



DEER 2009 DEARBORN
DIRECTIONS IN ENGINE-EFFICIENCY
AND EMISSIONS RESEARCH CONFERENCE



U.S. DEPARTMENT OF
ENERGY

NAVISTAR[®]

HD Truck and Engine Fuel Efficiency Opportunities and Challenges Post EPA2010



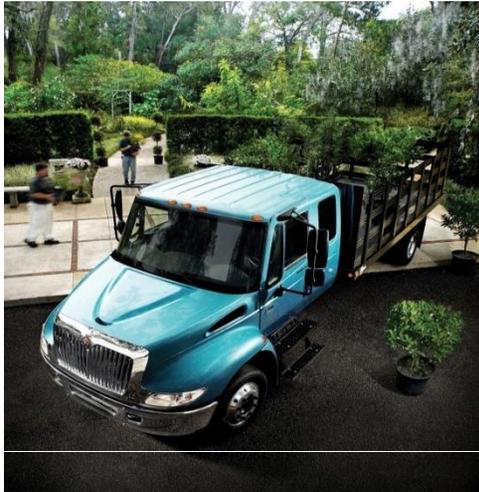
Ning Lei

Advanced Technology, Navistar, Aug 4th, 2009

About Navistar

NAVISTAR®

North America's Largest Integrated Truck and Engine Manufacturer



Navistar's Engine Products

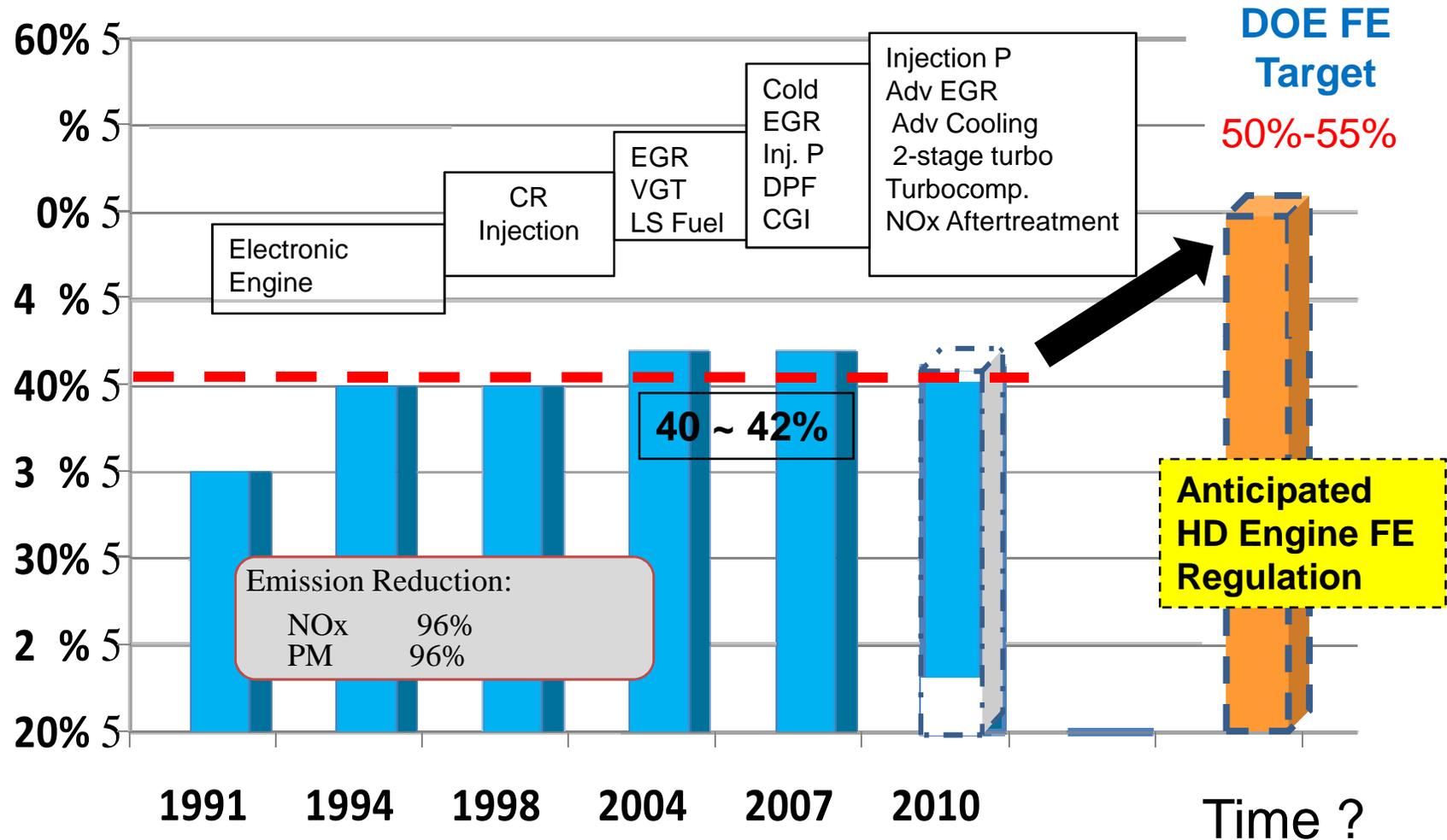


- ❑ A world wide leader with a full range of Diesel engines for commercial vehicles
- ❑ # 1 Engine Manufacturer in South America

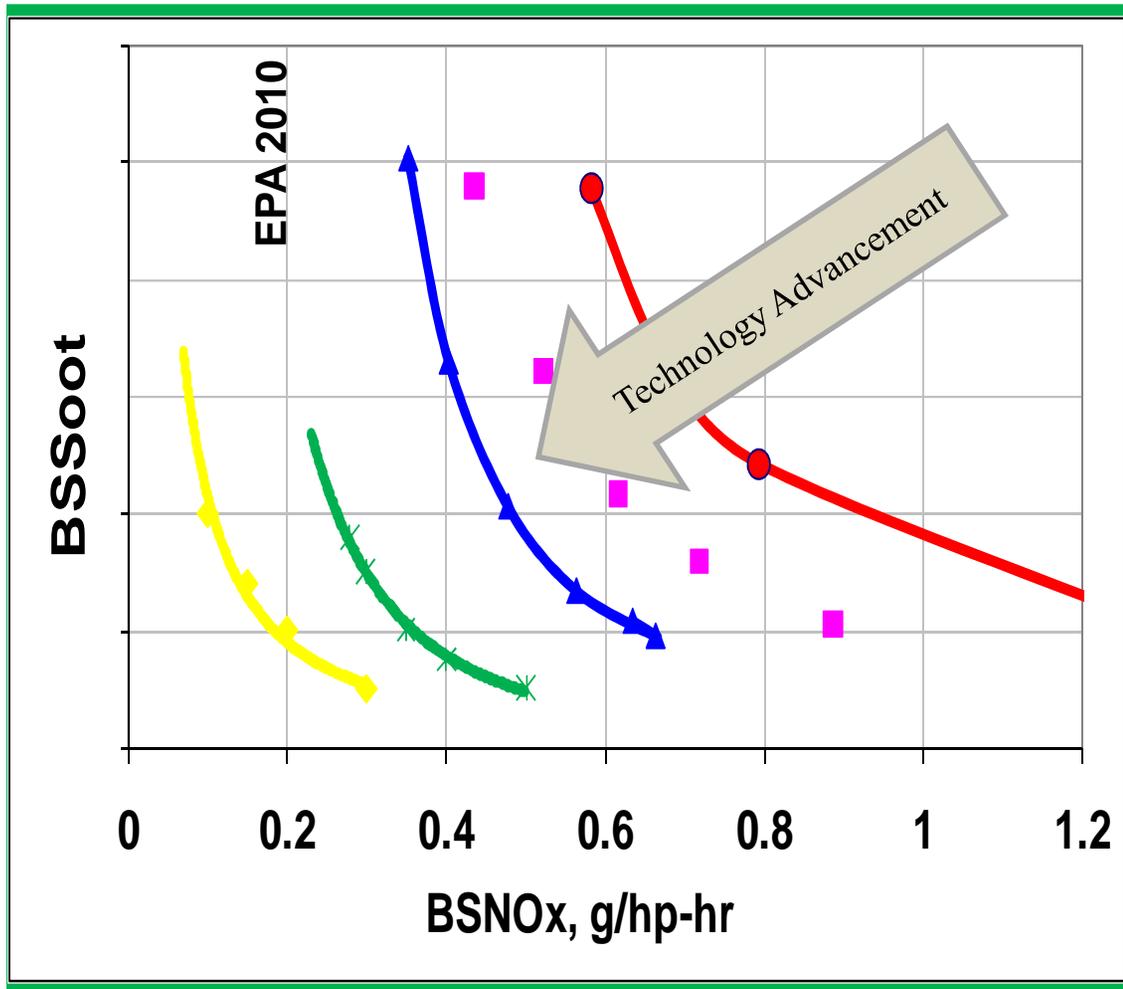
					
South Americana Engines	MaxxForce™ 5 a	MaxxForce™ 7 a Ford V8a	MaxxForce™ a DT Series 9/10a	MaxxForce™ a 11/13 a	MaxxForce™ a 15a
I-4/I-6 a 100 -æ220 hp a	4.5L V-6a 150 -æ110 hp a	6.4L V-8a 200 -æ350 hpa	7.6L/9.3L I-6a 210 -æ330 hpa	11L/13L Big Bore I-6 310 -æ475 hpa	15L Big Bore I-6 450 -æ550 hpa
Complete line of 3L-7L products a	For Class 4-5 a	HD diesel Pickup/Vansa	Class 6-7 Truck and School Busa	Class 8 Trucka	Class 8 Trucka



Engine BTE 5



Diesel Engine In-Cylinder Emission



Core Combustion Technology

- ❑ Significant advancement in In-Cylinder combustion capability
- ❑ Total engine technology integration is the key toward a successful product

Conventional Diesel Engine Opportunities

Clean and Efficient ICE Will be with us for long time

For Clean and Efficient Combustion

- Adaptive Combustion Technology*
- High Injection Pressure*
- Fuel opportunities*
- Flexible Air & EGR Charging System*
- Total Engine and Vehicle Cooling Thermal Management*
- Smart Engine Controls & Sensors*
- Variable Valve Technology*
- Waste Heat Recovery*
- Aftertreatment Advancement*
- Powertrain Integration*
- Hybridization & Electrification*

Key to Successful Commercialization

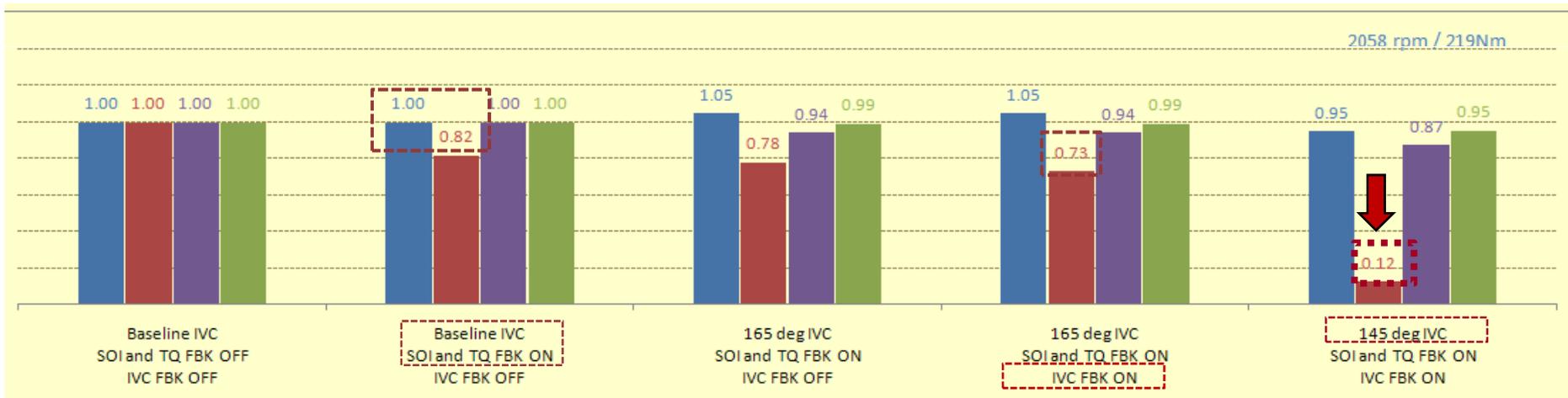
Technology Integration to meet Customer Expectations at **Cost, Quality, Timing, Reliability**



Adaptive Combustion Control

Look beyond traditional combustion optimization

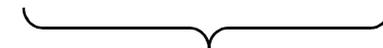
NOx (ppm) Smoke (FSN) EGR% BSFC (g/hp-hr)



Cylinder-to-Cylinder
Fuel "trim"



Cylinder-to-Cylinder
IVC "trim"

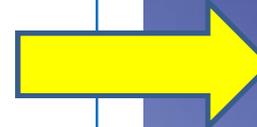


IVC adjustment

MaxxForce 13L

- ✓ 475hp, 1700ft-lb torque
- ✓ CGI crankcase
- ✓ High injection pressure, 2200bar
- ✓ Advanced 2-stage EGR & Cooling
- ✓ 2-stage turbocharger
- ✓ Improved control
- ✓ Improved DPF

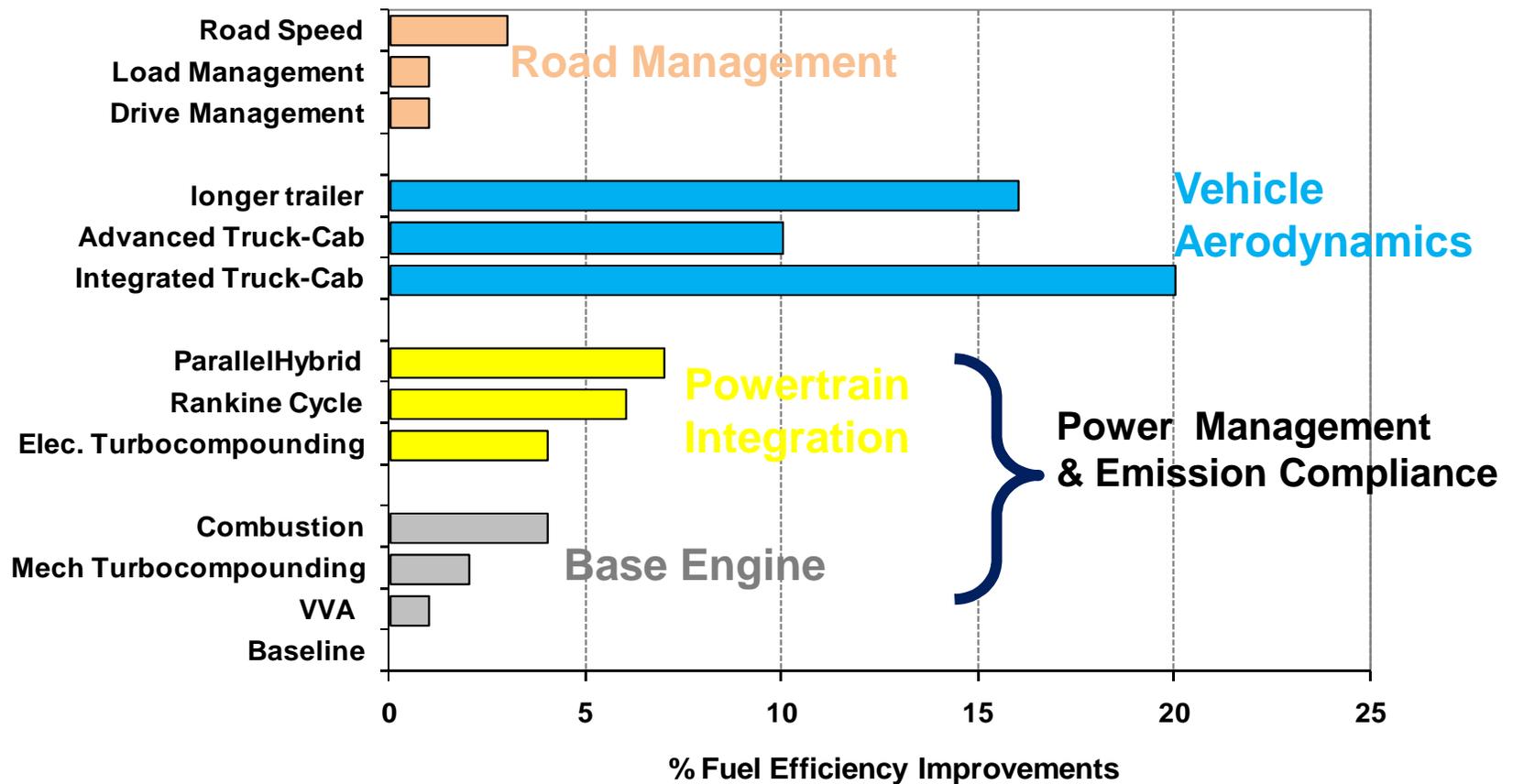
Technology
Commercialization



Looking Beyond Diesel Engine

A system approach to FE

Heavy Duty Class 8 Long Haul Truck FE Study



*** Data from multiple source, NESCCAF, ICCT, Calstart

Amazing Aerodynamics



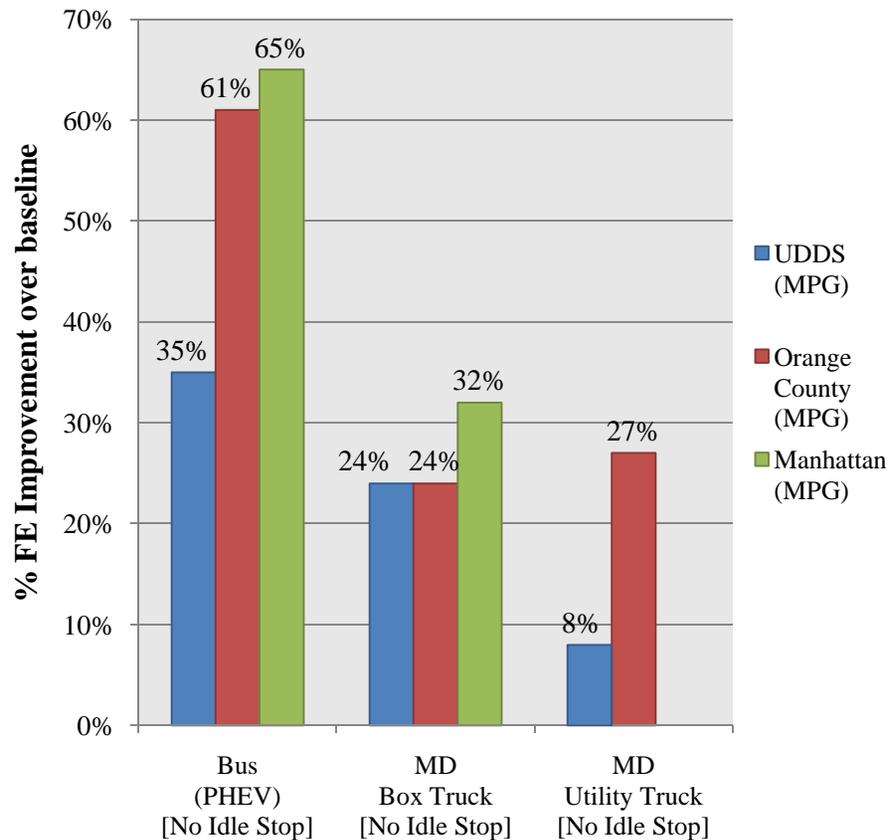
LoneStar

Navistar's Flagship Product

- ❑ Aerodynamics plays a key role in truck's fuel efficiency.
- ❑ LoneStar was designed with
 - ✓ fuel efficiency as a top priority
 - ✓ functionality & emotional appeal
- ❑ LoneStar earned
 - ✓ EPA SmartWay certification
 - ✓ Truck of the Year award
- ❑ LoneStar is projected to be 5 to 15 percent more fuel efficient than traditional classic trucks

Truck Hybridisation

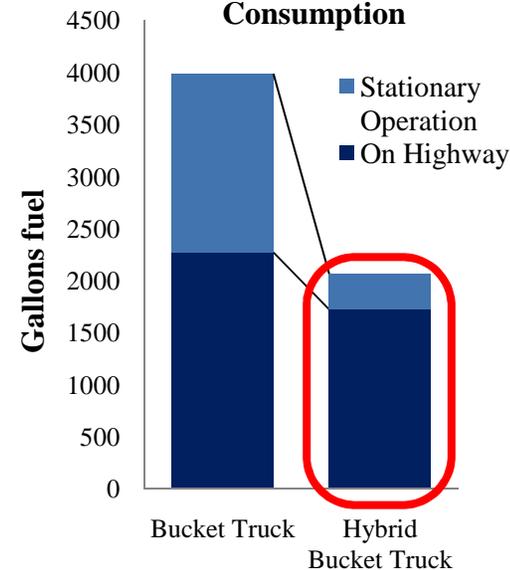
Certified FE Improvements Current Systems



Does not include 'Well to Wheel' considerations
only diesel fuel consumed during test

- Fuel Economy benefit highly dependent upon drive cycle
- Hybrid Trucks are most efficient in city driving
- Greatest benefit from working trucks is idle engine off operation

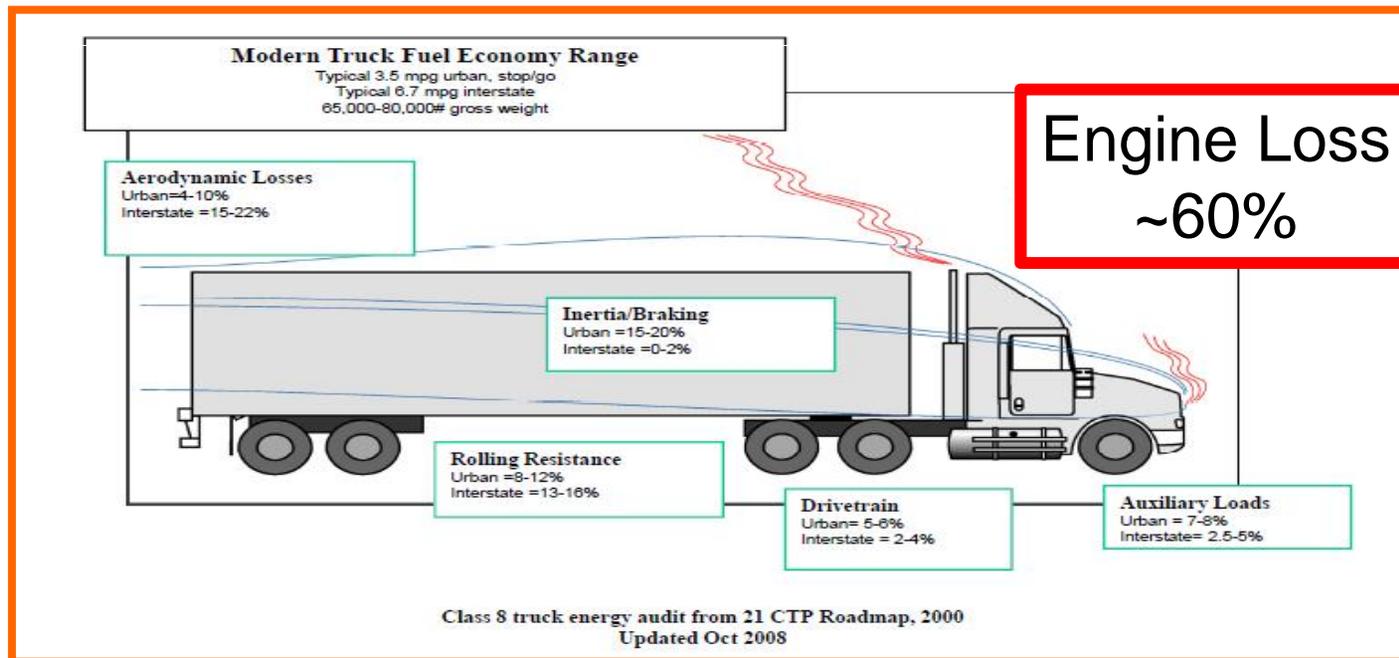
Work Truck Fuel Consumption



80% reduction Stationary Operation
20% reduction On Highway

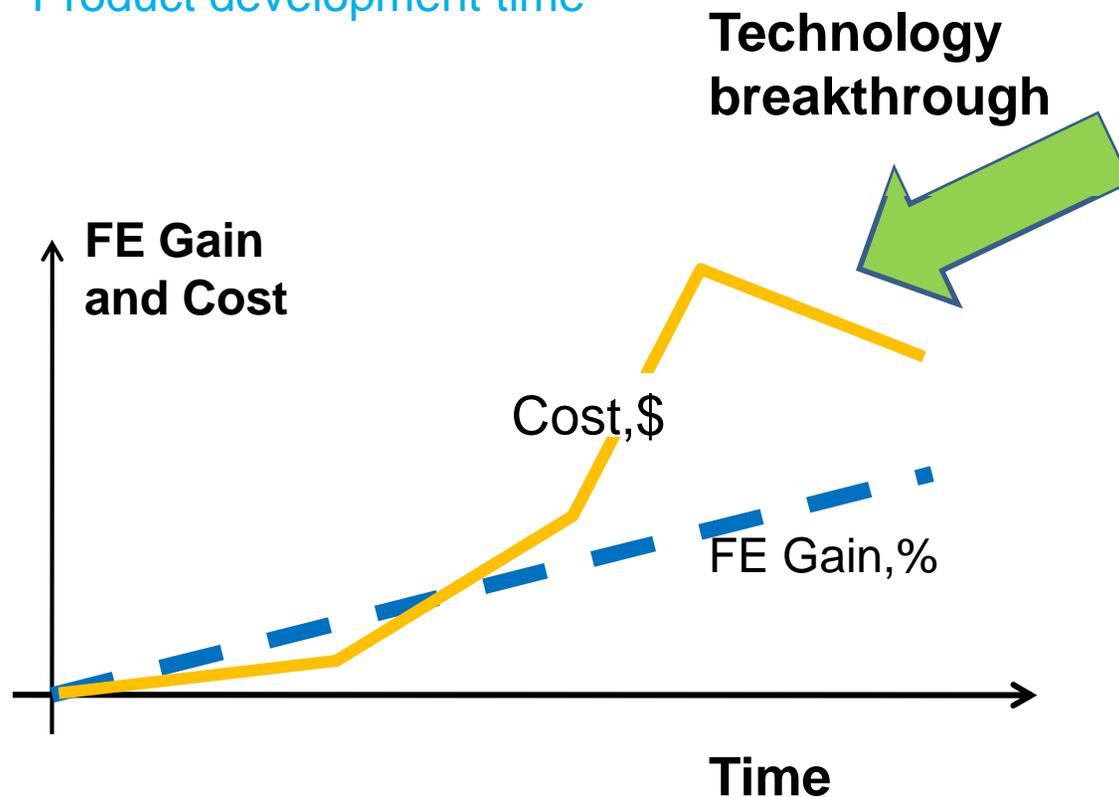
DOE Supertruck Program

- ❑ DOE latest solicitation for HD OEM on vehicle efficiency
- ❑ Total system approach to achieve 50% improvement
- ❑ Fuel efficiency improvement requirements; 20% engine + 30% vehicle
- ❑ Great opportunity for collaboration, advancing the technology and defining the path to future commercialization for high FE technology



Challenges to Commercialization

- ✓ Product cost
- ✓ Technology maturity and complexity
- ✓ Supplier base readiness
- ✓ Product development time



- Industry Collaboration
OEMs, fleets, and suppliers

- University & Research Lab



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Thank you

DOE to bring all of us together