

STEPS Workshop

Achieving Targets for 2030

Technology & Fuels for Trucks

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May 12, 2015

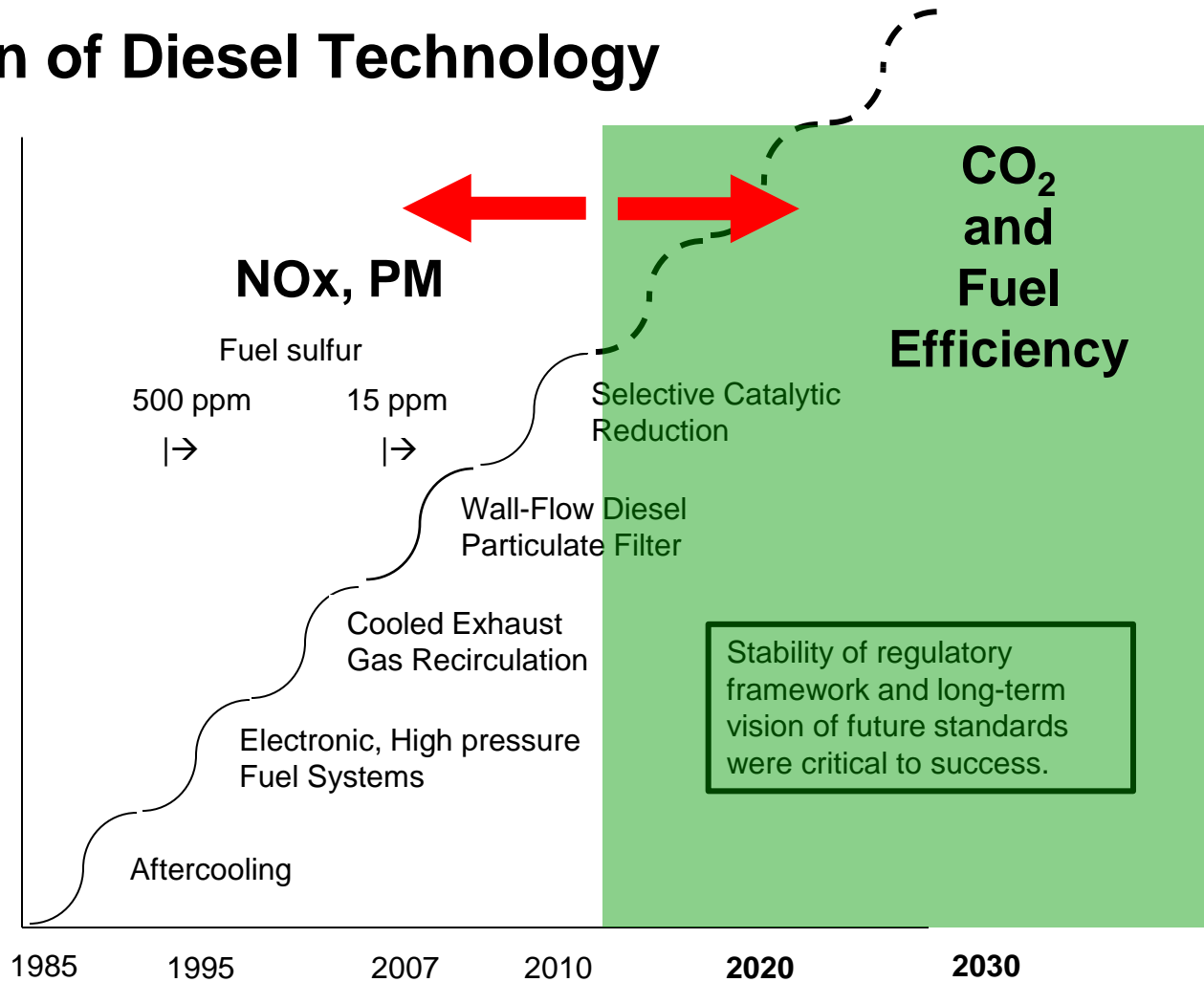


Cummins' Products are Everywhere

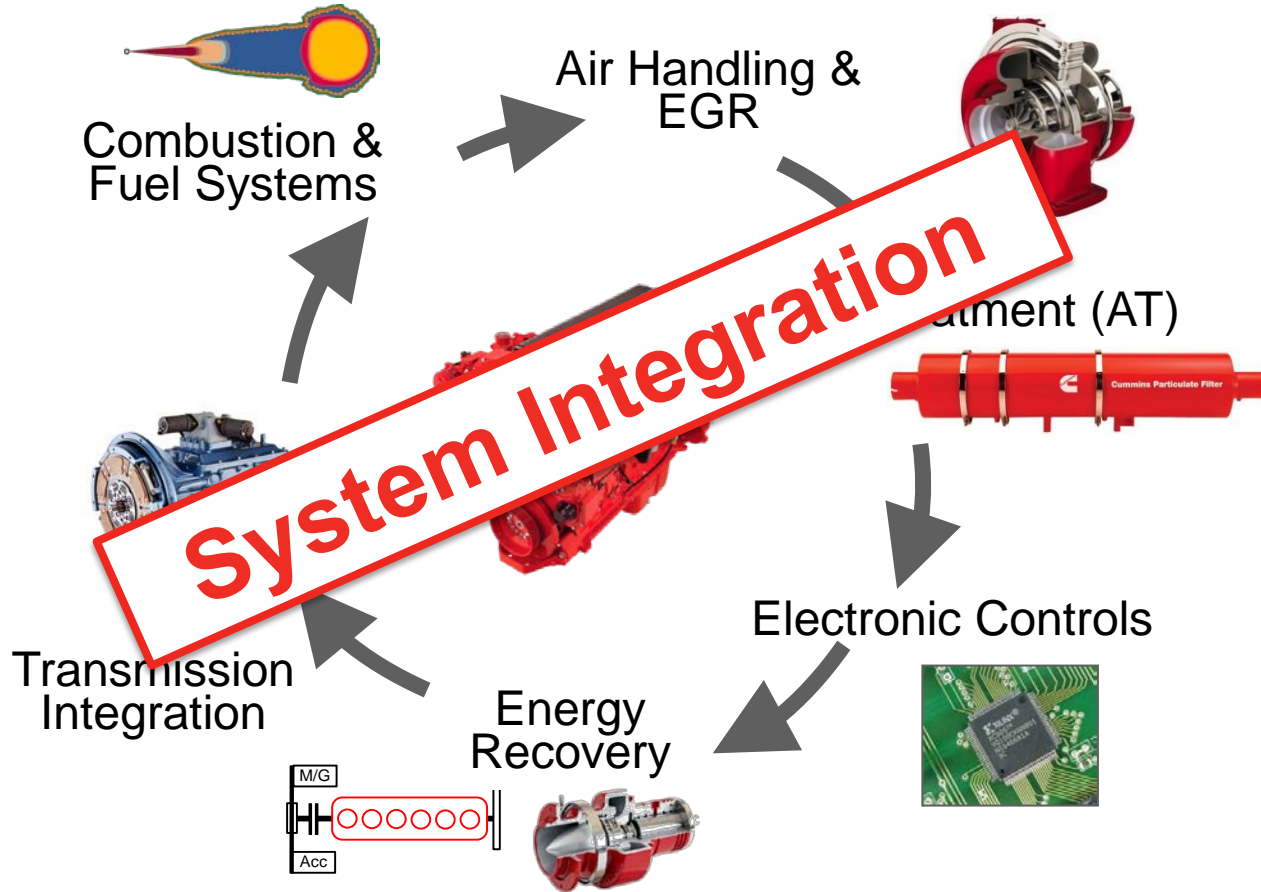
- The world's largest independent manufacturer of diesel engines
- Diesel & natural gas products 2.8 – 95L displacement
- Global manufacturing and support
- Over 1,200 OEM customers
- Powering more types of equipment in more markets than any other engine company



Evolution of Diesel Technology



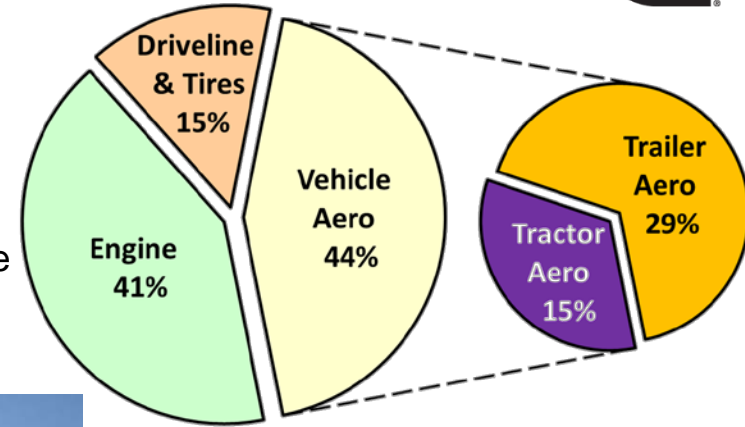
Key Engine and Powertrain Technologies



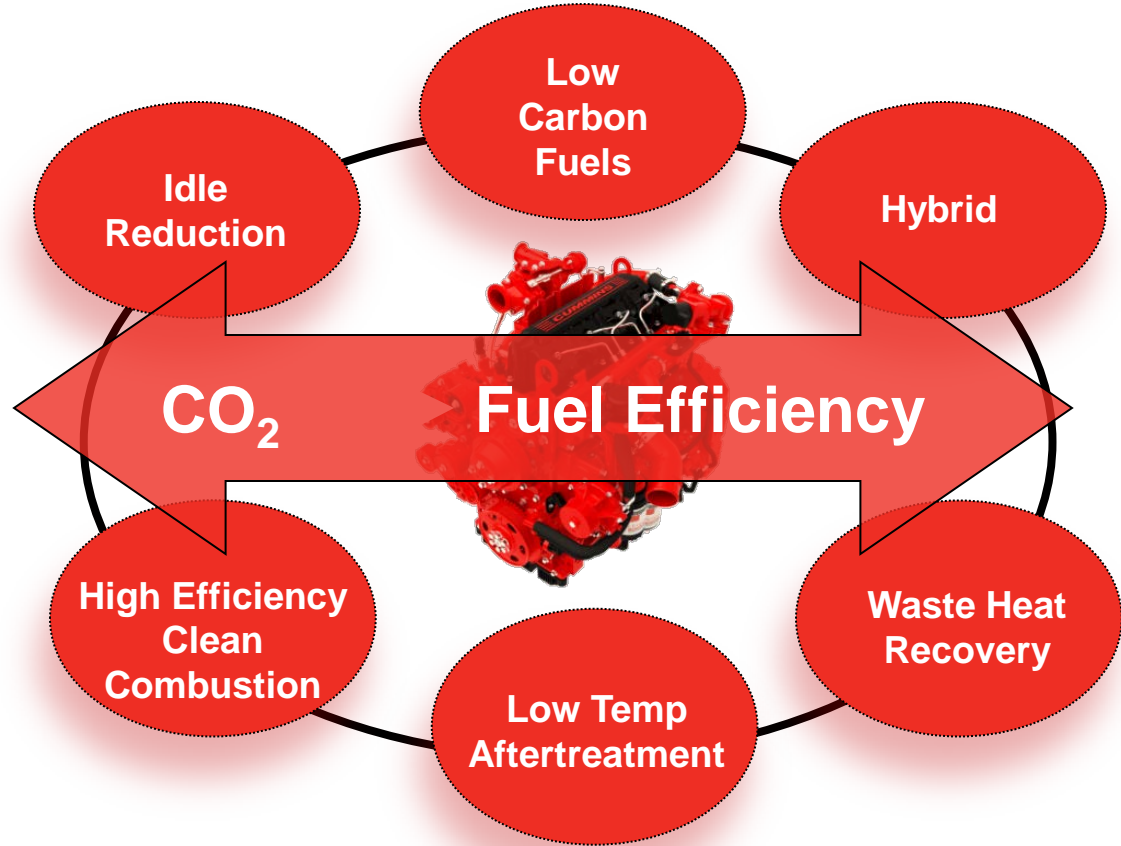
Looking Ahead: Technologies



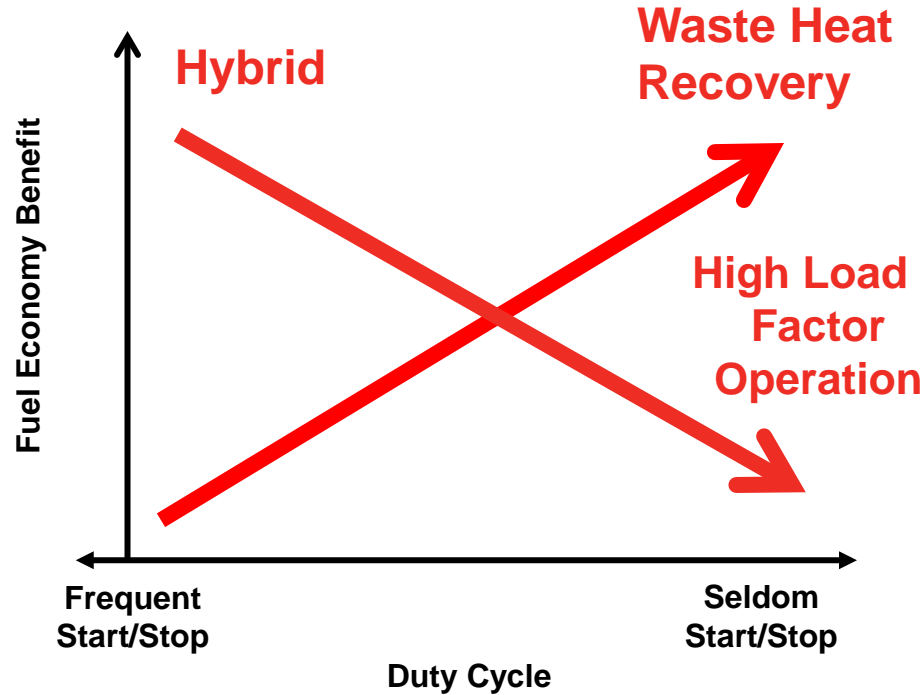
- SuperTruck averaged a 75% improvement in fuel economy over 2009 baseline truck
- Engine is significant contributor
 - GHG Phase 1 HD engine ~10% improved from 2009 baseline
 - Up to 15% CO₂ improvement over 2017 tractor engine standard possible in GHG Phase 2



Reducing CO₂

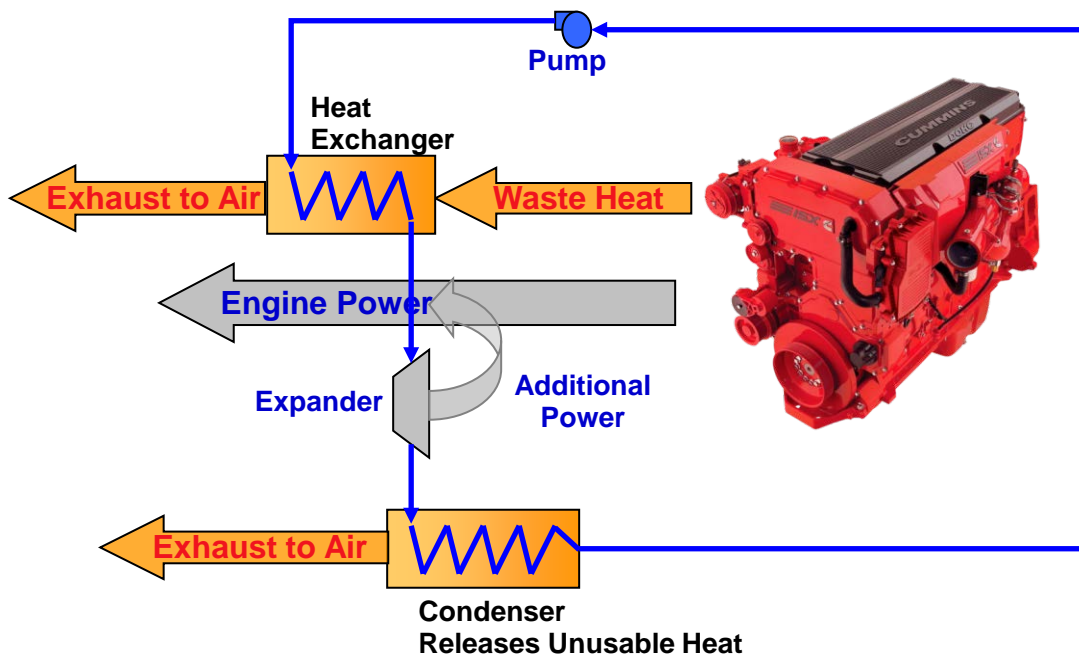


Waste Heat Recovery vs. Hybrid



Waste Heat Recovery Technology

4-5% Fuel Consumption Benefit

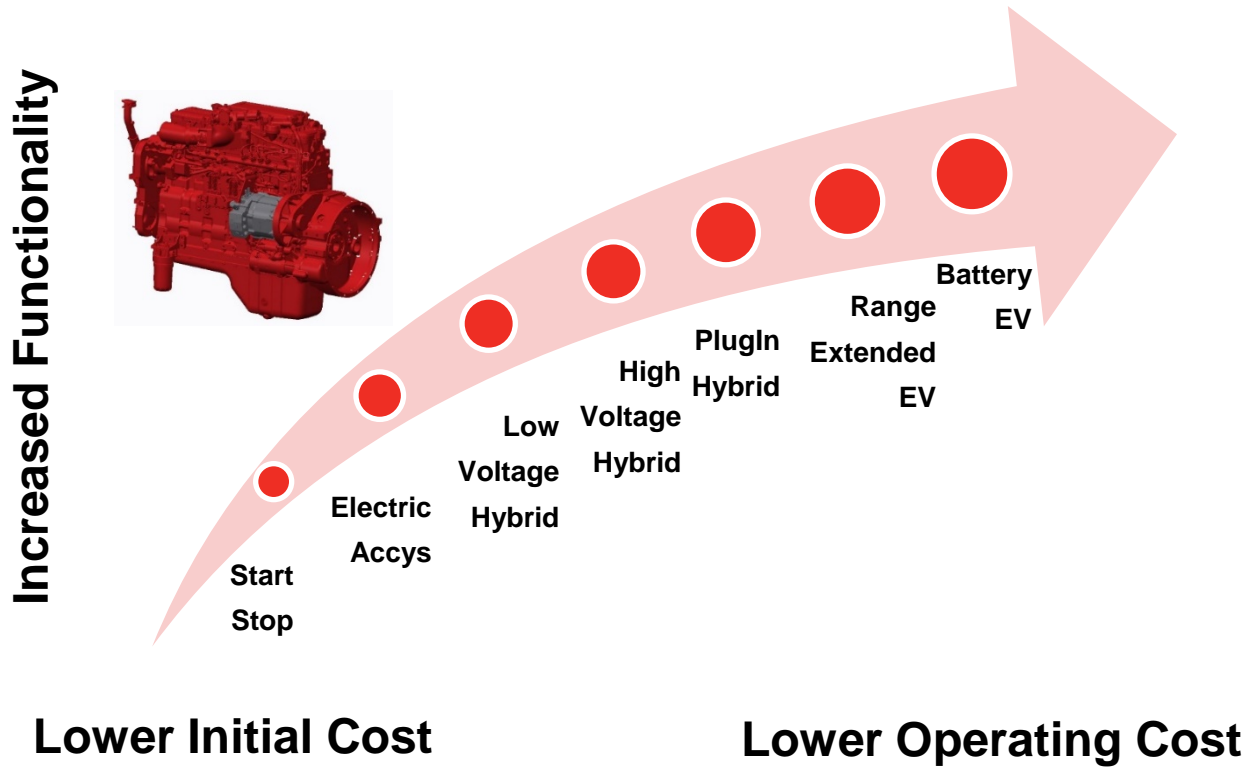


Beyond SuperTruck

- 4th generation design
- Improvements for packaging, cost, reliability
- End-user testing planned for late 2015
- Production possible by ~2020



Long Term Approach to Electrification

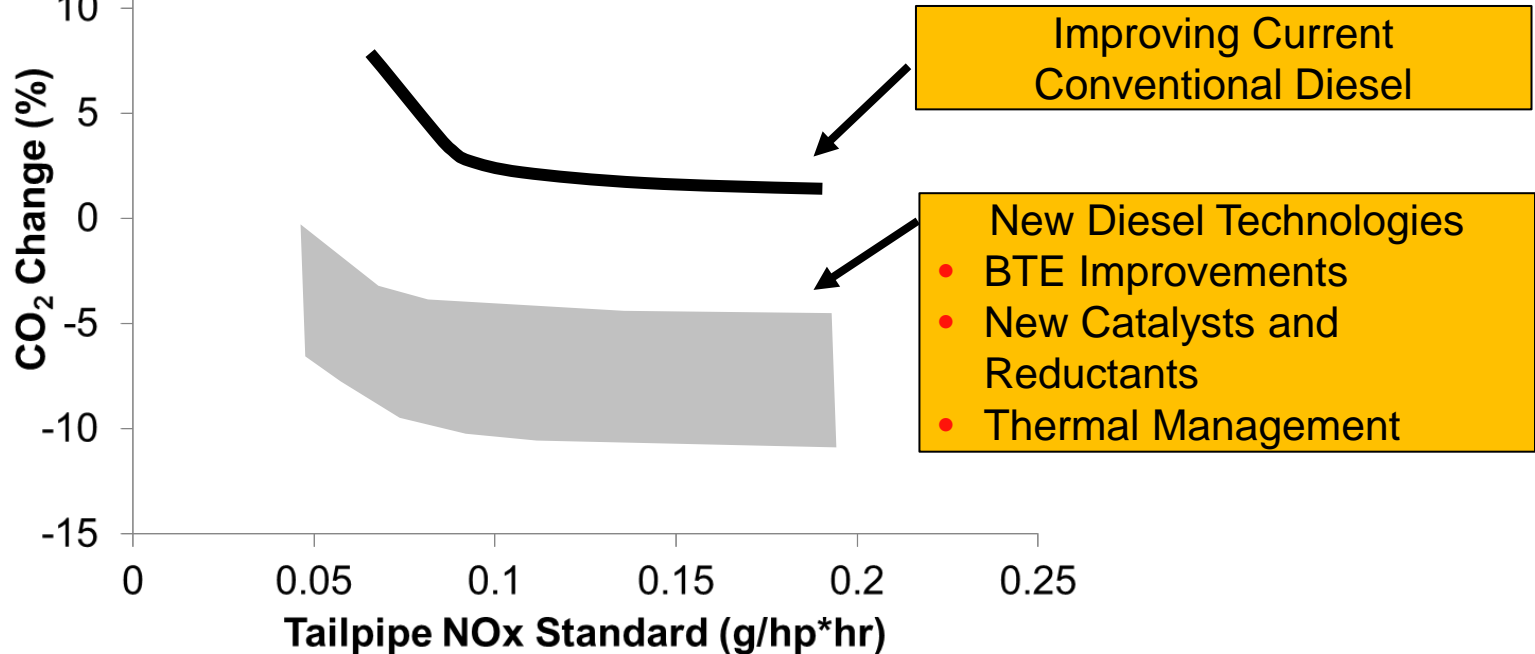


GHG Penalty at Low Tailpipe NOx



Diesel

- More work needed to identify a robust 0.02 g/hp*hr diesel solution
- Potential path to ~0.1 g/hp*hr with minimal CO₂ penalty
- New technology will help, but needs development

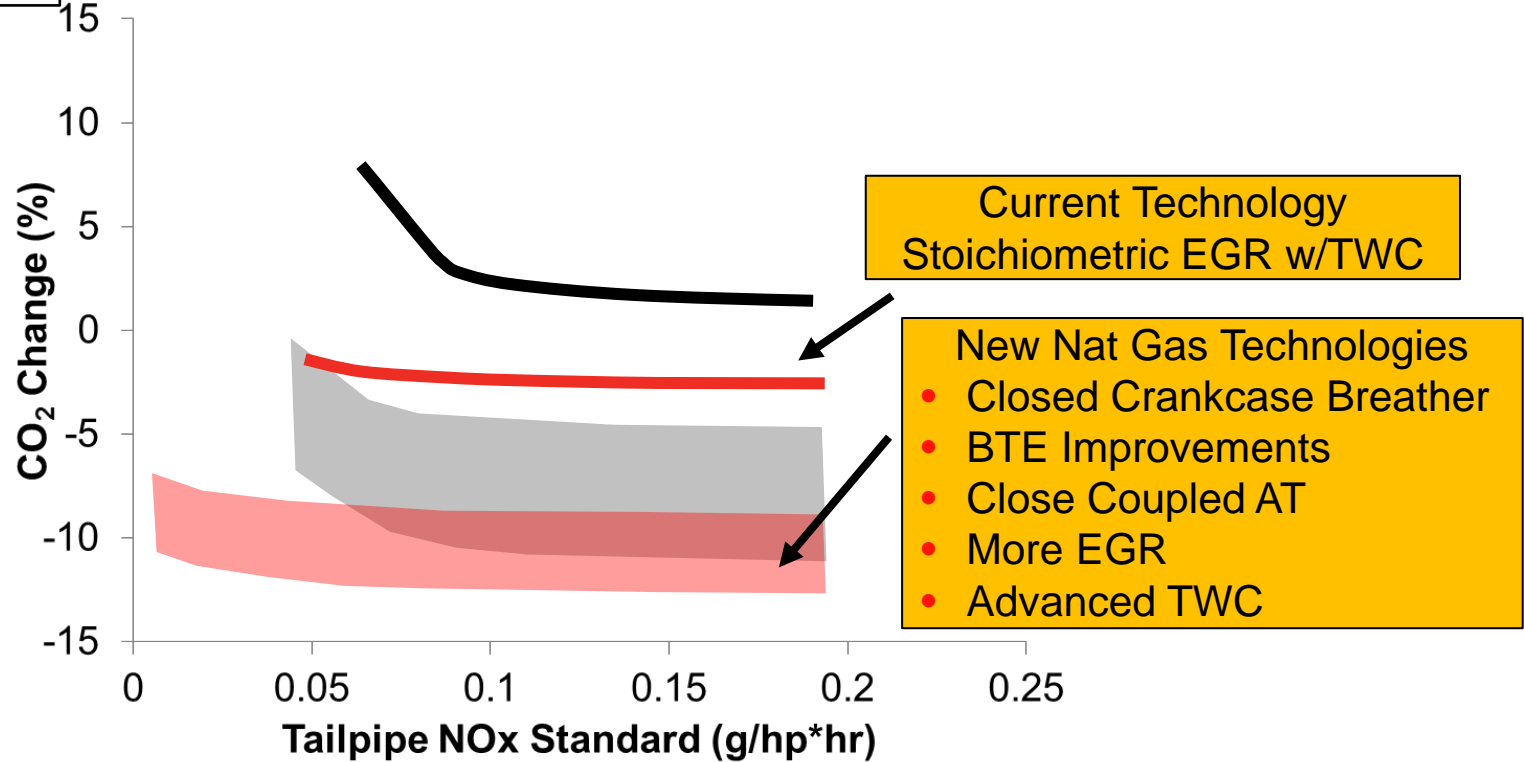


GHG Penalty at Low Tailpipe NOx



Diesel
Natural Gas*

• Path to 0.02 g/hp*hr with natural gas with small CO₂ penalty



Current Technology
Stoichiometric EGR w/TWC

- New Nat Gas Technologies
- Closed Crankcase Breather
 - BTE Improvements
 - Close Coupled AT
 - More EGR
 - Advanced TWC

* Includes methane emissions as equivalent CO₂

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