

Biodiesel Effects on the Operation of U.S. Light-Duty Tier 2 Engine and Aftertreatment Systems

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August 15, 2007

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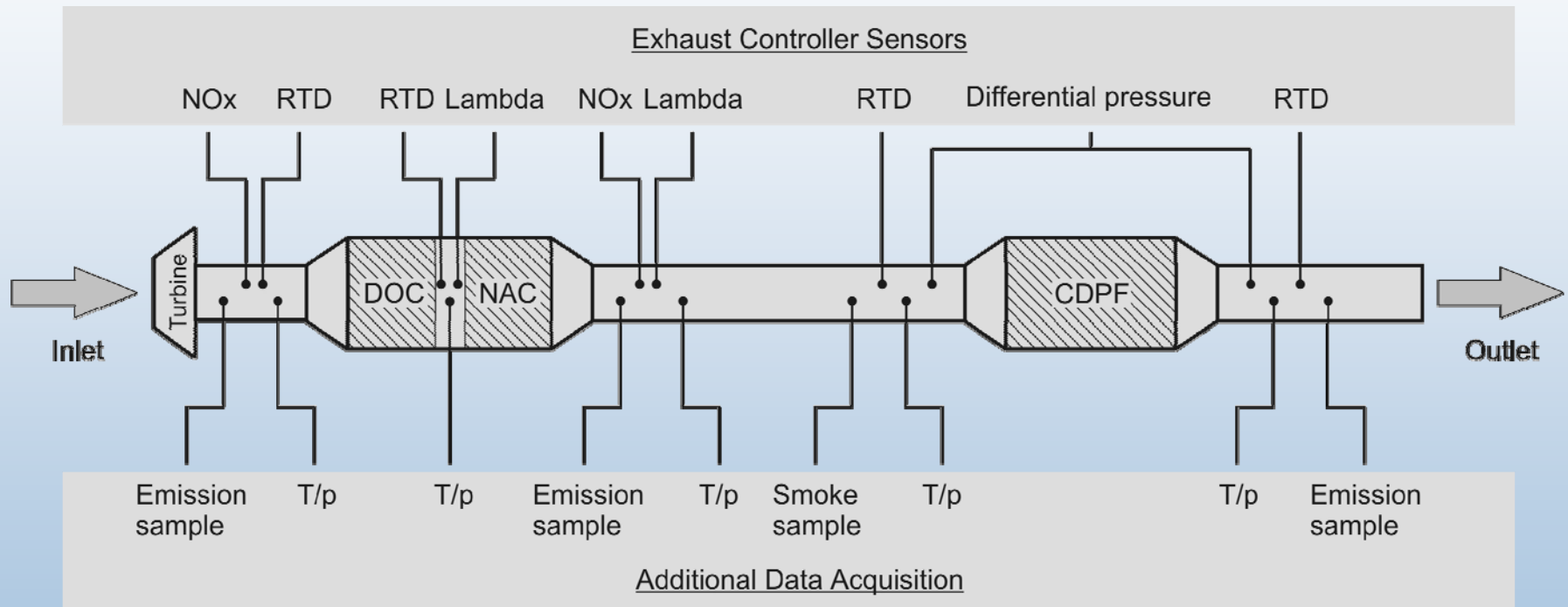
Overview

- ❑ Project Goals
- ❑ Hardware Overview
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- ❑ Fuel Specifications
- ❑ Test Results
 - ❑ NOx Adsorber System
 - ❑ DPF Regeneration
 - ❑ Lean-Rich Modulation
 - ❑ Vehicle Emission Test Results
- ❑ Summary and Conclusions

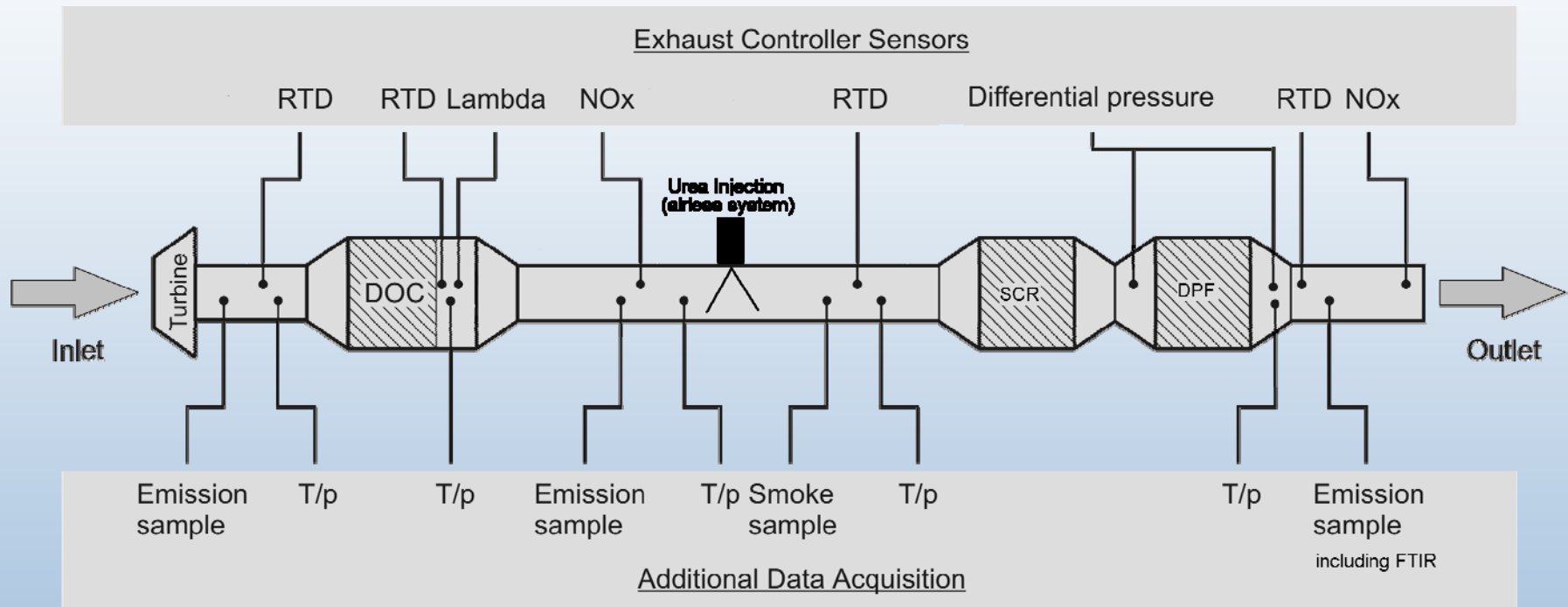
Project Goals

- ❑ Evaluate the impact of Biodiesel fuel blends on the performance of advanced emission control systems for light-duty diesels e.g. conversion efficiencies, regeneration effects (NAC/DPF and SCR/DPF)
- ❑ Understand effects over time (system aging)
- ❑ Assess engine and fuel system operation impacts at end of project (i.e. combustion chamber, fuel injection system, fuel pump)

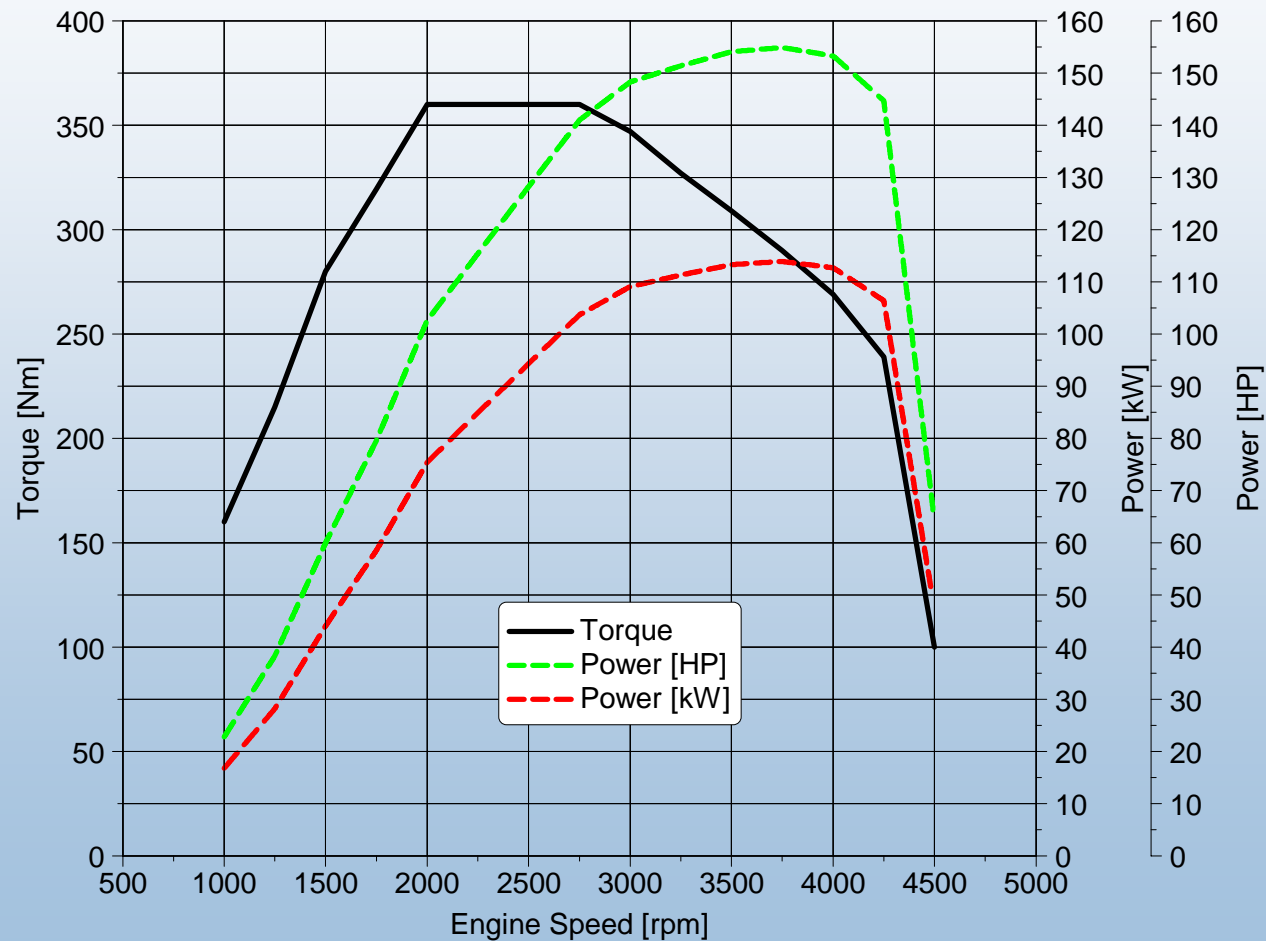
Hardware Overview – NOx Adsorber System



Hardware Overview – SCR System

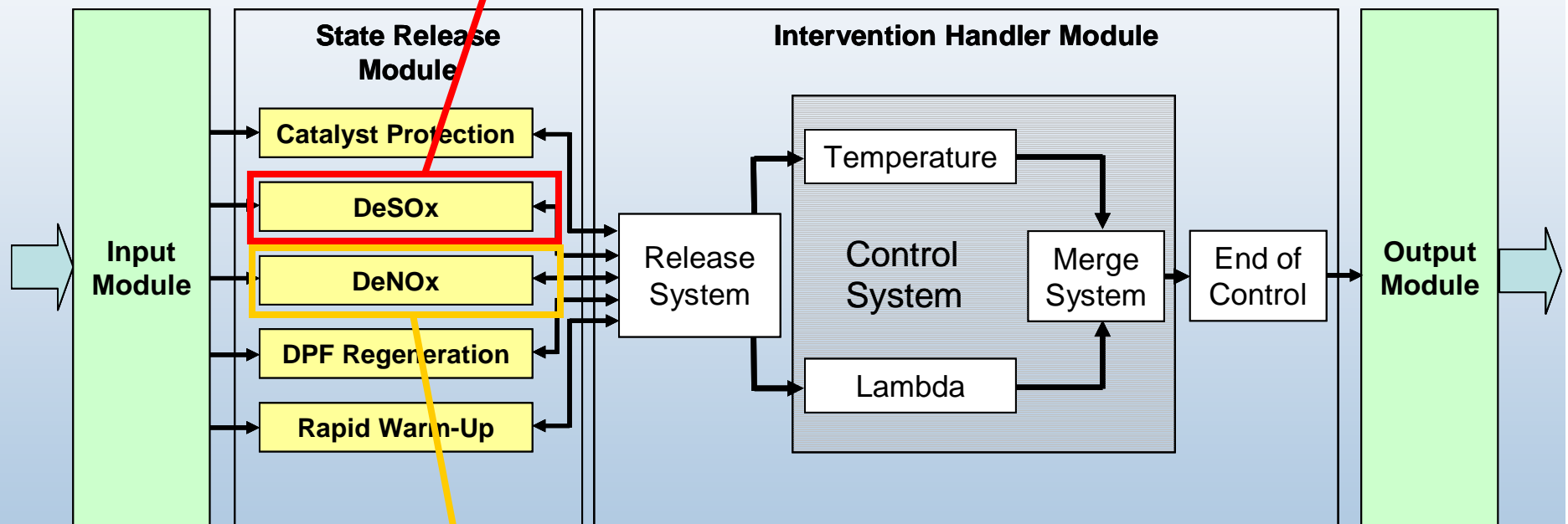


Hardware Overview – Test Engine Hardware



Control System Overview

Only used with the NOx adsorber system

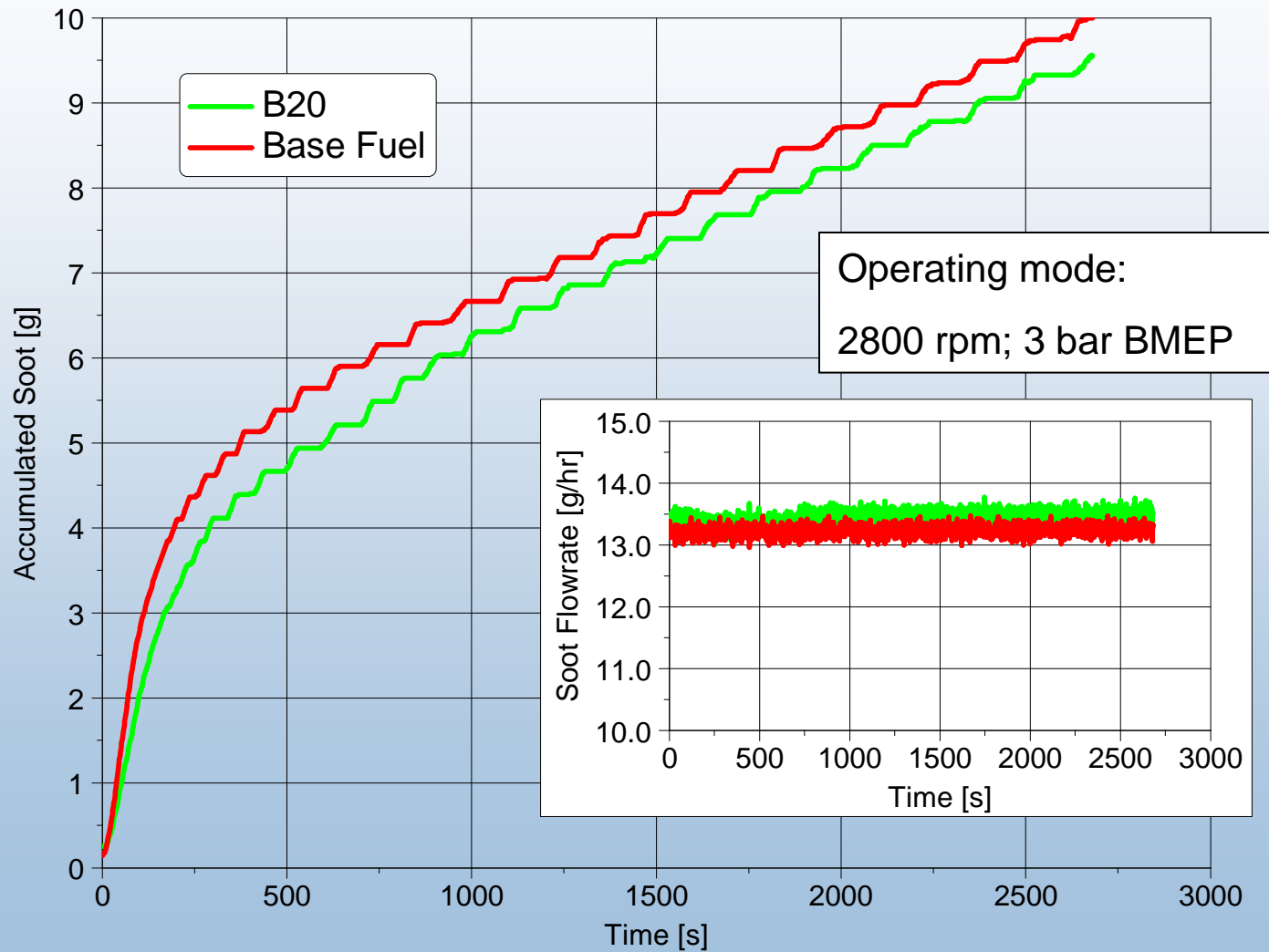


NOx adsorber: Lean-rich modulation release
SCR: Urea dosing

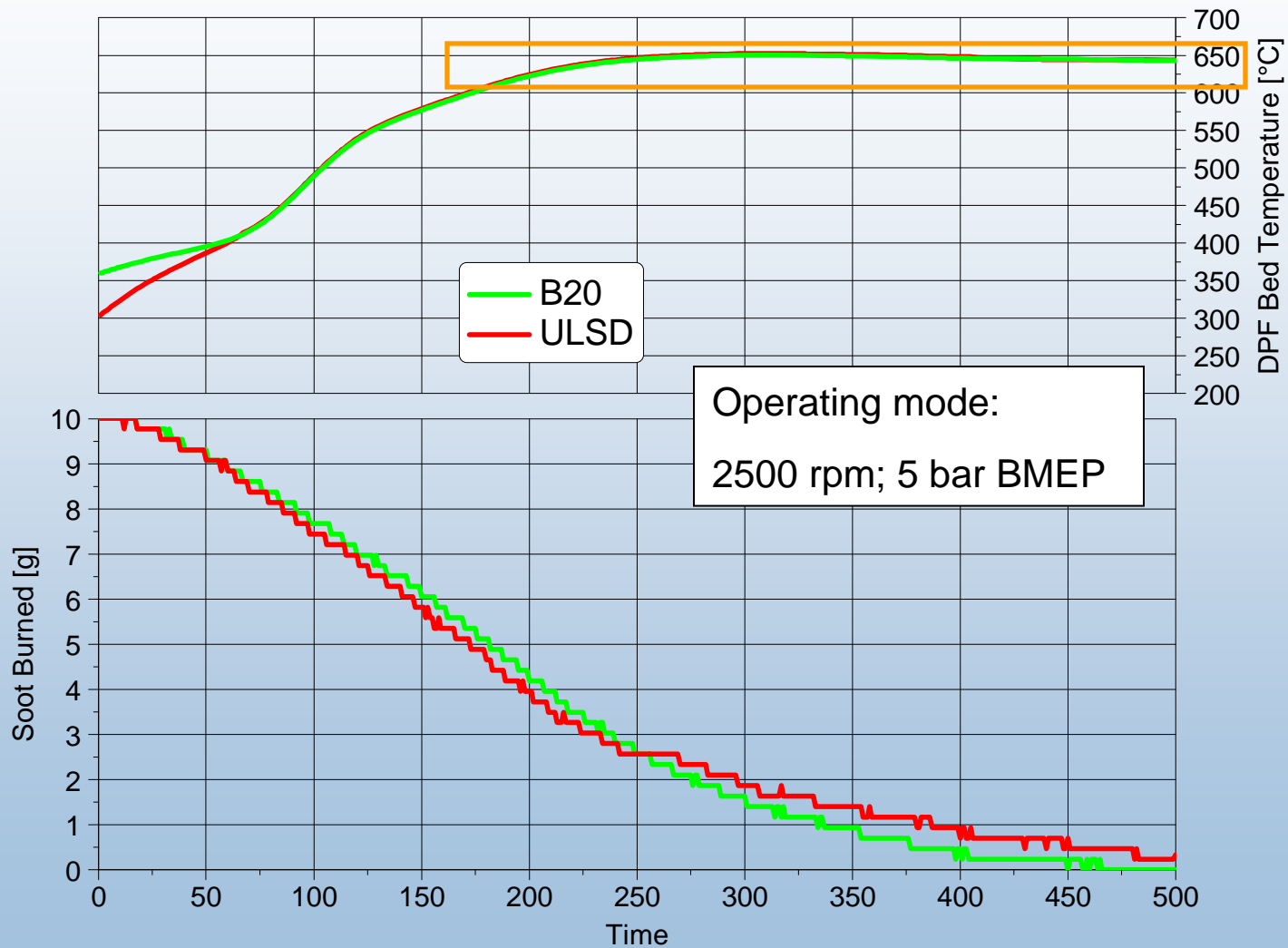
Fuel Comparison

	ULSD Base Fuel	B20
Density (kg/dm ³)	0.846	0.853
Cetane Number	42.0	43.2
Carbon (wt%)	87.08	85.04
Oxygen (wt%)	0.00	2.37
Hydrogen (wt%)	12.92	12.59
Kinematic Viscosity at 40°C [mm ² /sec]	2.28	2.74

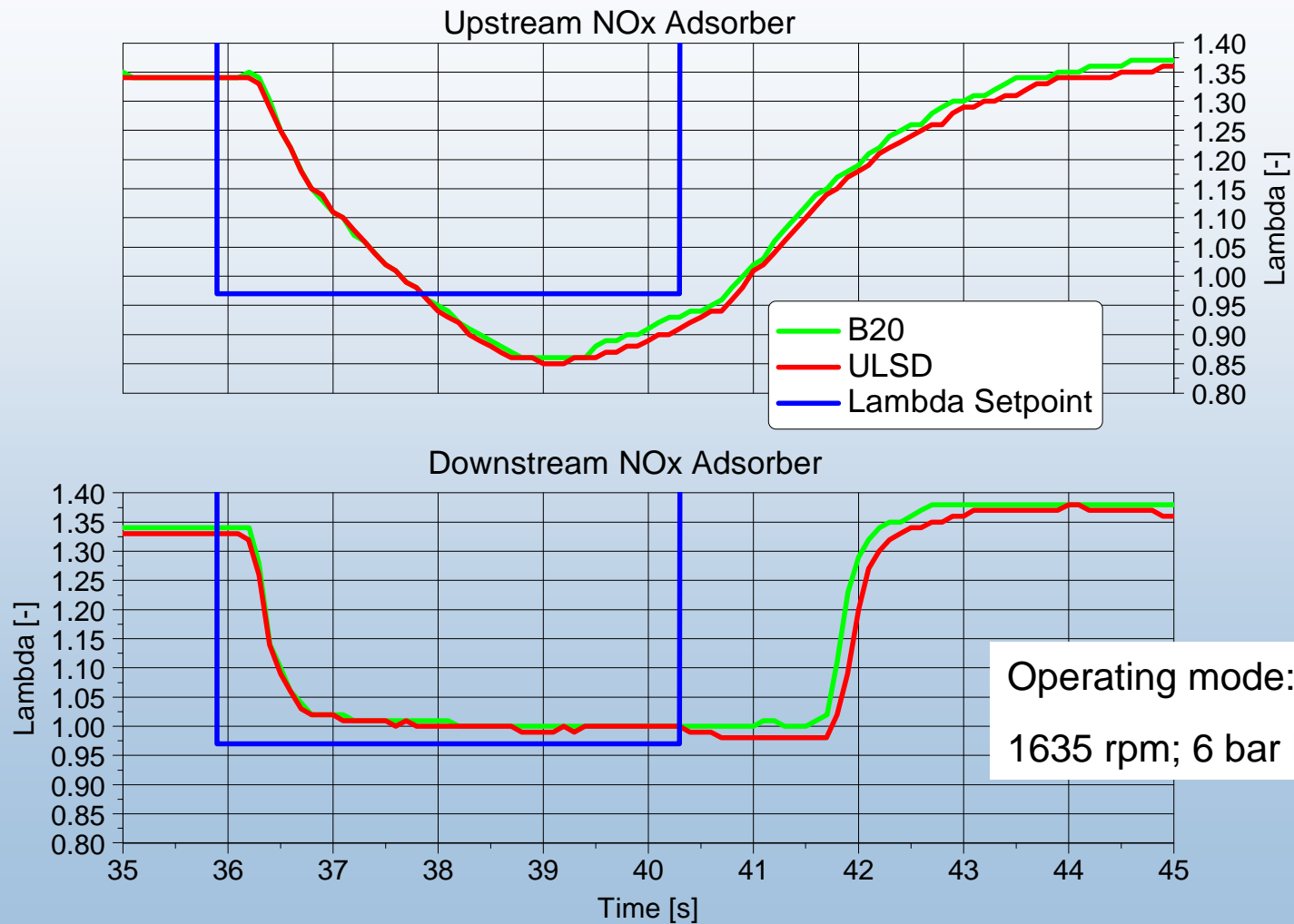
Test Results – DPF Operation and Regeneration



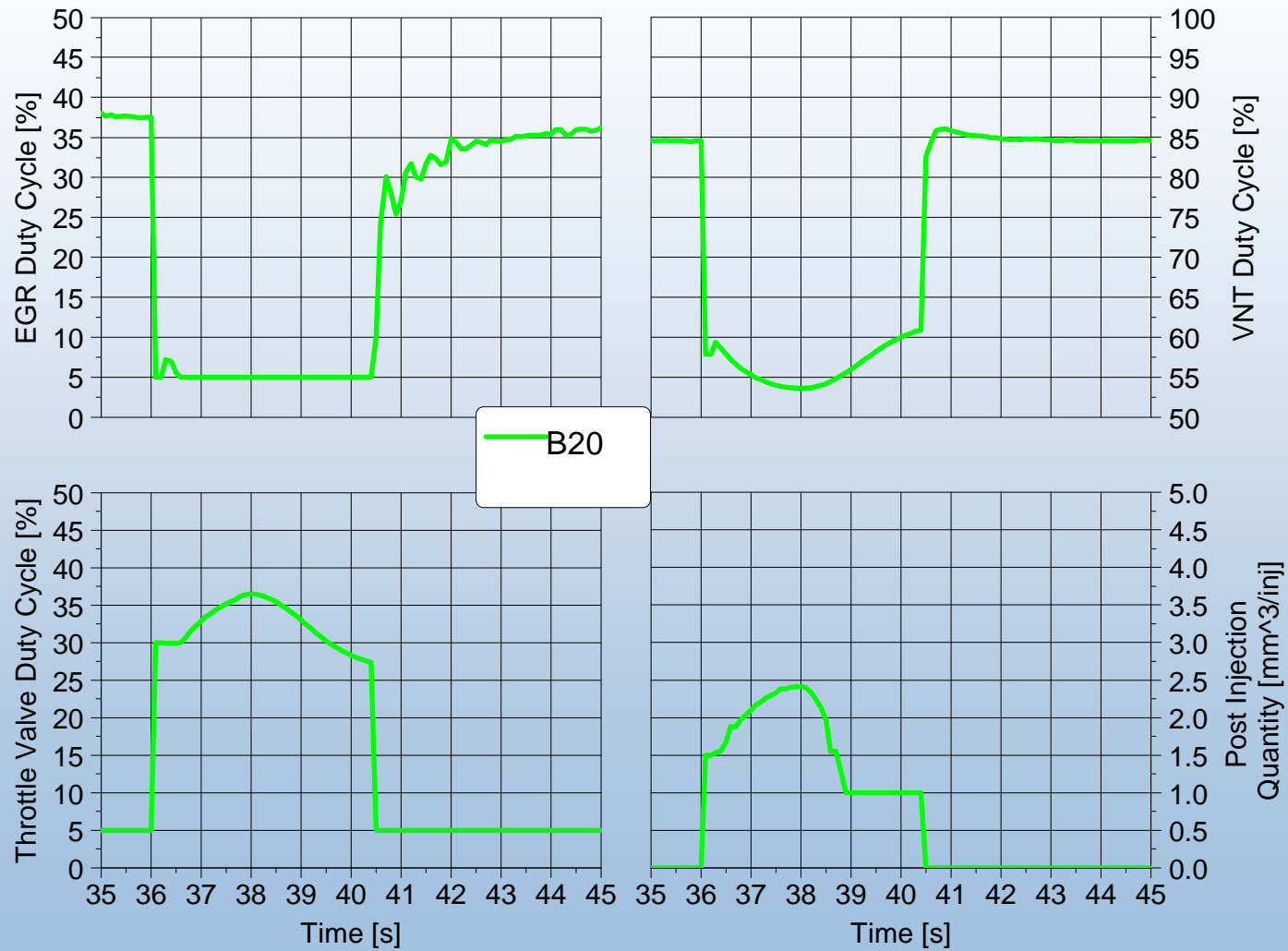
Test Results – DPF Operation and Regeneration



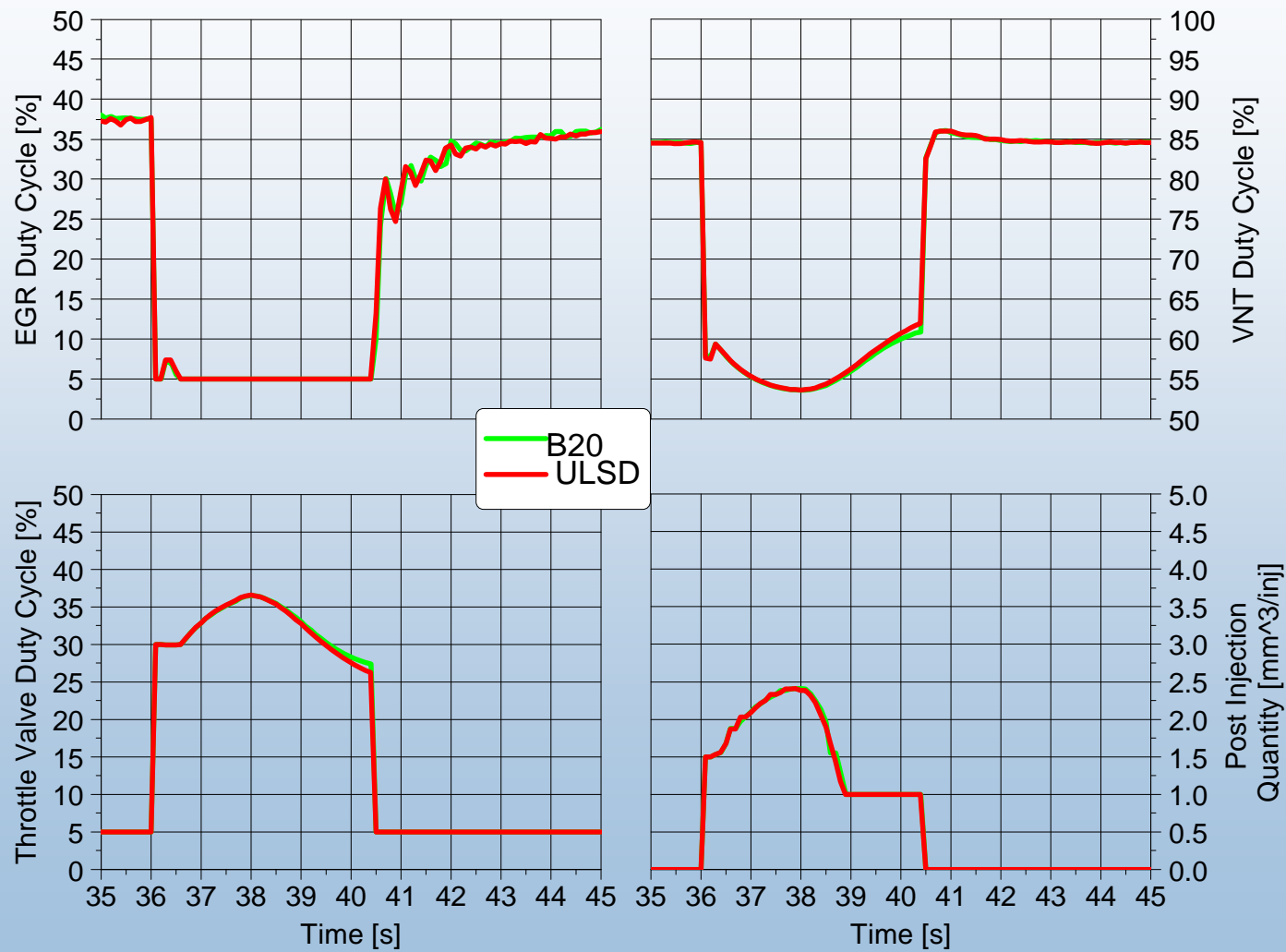
Test Results – NOx Adsorber Regeneration



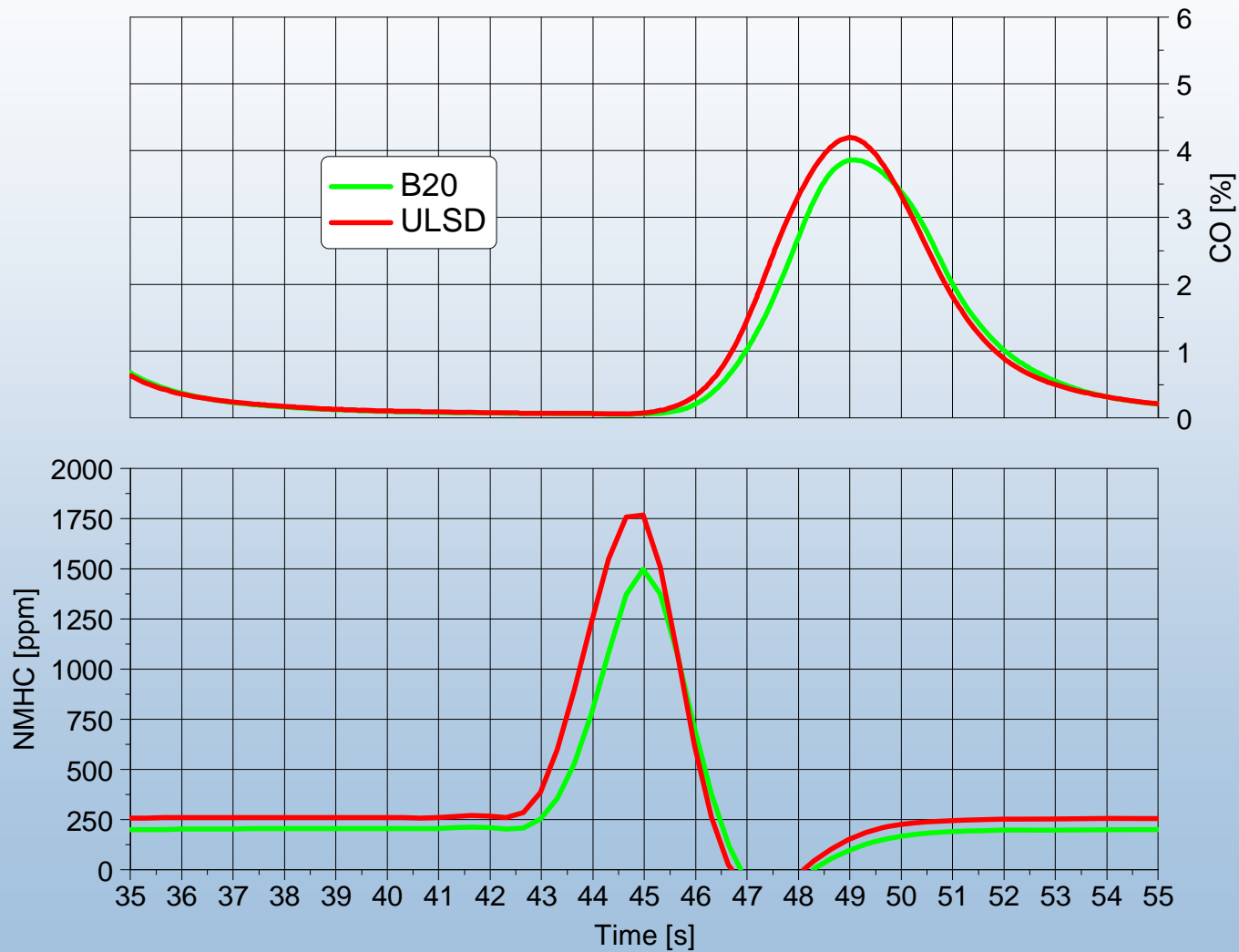
Test Results – NOx Adsorber Regeneration



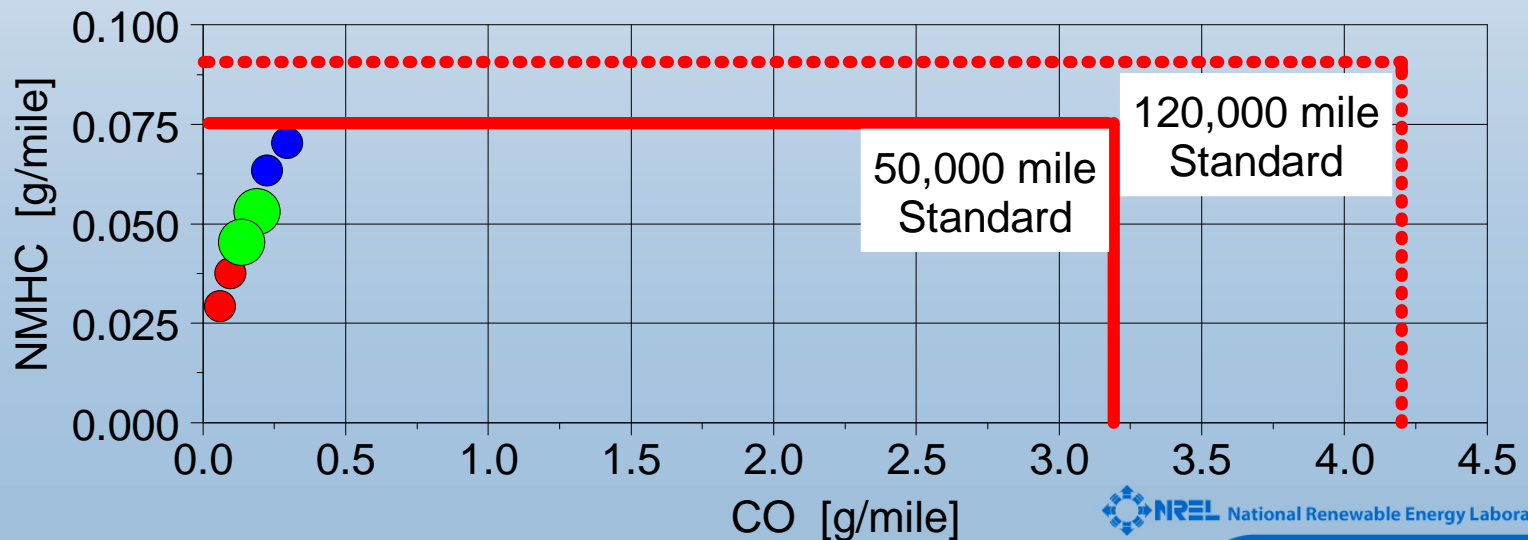
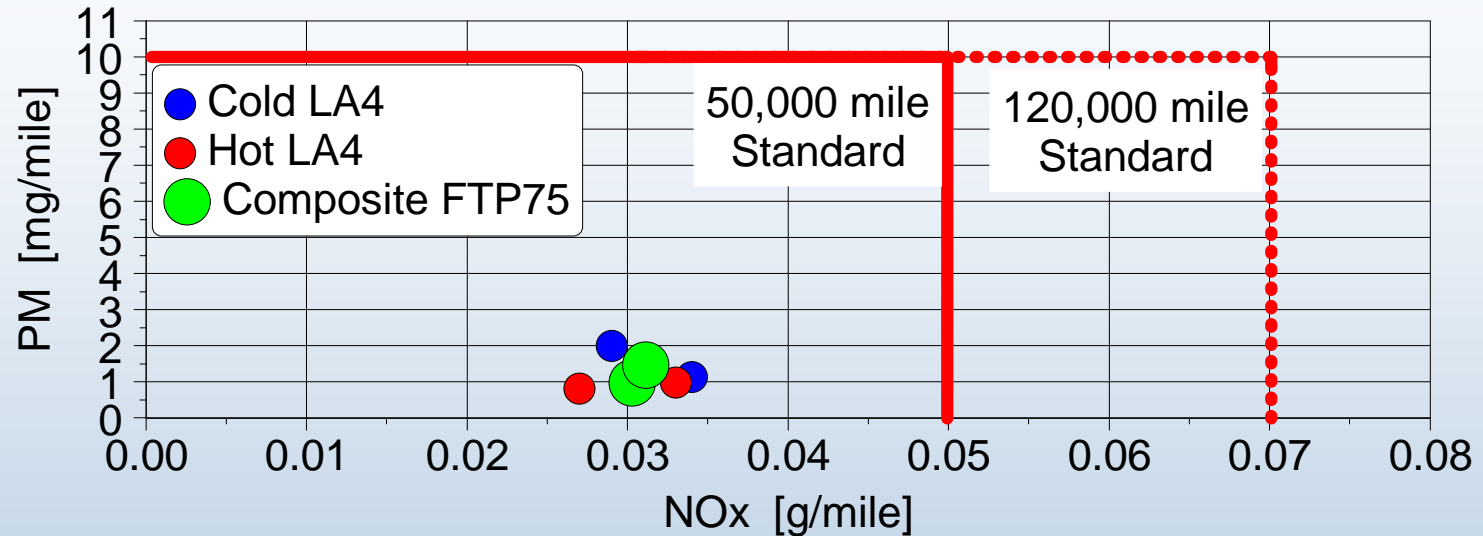
Test Results – NOx Adsorber Regeneration



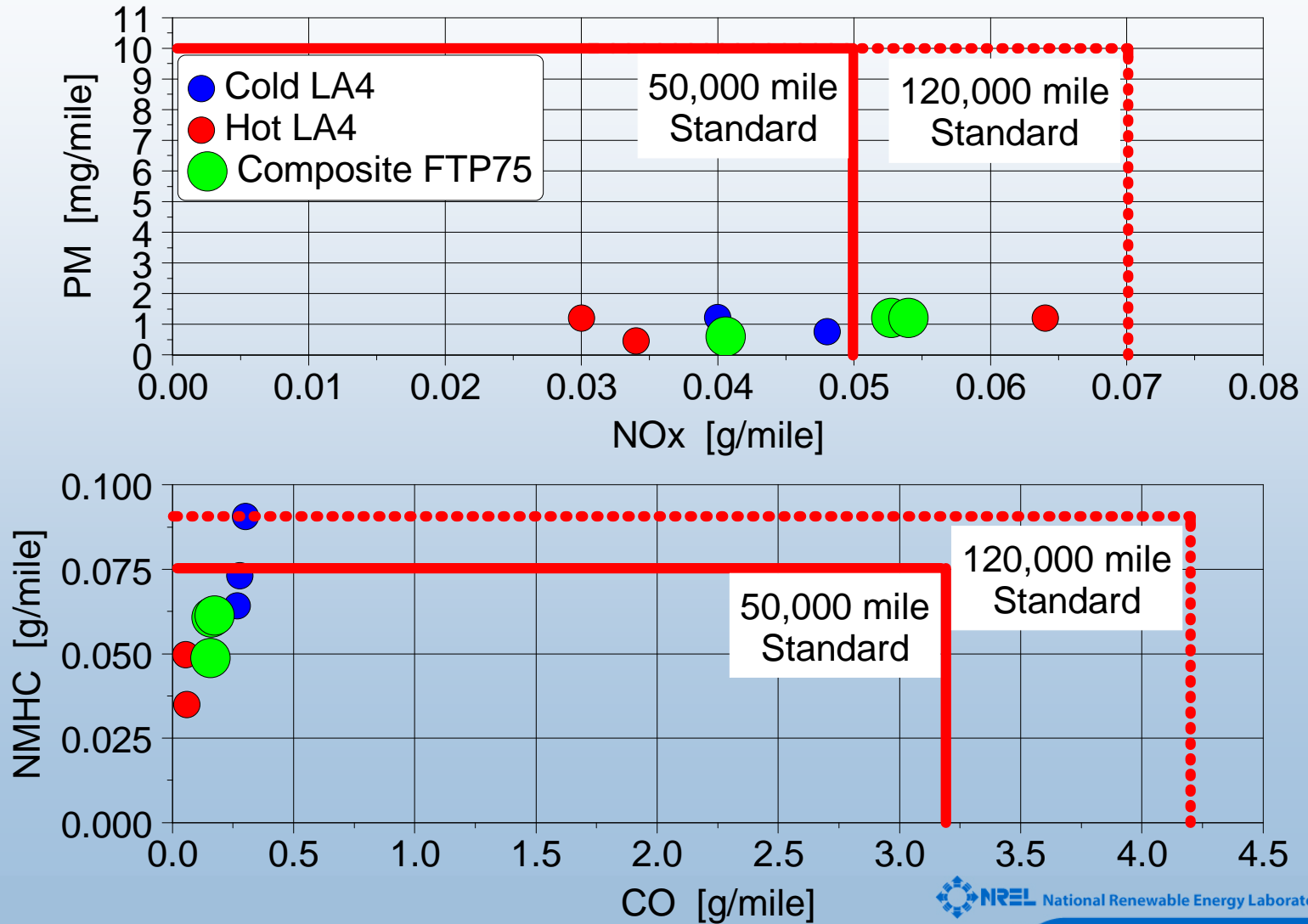
Test Results – NOx Adsorber Regeneration



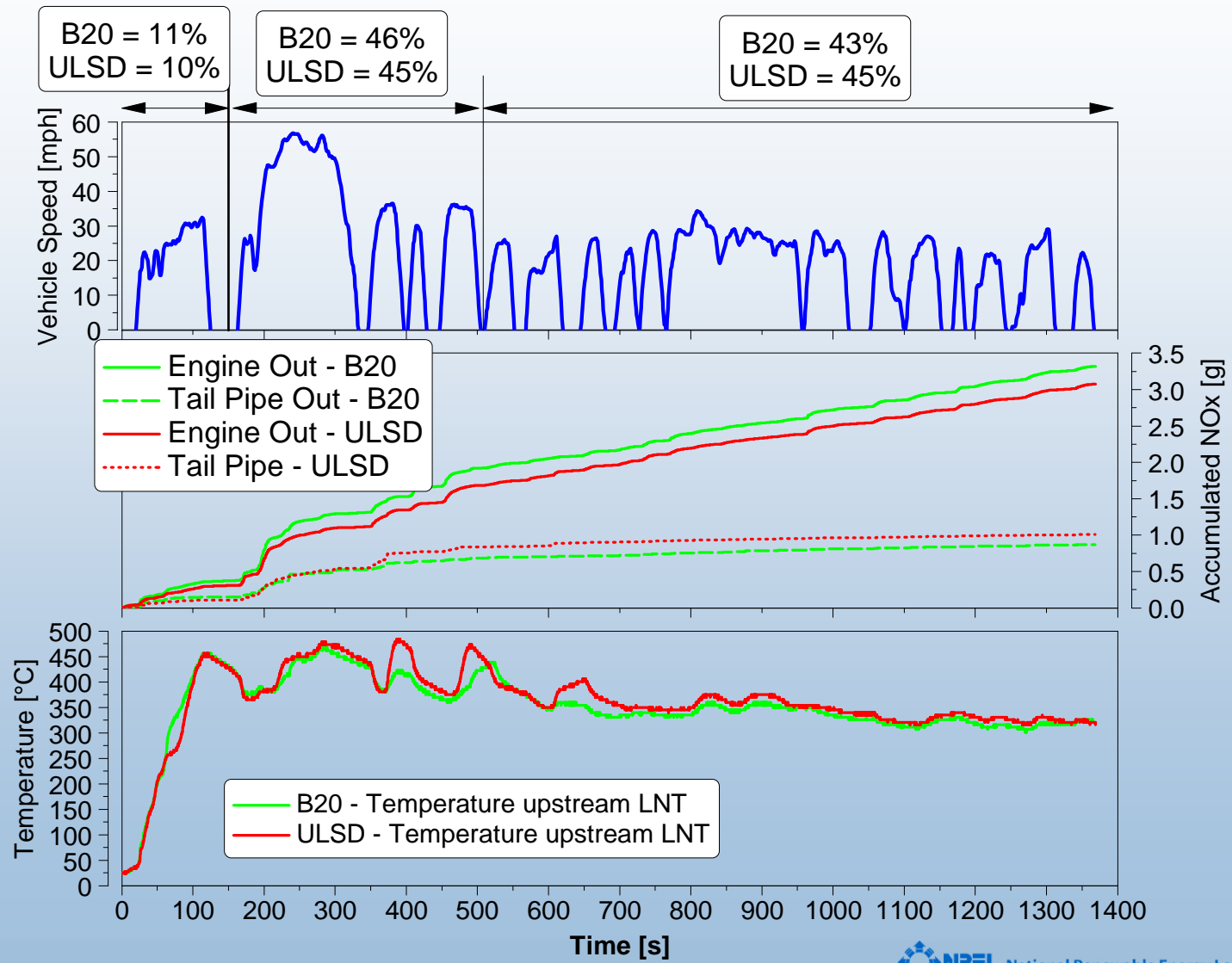
Test Results – EPA Chassis Dynamometer B20 Fuel



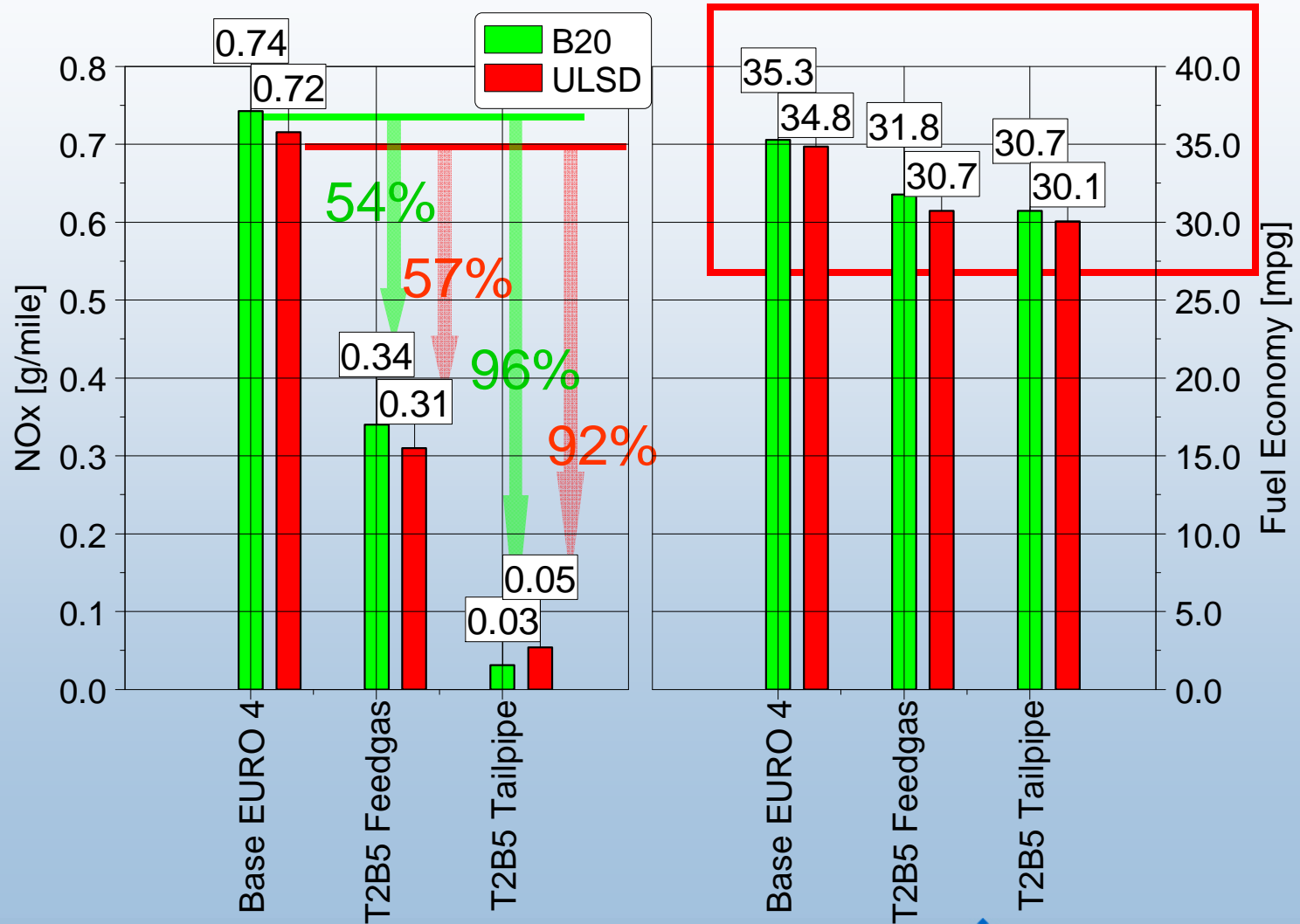
Test Results – EPA Chassis Dynamometer ULSD



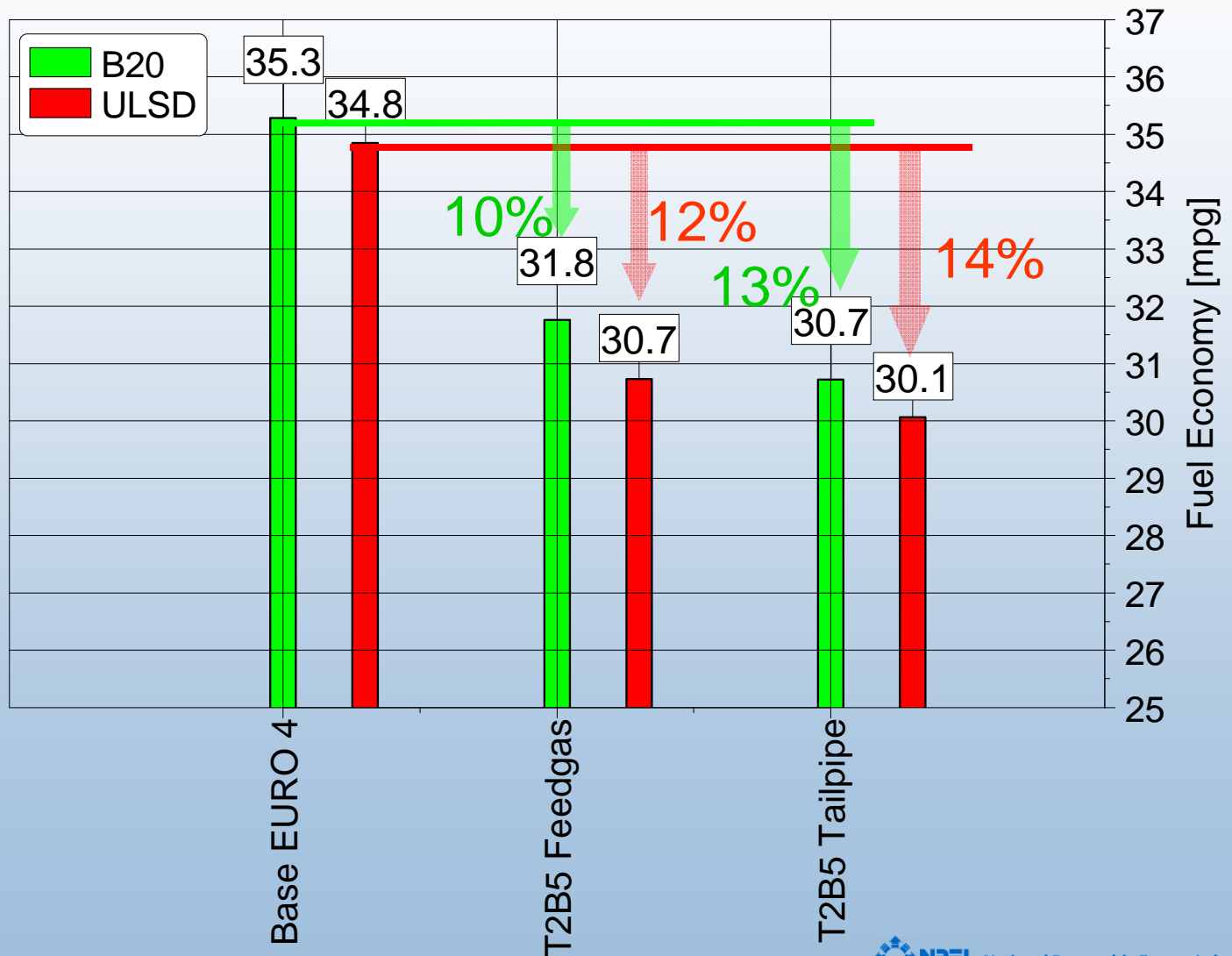
Test Results – EPA Chassis Dynamometer



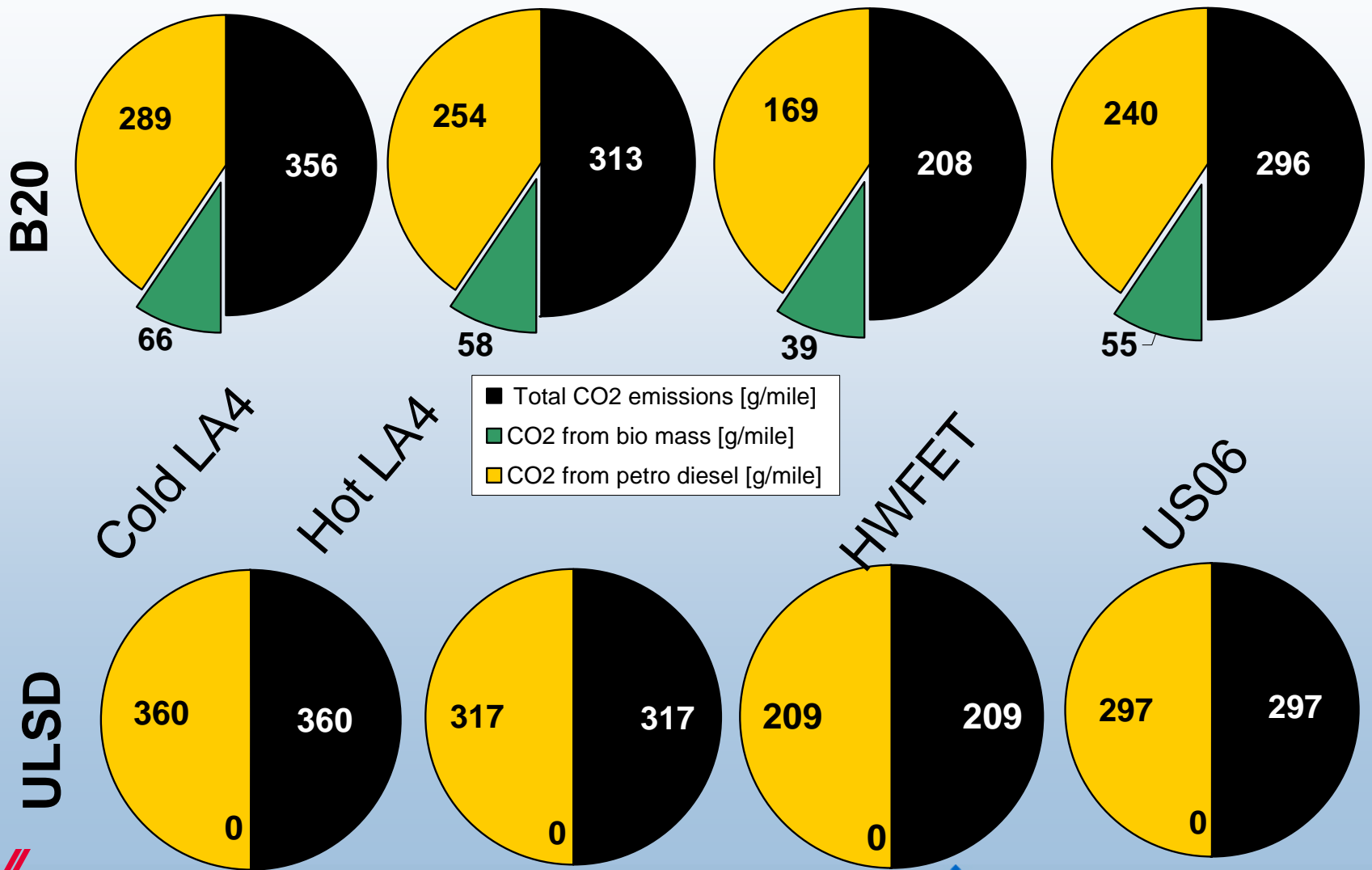
Test Results – EPA Chassis Dynamometer



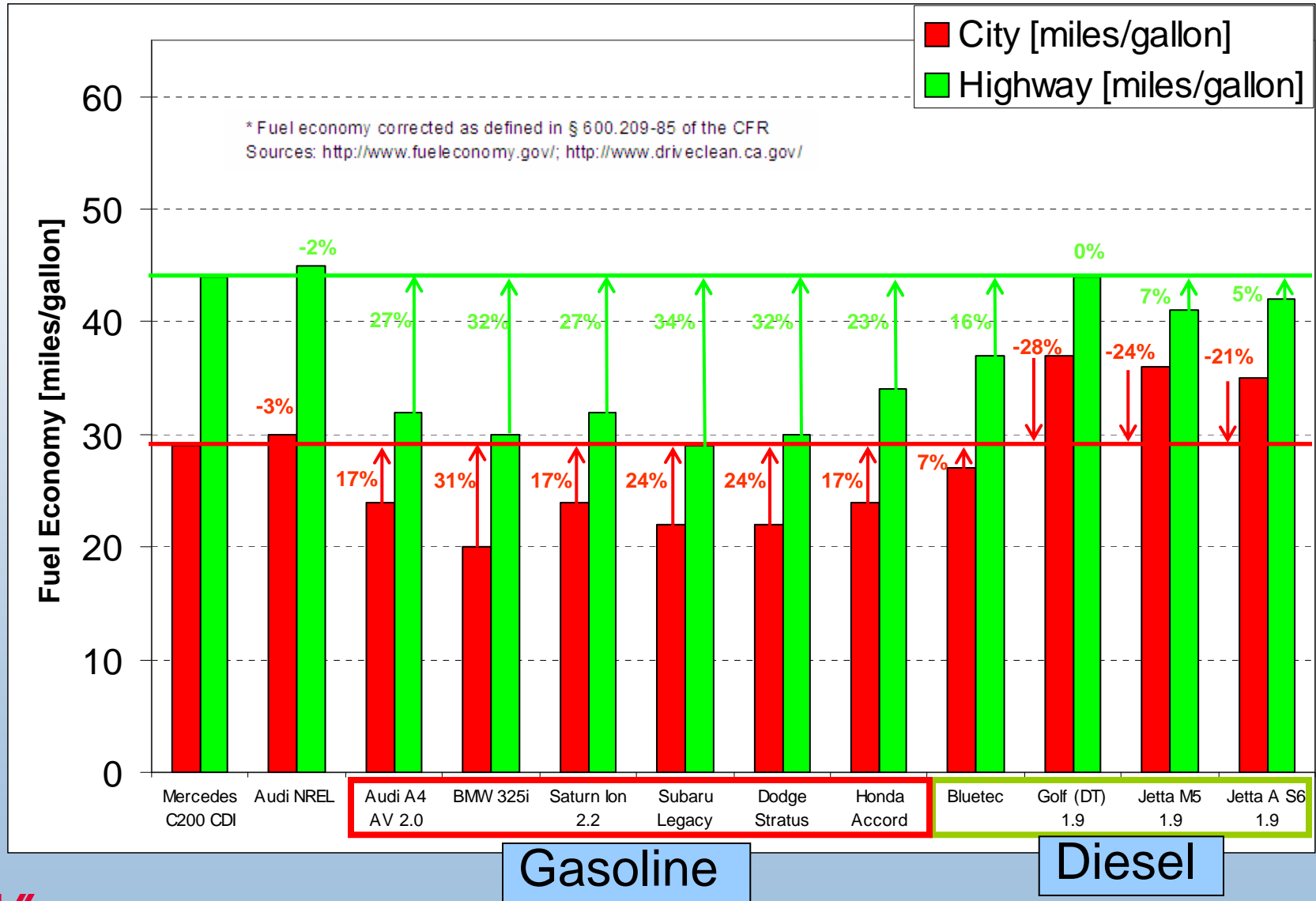
Test Results – EPA Chassis Dynamometer



Test Results – CO₂ Contribution



Test Results – Fuel Economy Comparison



Summary and Conclusions

- ❑ Vehicle as well as test cell results indicate an increase in NOx and decrease in PM using Biodiesel blends – the greater the Biodiesel portion the more pronounced is this effect. This effect does not translate into greater tailpipe emissions with the NOx adsorber aftertreatment system.
- ❑ In the investigated configuration the DPF loading and regeneration performance did not change using Biodiesel fuel.
- ❑ NOx adsorber regeneration control remains the same comparing petroleum based and Biodiesel blended fuel.
- ❑ Fuel economy impact using Biodiesel fuel is marginal using an integrated Tier 2 Bin 5 system.
- ❑ Durability investigations focusing on Biodiesel effects on engine and aftertreatment system are currently underway.
- ❑ SCR system development and improvement currently underway.

Acknowledgments

DOE Office of FreedomCAR and Vehicle Technologies, Advance Petroleum Based and Non-Petroleum Based Fuels Activities: Stephen Goguen, Kevin Stork, and Dennis Smith, Technology Managers

National Biodiesel Board: Steve Howell

MECA: Joe Kubsh and Rasto Brezny

EPA: Charles Schenk

