL, PW25A	
Type	Heavy duty truck	
Dimension	Overall Length [m]	12
	Overall Width [m]	2.5
	Overall Height [m]	3.4
Gross vehicle weight [tons]	20	
Maximum payload [tons]	10	
DME tank capacity [liters]	342 (171 + 171)	
Driving range [km]	627 *	

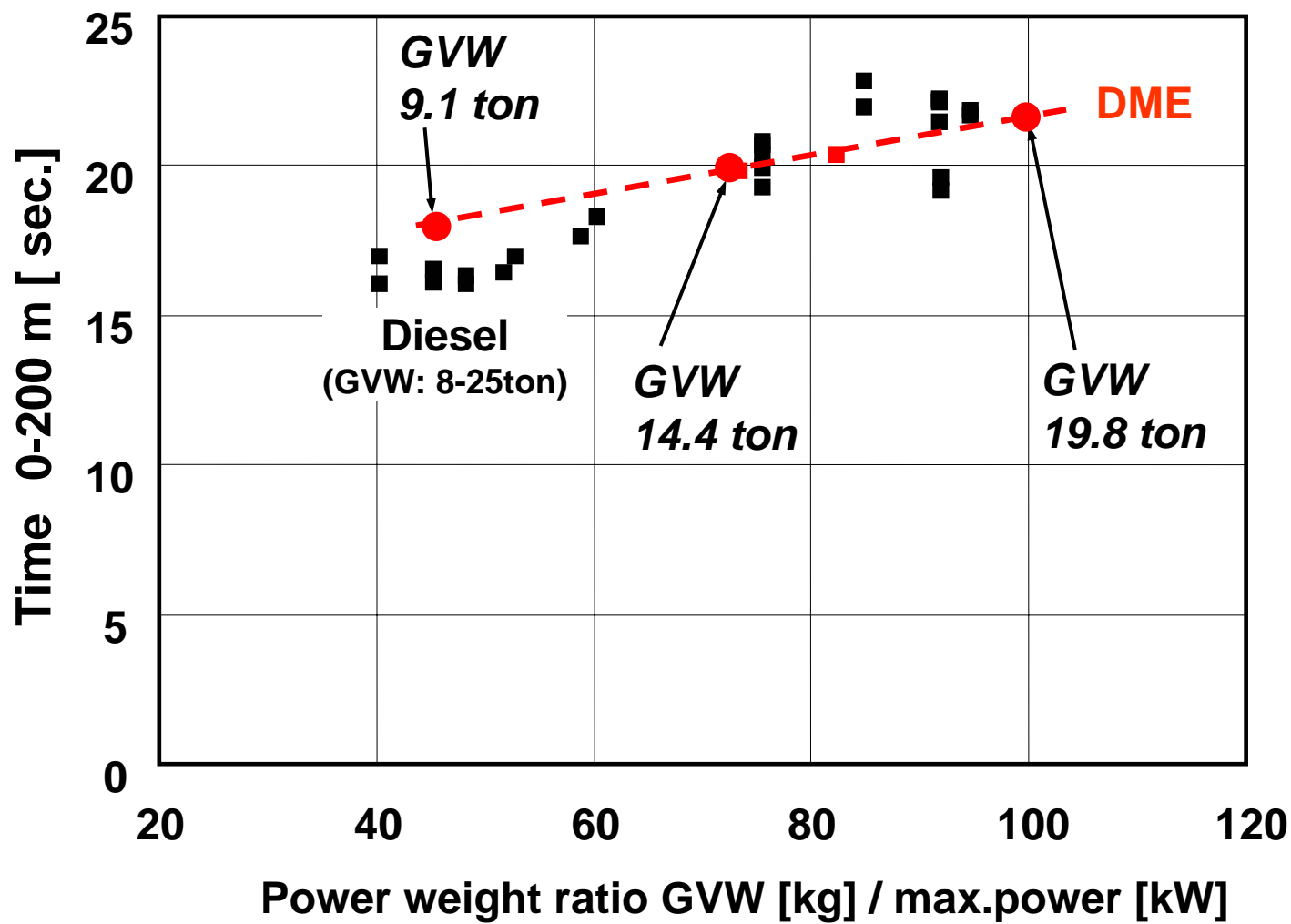
*Calculated value from the JE-05 mode test result



Side-view of fuel system



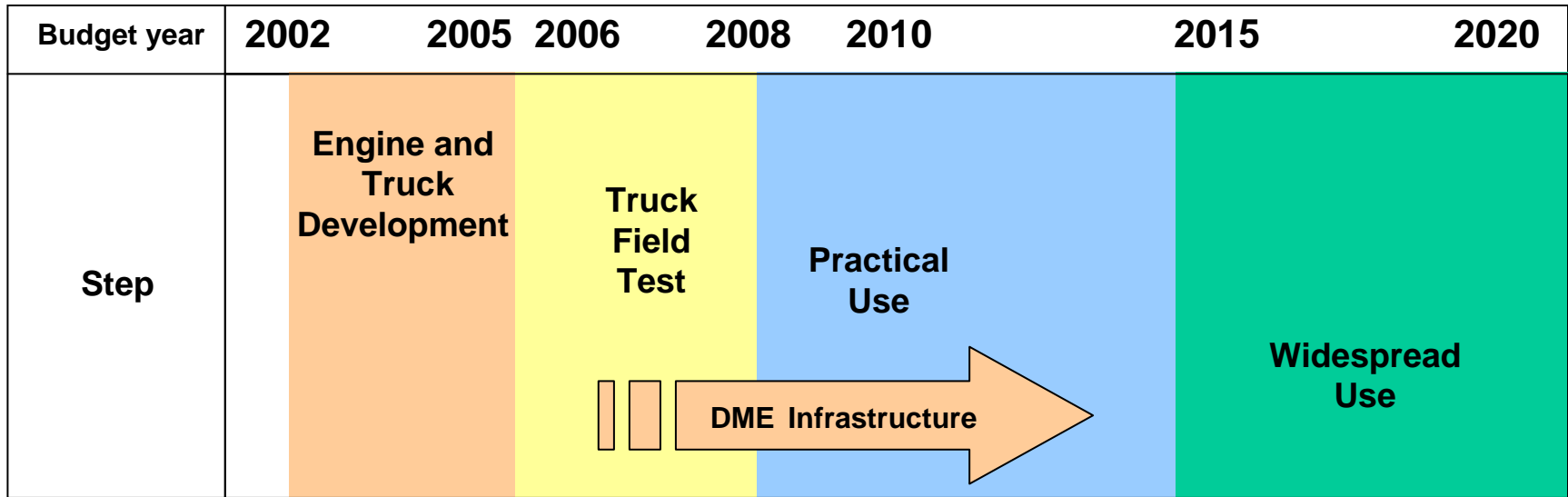
Vehicle acceleration performance



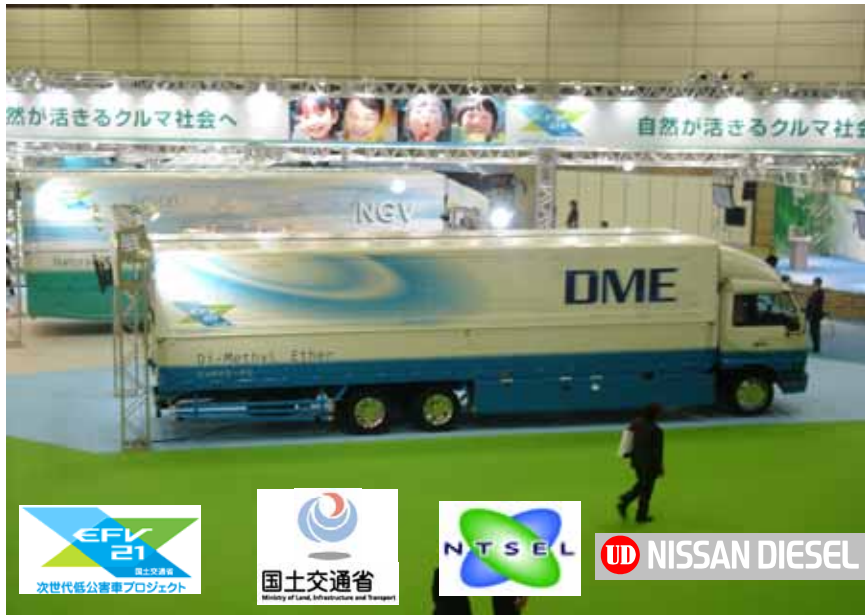
Conclusions

- **Heavy-duty dimethyl ether (DME) trucks developed and tested jointly by the National Traffic Safety and Environment Laboratory and Nissan Diesel Motor Co., have exceeded the upcoming 2010 US heavy-duty emissions regulations.**
- **Through the optimization of the combustion system and the combination of emission reduction technologies, the DME truck achieves the same level of fuel consumption (BSFC), output, cruising distance and payload as conventional diesel vehicles, while significantly reducing emissions.**

Field test of DME truck/2006-2008



- Ministry of Land, Infrastructure and Transport (MLIT) has started a field test of the developed DME truck in three years since 2006.
- By this test, system's operation, practicality, reliability, durability, etc., are investigated in various driving conditions toward practical use.



Nov. 2004, 38th Tokyo Motor Show



Aug. 2005, High-Speed Cruising Test

Thank you for your kind attention !