Technical Challenges and Opportunities

Light-Duty Diesel Engines in North America

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Chicago

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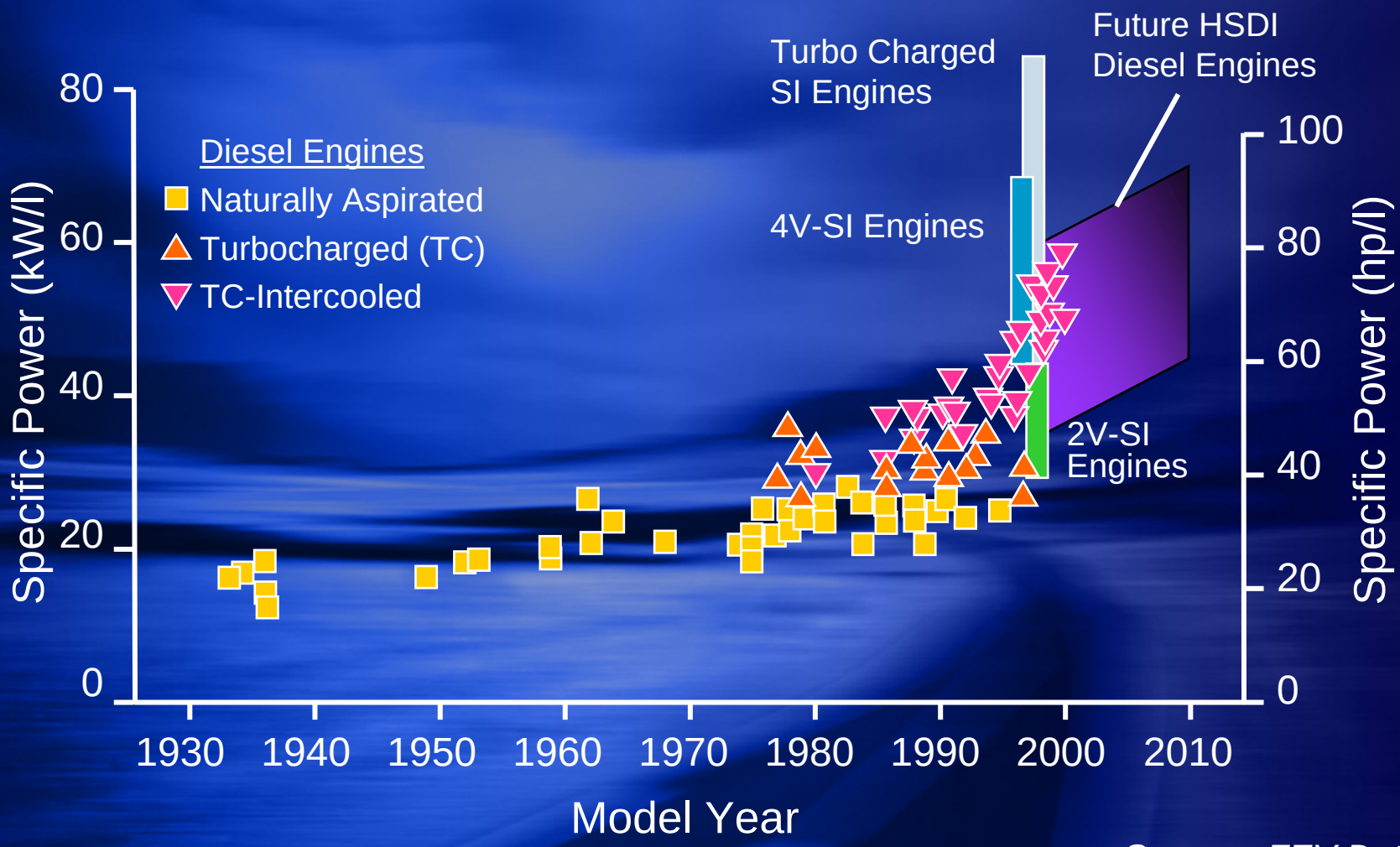
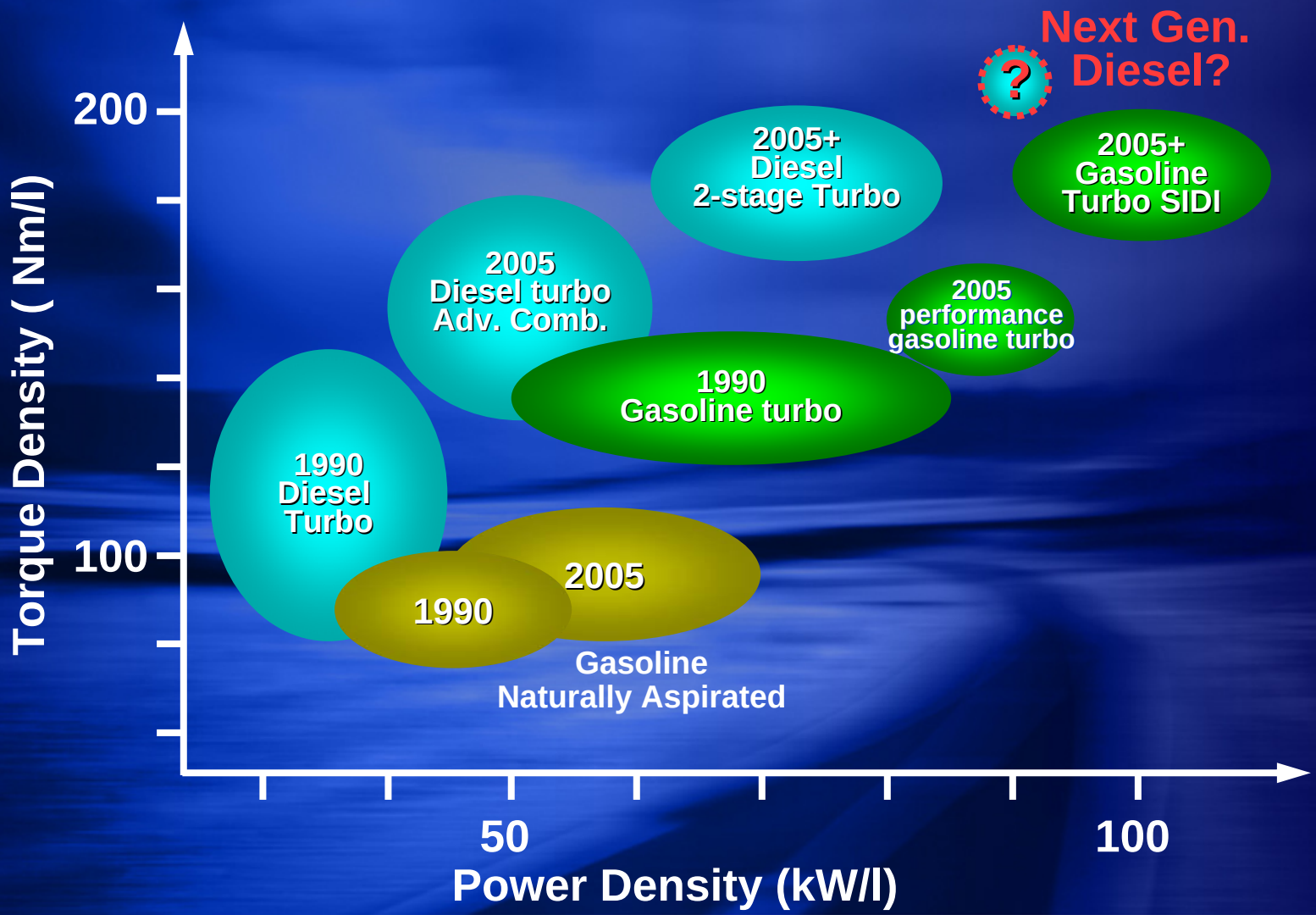
Benchmark Power Density Trends

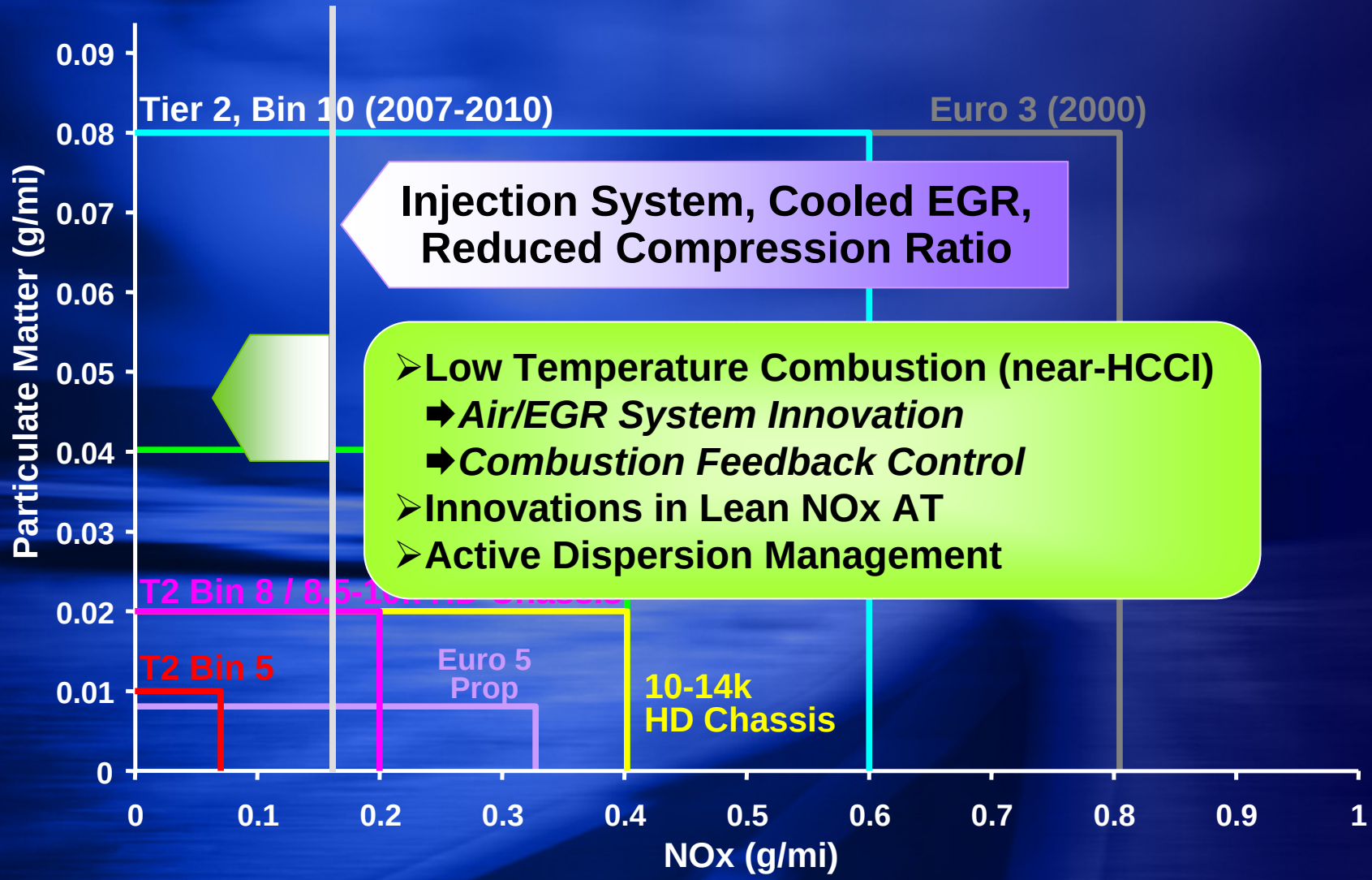


Source: FEV Data

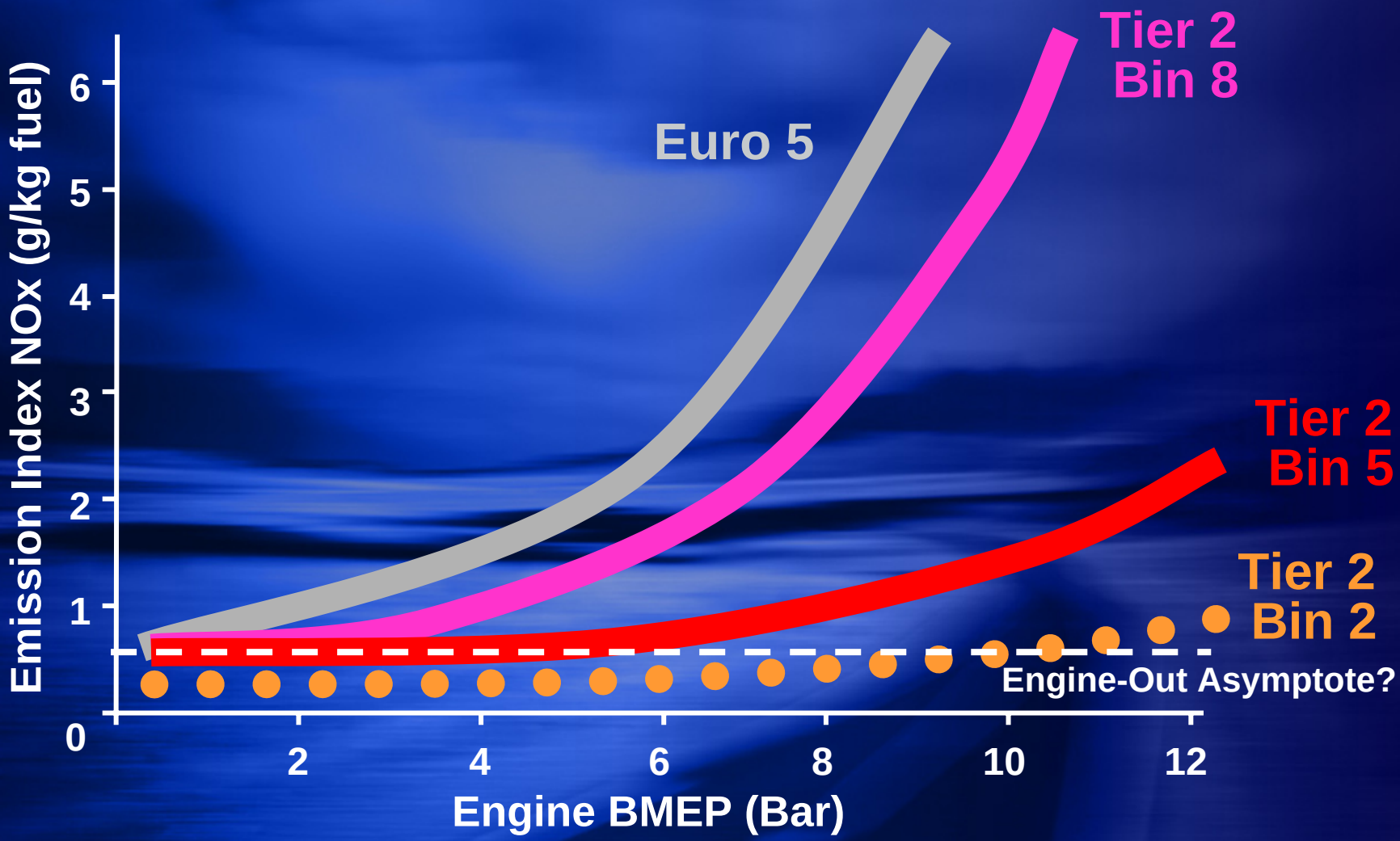
Evolution of Specific Torque



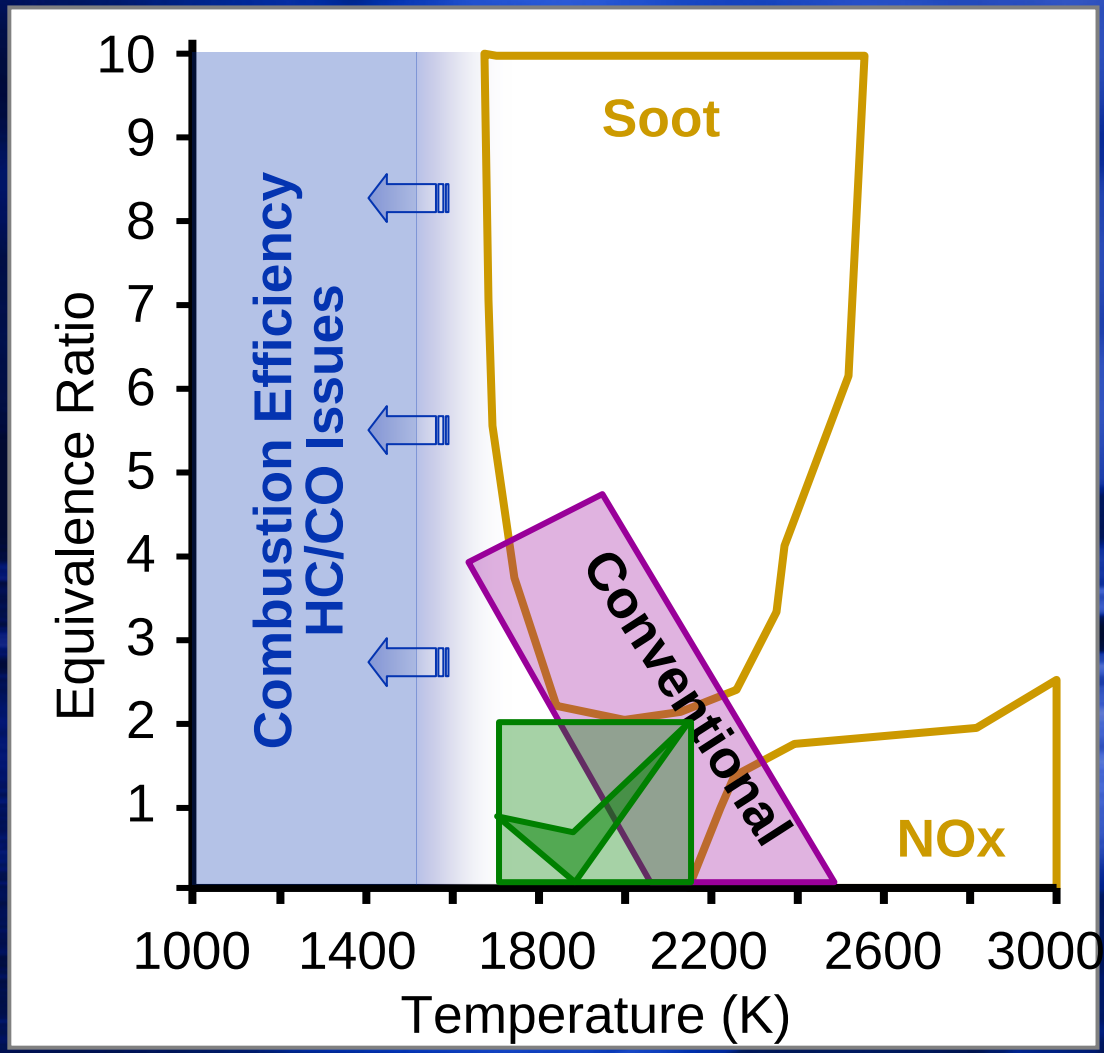
Emission Evolution



NOx – Load Requirements



Clean Combustion with Diesel



Conventional Combustion

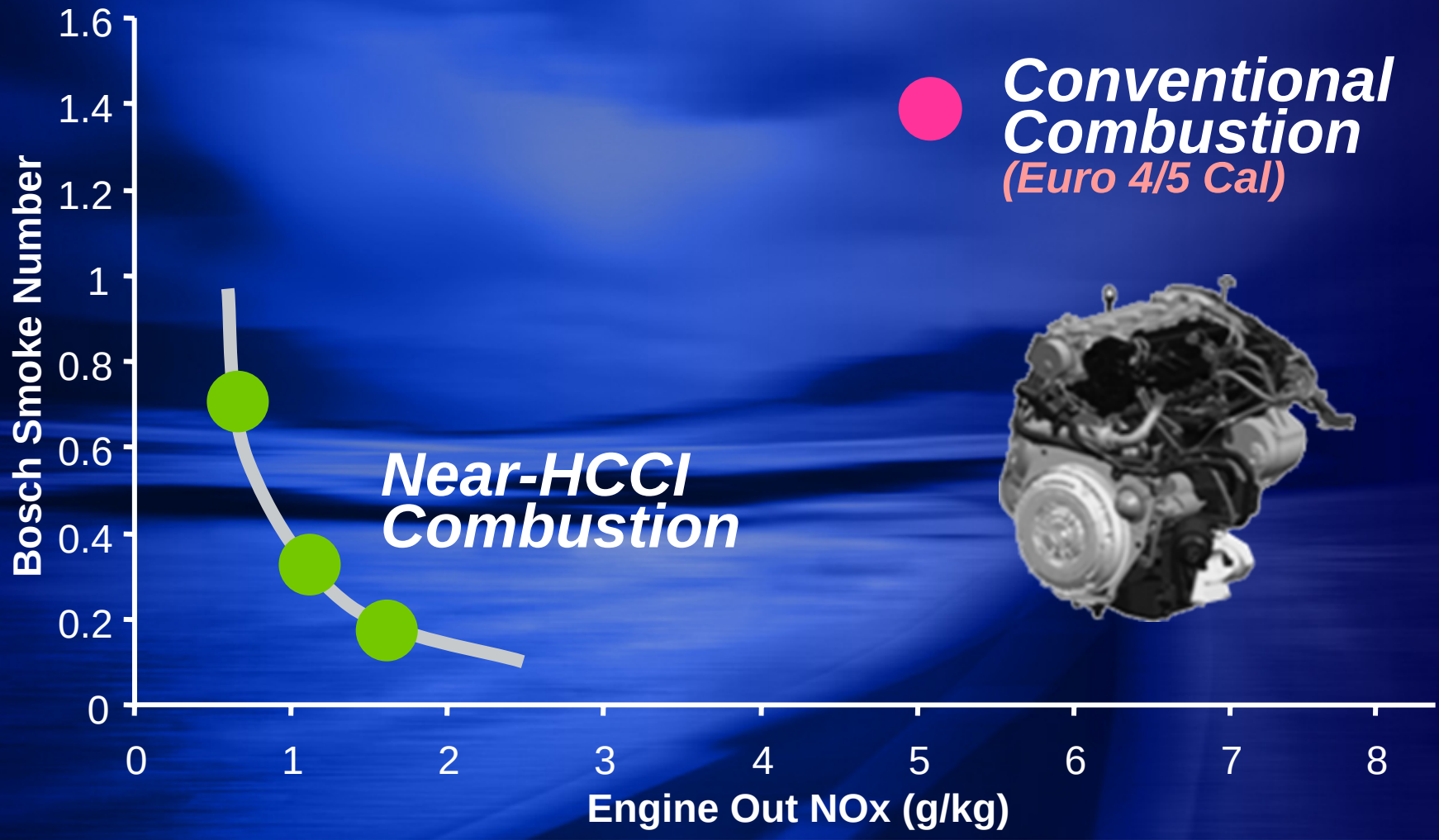
Fuel rich combustion leads to NOx and PM formation.

Near-HCCI Combustion

Tight control on charge temperature and mixture formation is required

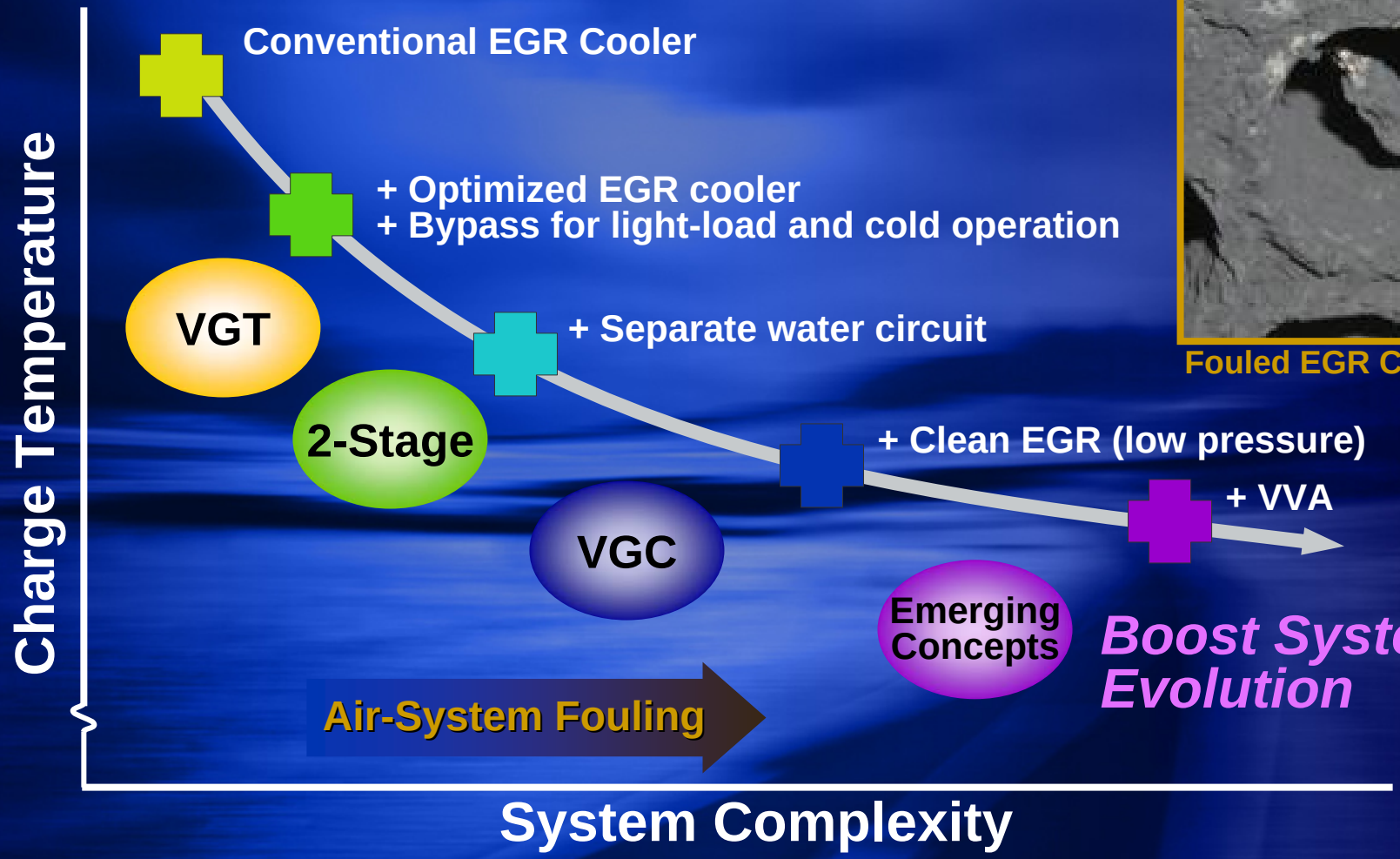
Near-HCCI Potential for Diesel

Simulated Vehicle Cruise Condition



Towards Wide Range Charge Control

Temperature and composition



Fouled EGR Cooler Tube

The Next Revolution

Regaining control with direct combustion-feedback

- Near-HCCI combustion
  - Ultra-low NOx operation
  - Transients + mode switching
- Adaptive dispersion control
  - Component wear
  - Environmental factors
- Enhanced OBD diagnostics

Lots of development to do!

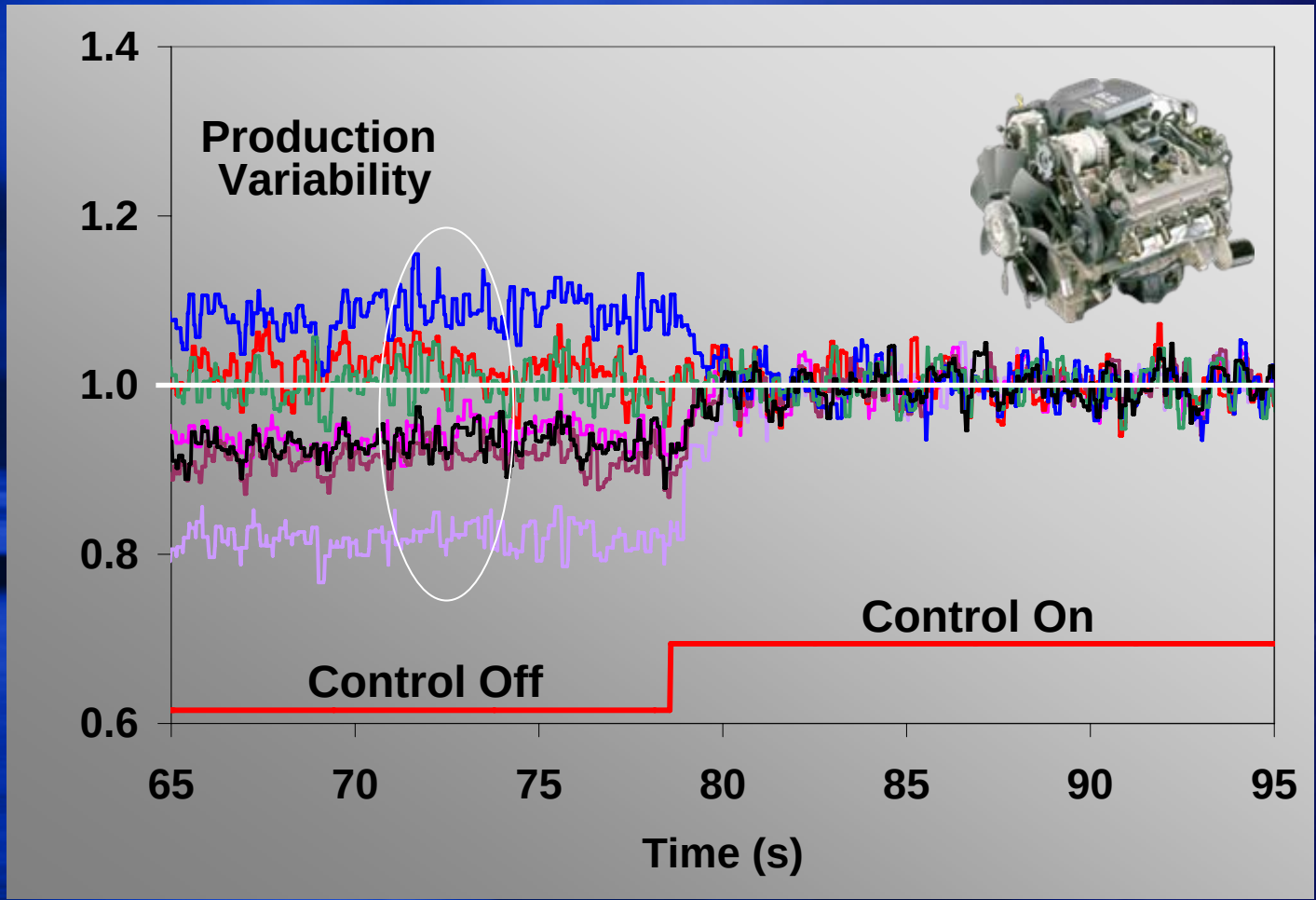
Combustion Feedback

An example of injector dispersion control

Over

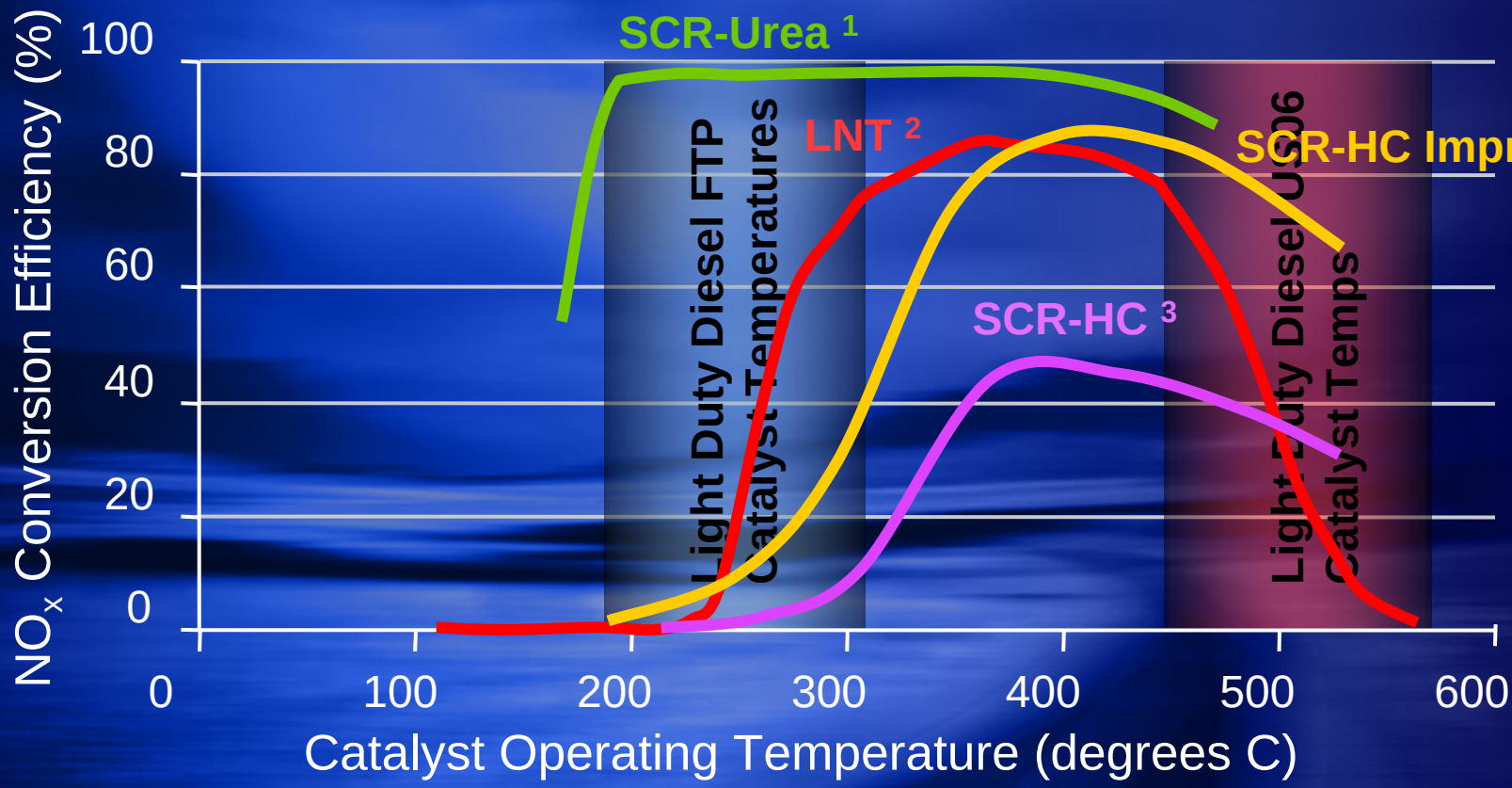
Target Fueling

Under



Lean-NOx Aftertreatment Options

Balancing catalyst activity between the FTP & US06



[1] Aged 120 k mi, transition metal Zeolite
[2] Aged 120 k mi, vehicle measurement
[3] Aged 120 k mi, transition metal Zeolite
[4] Bench Test – Combinatorial & High Throughput Materials Science – DOE Award DE-FC26-05NT42415

Summary

- Technical case for US LD diesels is improving
- Major innovation is underway

What will it take for wide-spread US LD Diesels?

- Continued technical progress
- Market demand
  - Continued energy supply pressure
  - Public experience with new clean diesels

Thank you for your attention

GM R&D Center