



NAFTA Heavy Duty Engine and Aftertreatment Technology: Status and Outlook

2006 DEER Conference Luncheon Address
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Agenda



- **DOE/Detroit Diesel Collaboration**
- **EPA 2007 Readiness**
- **EPA 2010 Emissions**
 - **AdBlue Infrastructure and Compliance**

Technology & Products that Continue to Benefit the Environment

Fuel Economy

- Supplier of the most fuel efficient diesel engines for various applications within the United States for nearly 20 years.
- Engines that help our customers reduce diesel fuel consumption in America by 2.5 million gallons per day.

Emissions

- Detroit Diesel meets the highest clean air standards for today and is a leader in developing clean burning diesel engines for the future.
- 2007 Detroit Diesel engines will emit 70% less pollutants than they did in 1998 – helping to preserve the clean air that Americans breathe.

Hybrid Technologies

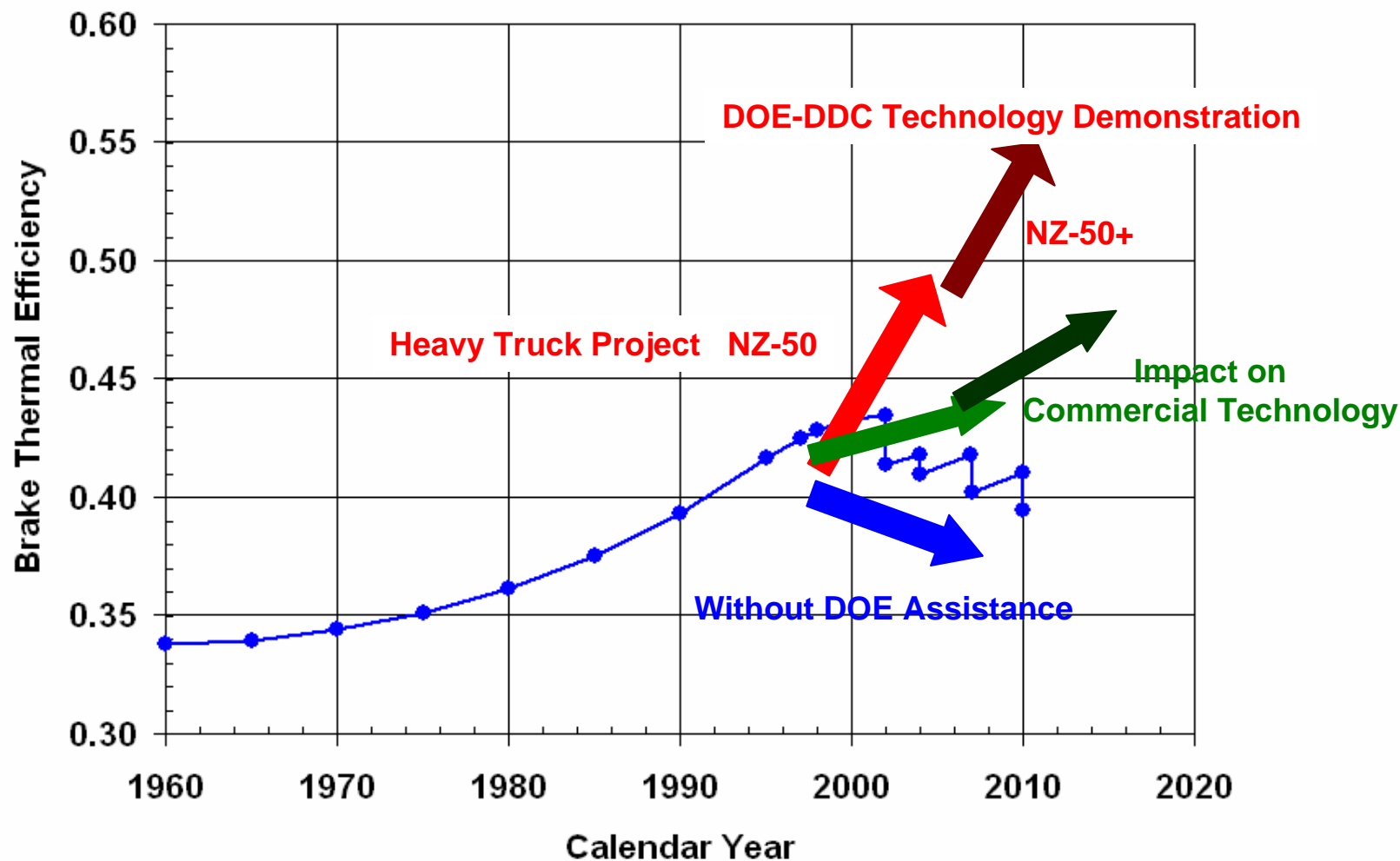
- Detroit Diesel and Freightliner are working together to develop diesel hybrid electric engines that will:
 - Improve fuel economy
 - Reduce emissions
- Development of hybrid technologies is gaining momentum and will lead to high quality jobs and industry growth.

Celebrating 20+ Years of DOE & DDC Collaboration



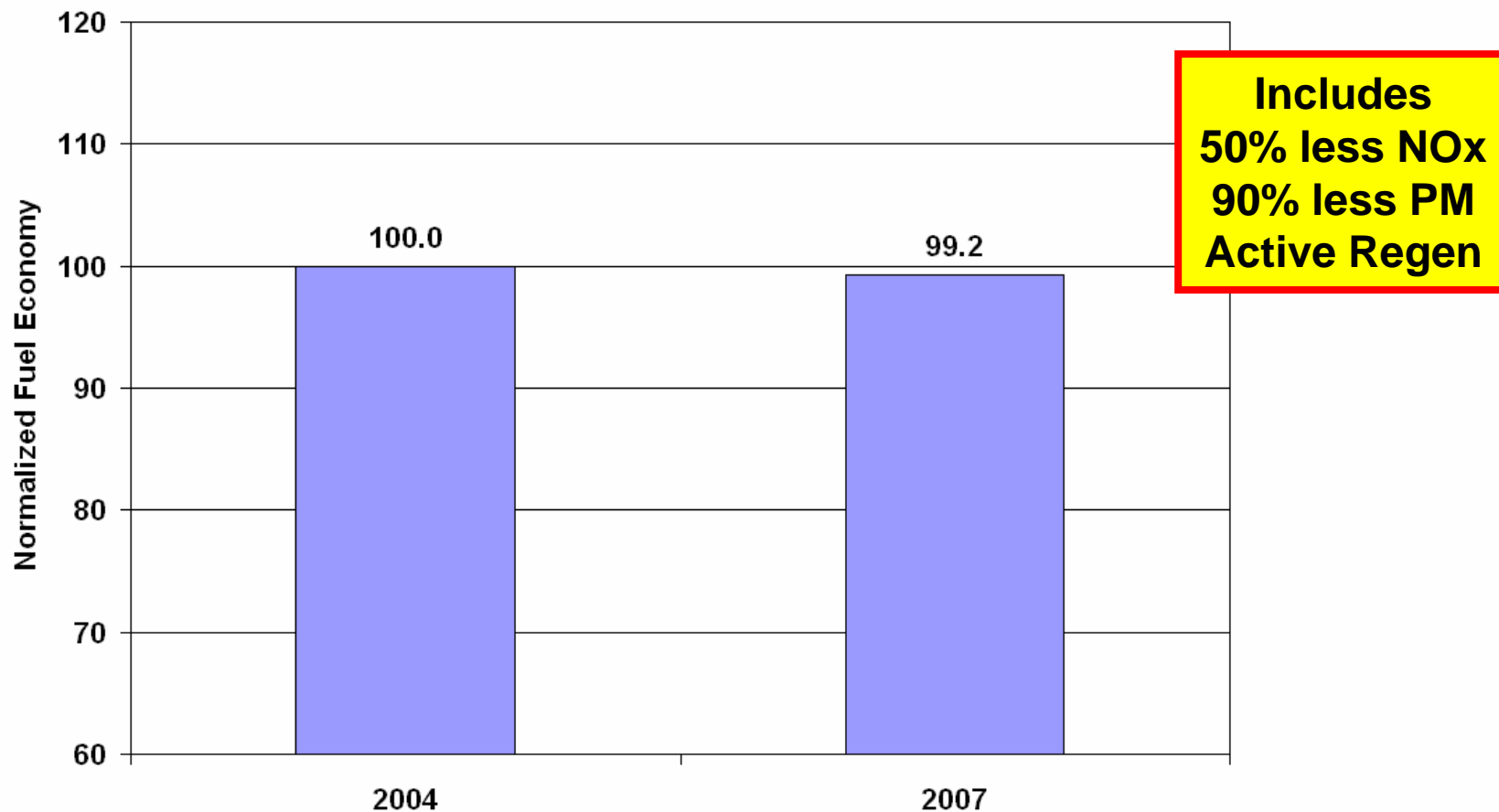


Heavy-Duty Thermal Efficiency Trend





2004 vs. 2007 DDC Fuel Economy Comparison



Testing showed EPA07 engine to be within 1% of the EPA04 engine.

All runs were within 2% variance.

This test was a preliminary look at EPA07 vs. EPA04 Fuel Economy.

EPA 2007 Readiness



Status Customer Demonstration Program

Series 60



Series 60

▪ Penske	2	▪ Ryder	3
▪ JB Hunt	3	▪ Conway*	1
▪ Werner	3	▪ Yellow	2
▪ Crete	1	▪ US Express	3
▪ Schneider	4	▪ Maverick	2
▪ KLLM	3	▪ PAM	2
▪ CR England	2	▪ Sanjel*	1
▪ Covenant	3	▪ Trimac	1
TOTAL			36

■ 36 Trucks delivered to end users



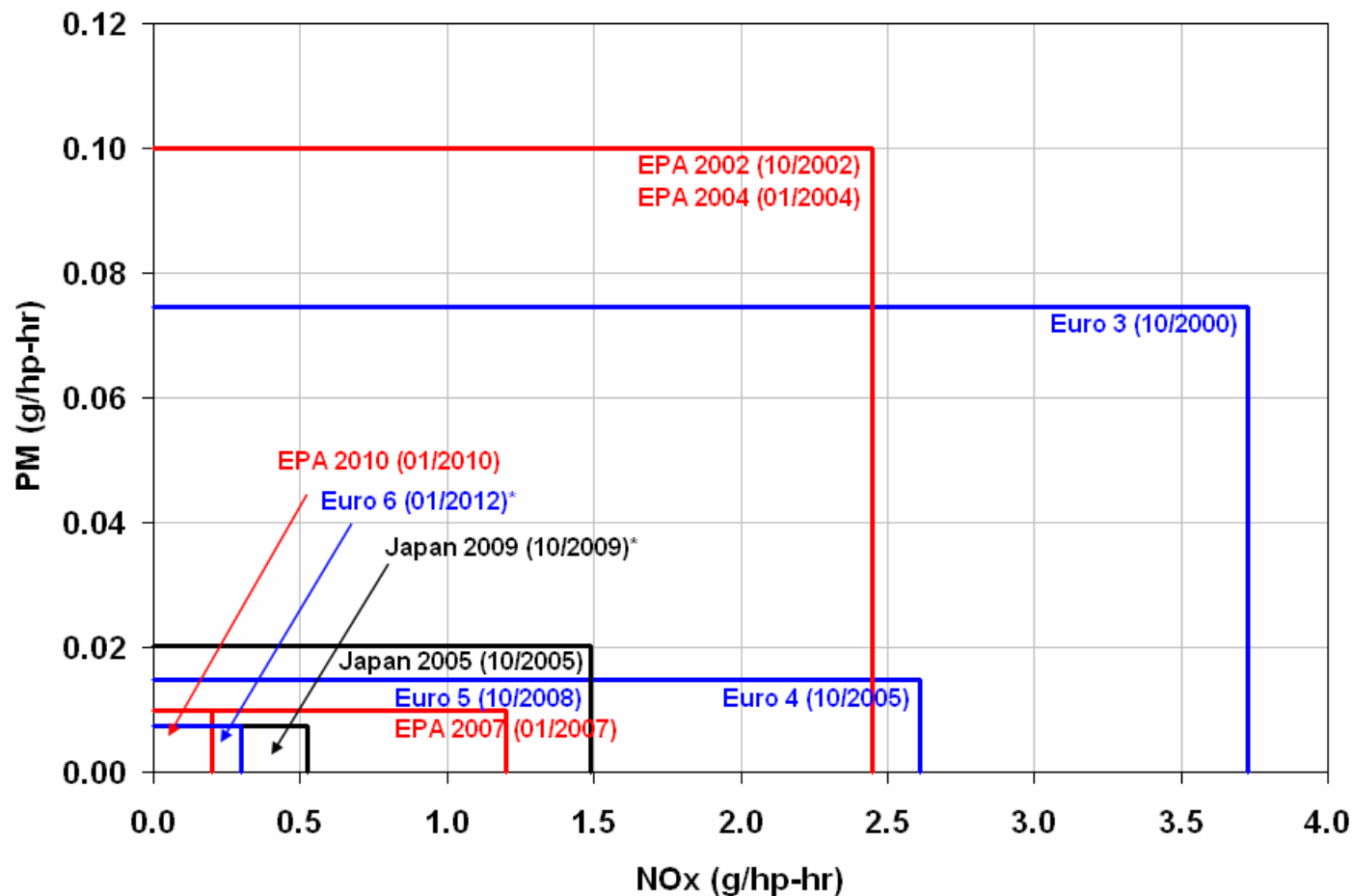
8 million equivalent miles of reliability growth on dynamometer and actual truck tests through July 2006

EPA 2010 Emissions

AdBlue Infrastructure and Compliance



Global Emissions Regulations

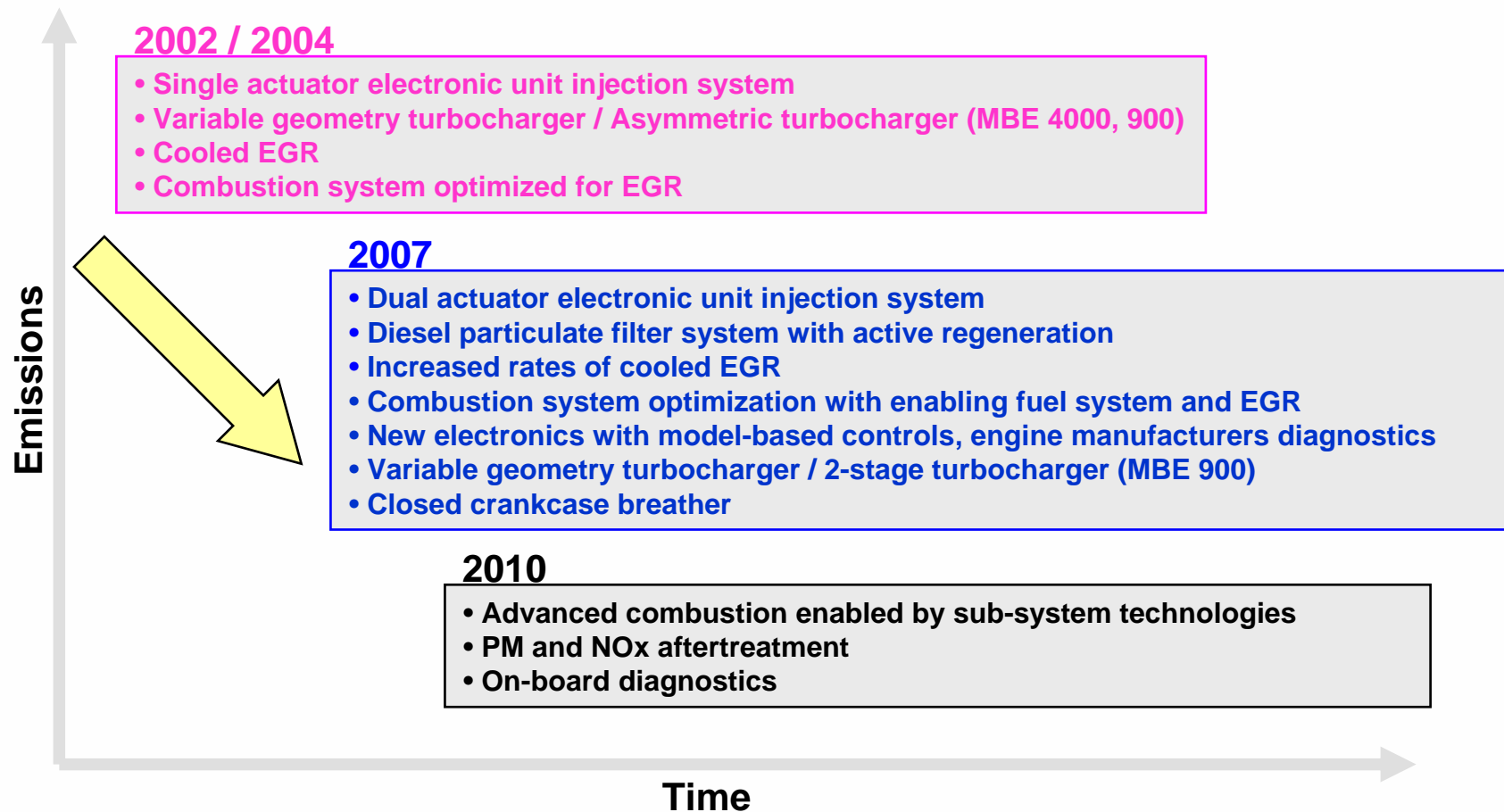


Global heavy-duty emissions regulations are approaching near-zero and present an opportunity for some common technologies to be utilized for global synergy

*Euro 6 and post-Japan 2005 Regulations yet to be Finalized









Heavy-Duty Engine Technology Evolution





DCX Vision for Global Emissions Control in Trucks and Medium and Heavy Duty Engines



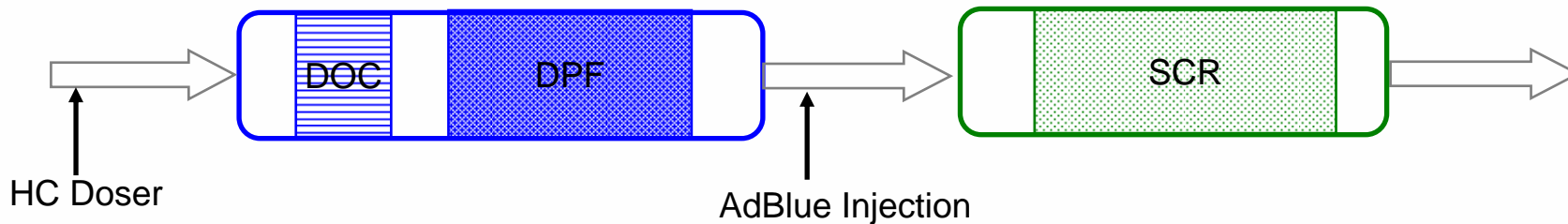
		2005	2006	2007	2008	2009	2010	2011	2012	2013
			Japan '05				Post-Japan '05?			
				EPA 2007			EPA 2010			
			Euro 4		Euro 5				Euro 6?	
	Medium Duty		EGR, DPF				EGR, DPF, SCR			
	Heavy Duty		EGR, SCR				EGR, DPF, SCR			
	Medium Duty		EGR	EGR, DPF			EGR, DPF, SCR			
	Heavy Duty		EGR	EGR, DPF			EGR, DPF, SCR			
	Medium Duty		SCR			SCR			EGR, DPF, SCR	
	Heavy Duty		SCR			SCR			EGR, DPF, SCR	

Production experience with several emissions control technologies within the DC family (e.g. EGR in U.S., SCR in Europe) lays a strong foundation for a global solution

2012 is the earliest opportunity for this global synergy to be implemented;
Possibility of earlier implementation via pre-fulfillment of Euro 6

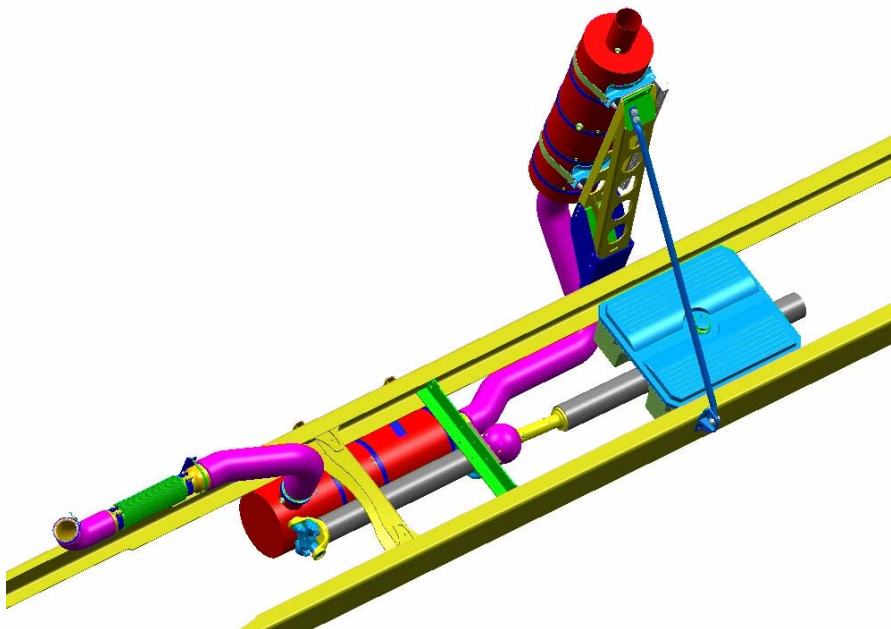


Low Emissions Combustion, DPF and AdBlue SCR Integrated on a Vehicle Test-bed



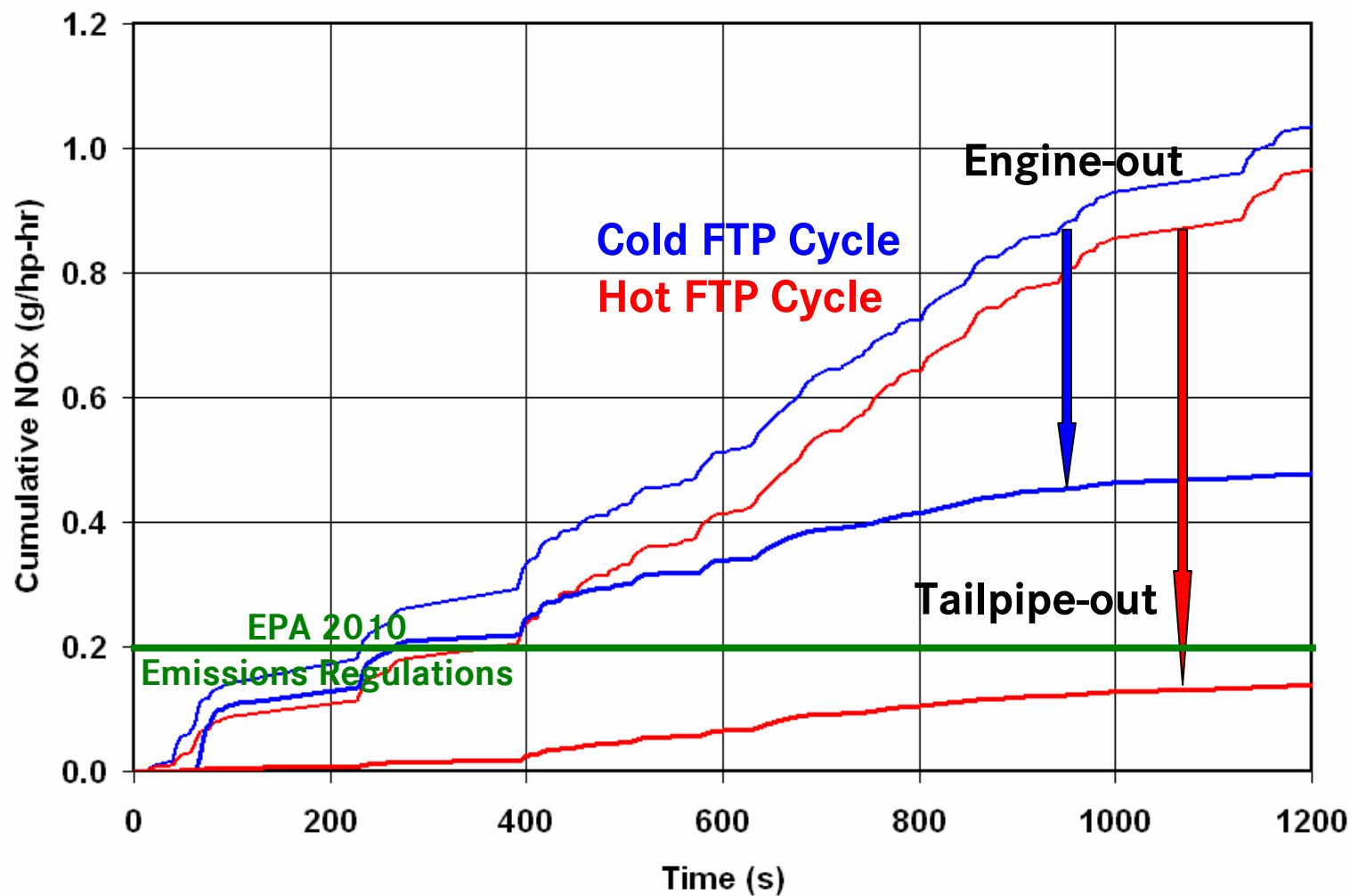
**Example System Integration
Installation for Long Sleeper Cabs**

**2010 Technology Vehicle at
the DEER 2006 Vehicle Display**





Engine-out and Tailpipe-out NOx

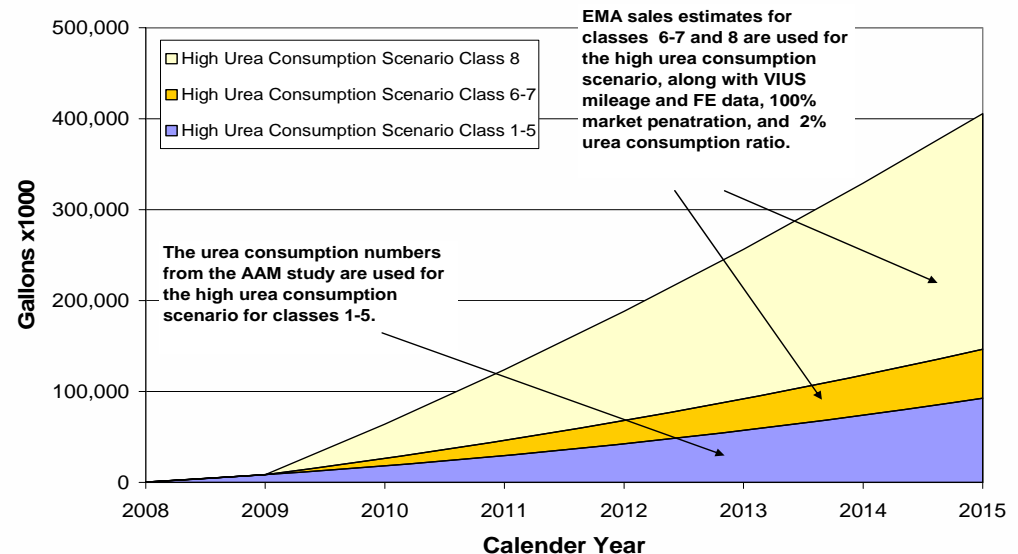




Urea Infrastructure at Distributors and Dealers



- Urea infrastructure
Ensure that drivers will find SCR-quality urea wherever they need it.
- Market study on urea consumption. By 2015 there consumption is projected to be 400 million gallons per year for all sectors of commercial vehicles
- EPA 2010 heavy-duty engine manufacturers reviewing what the Automotive Alliance plans are for infrastructure for this technology for light duty vehicles.
- Stakeholders include urea producers, distributors and retailers
- Freightliner dealerships and affiliated fuel truck stops will carry urea





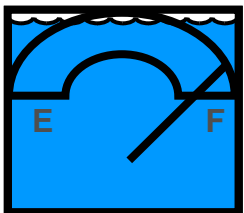
Urea Compliance Guidance from EPA



- **Urea Compliance**- Ensure that vehicles will meet the standards
 - Drivers will not drive with empty urea tanks
 - Vehicle standards may not be exceeded due to lack of urea.
 - Audible & visible alarms when urea is running low are needed
 - No-start mechanisms are to be used as last resort.
 - Detect if fluids other than urea are used. Urea Sensor vs. NOx Sensors are developed, but require much reliability growth testing before introduction to series production.

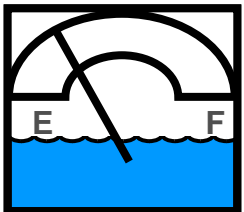


EPA 10 SCR Urea Compliance Strategy (Proposed)



Urea tank > 10% full

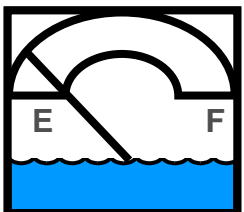
- No lamps lit



< 10% full



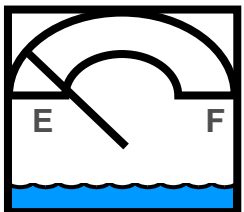
- AdBlue lamp lit solid



< 5% full



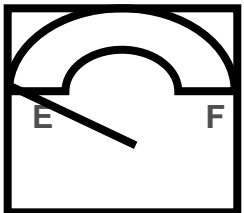
- AdBlue lamp flashing



Range < 1 fuel fill



- AdBlue lamp flashing
- Check engine lamp lit solid
- **Light engine derate**



Urea tank empty



- AdBlue lamp flashing
- Check engine lamp lit solid
- **Additional measures**

Thank You