

DAIMLER

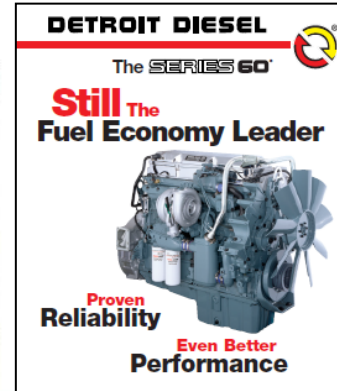
Sustainable Pathways for Trucking DTNA Recommendations for Rulemaking

STEPS Workshop

David Kayes
May 13, 2015



Our longtime mission...



..but fuel economy is constrained by NOx

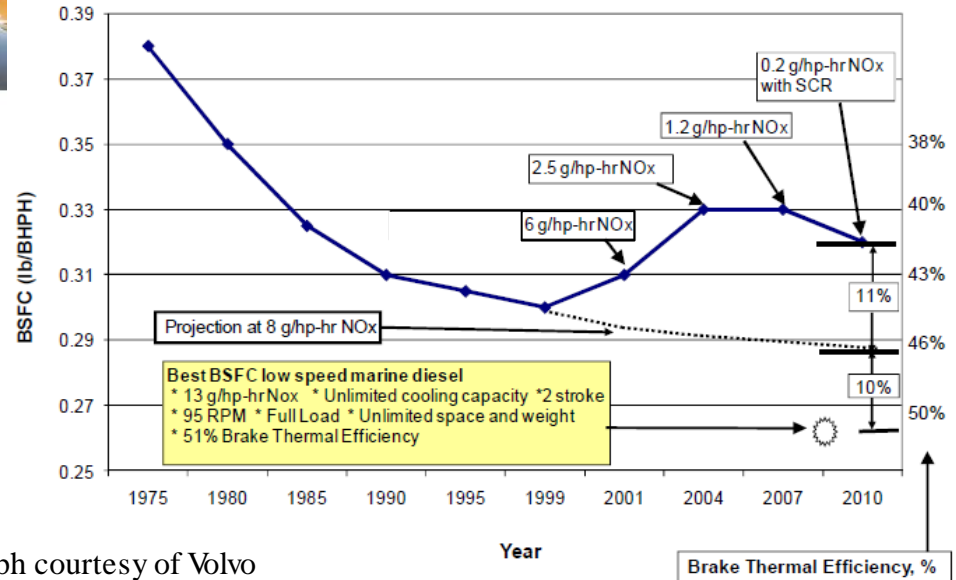
Jack Cole Company reports new GM "6-71E" engine gets over 7 miles per gallon — engine maintenance costs less than 1/2 cent per mile for parts and labor

profit-killing increase in petroleum and lower water per mile!

Figures quoted from Jack Cole's testimonial. Figures are for the engine only. All other performance figures are for the truck. All other figures are for the truck. All other figures are for the truck.

Other "71E" models in the line have similar performance. For more information, contact your local DaimlerChrysler distributor.

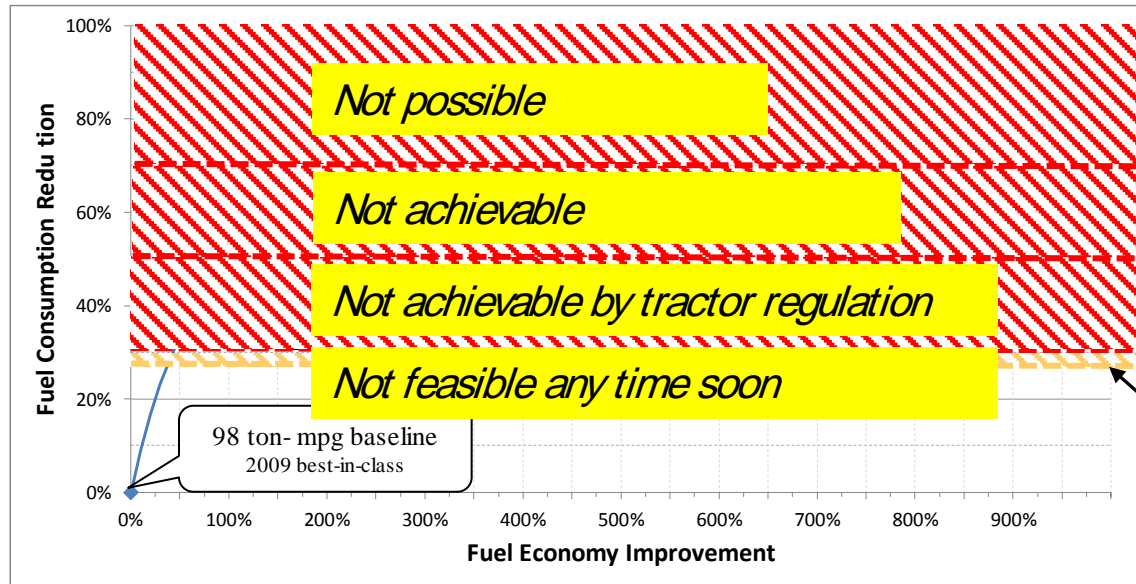
DETROIT DIESEL Engine Division of General Motors, Detroit 26, Michigan



Graph courtesy of Volvo

Are the 80 to 90% reduction targets achievable?

Relationship between Fuel Economy Improvement and Fuel Consumption Reduction



Second Law Limit

\$80M concept tractor/ trailer

\$80M concept tractor

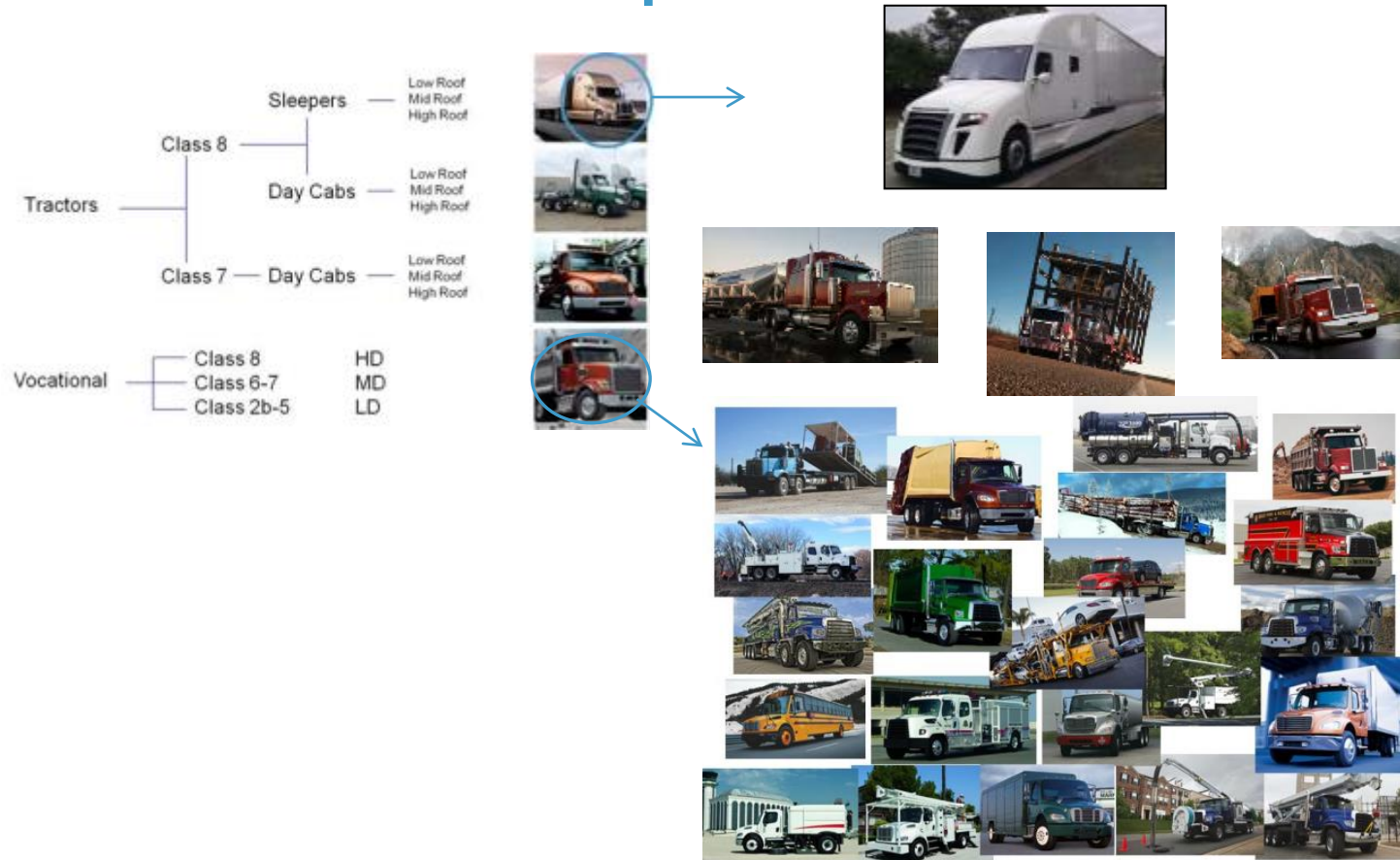
Contribution to \$80M concept tractor FCR from feasible technologies

	Second Law Limit Vehicle
<i>Engine</i>	Second law, maximum theoretically possible
<i>Aero CdW</i>	Less than 1/2 of best vehicle on the market
<i>Transmission & Axle</i>	No friction, best axle and gearing available
<i>Auxiliaries</i>	No power consumption
<i>Overall Rolling Resistance</i>	Steel wheels

Electric heavy-duty vehicle
200 gallon diesel equivalent range = approx. 75,000 lb. tare weight
At best, 5,000 lb. left for freight

Bottom line: No, the tractor targets exceed what a tractor may feasibly achieve.

And regulations must reflect the fact that—even if technology costs and feasibilities were not issues—not all vehicles can be Super Truck.



Bottom line: for any regulatory subcategory, standards must be based on technologies' FCRs times their achievable market penetration rates.

Multiple approaches to reduce braking losses

..and energy kinetic energy optimization erodes energy recoverable from waste heat.

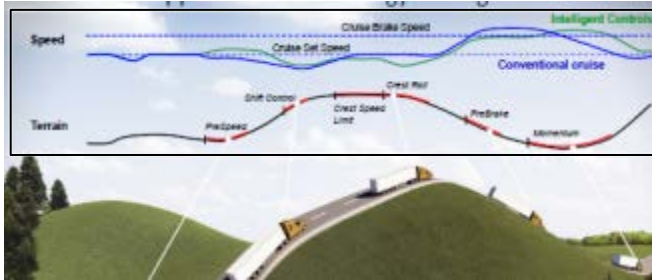
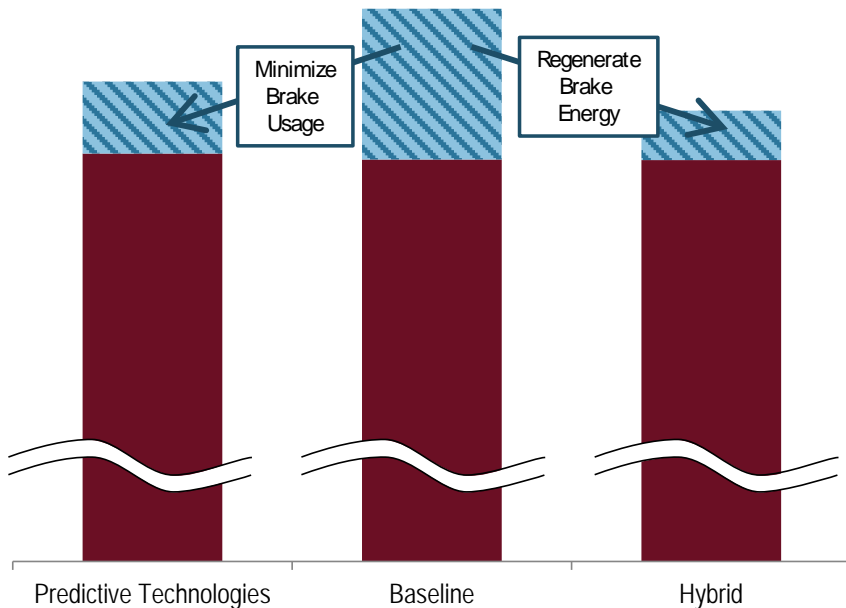


Illustration courtesy of Volvo Trucks

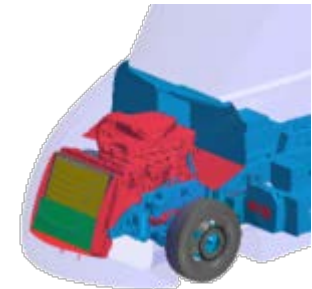
Energy Consumption on Highway Route

■ Propulsion to overcome braking losses ■ Positive Propulsion



Waste-Heat Recovery system on A-sample SuperTruck prototype.

Cooling System



➔ *Most of benefit is derived at minimal hardware, weight, and cost*

The optimal approach is a balance of vehicle GHG reductions and more.

