

# 2012 National Equipment Fleet Management Conference

## Advanced GHG Rule Vehicle Speed Limiter and Automatic Engine Shutdown Prorate Strategies & Advanced Technologies

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# Fuel Efficiency & Green House Gas Regulation

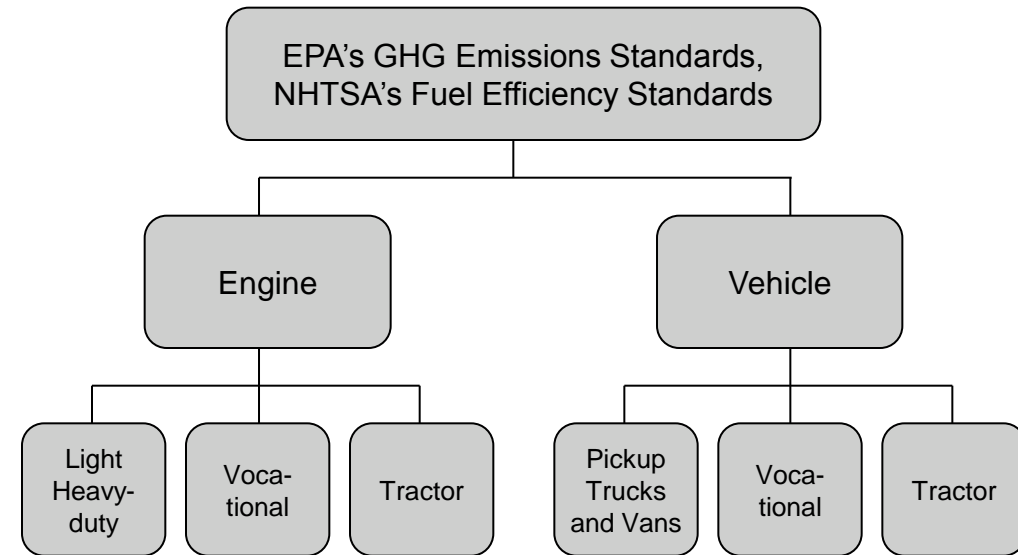
- EPA and DOT/NHTSA have published final GHG and FE standards for heavy duty vehicles
  - Mandatory from model year 2014
  - New targets model year 2017
- Sold trucks must be equipped with EPA approved features (e.g. aerodynamic kit)
  - “Innovative technologies” = Super Econodyne generates credits
- Canada and Mexico likely to follow
- EPA promises a Phase 2 regulation in 2020 with an integrated vehicle approach that could be harmonized with EU



# Fuel Efficiency & Green House Gas Regulation

## EPA's GHG Emissions Standards, and NHTSA's Fuel Efficiency Standards

- Separate engine and vehicle standards
- NHTSA standard is aligned with EPA CO<sub>2</sub> standard
  - NHTSA don't cover other GHG emissions
- Three engines categories
  - Light Heavy-Duty
  - Vocational
  - Tractor
- Three types of heavy-duty vehicles
  - Heavy-duty Pickup Trucks and Vans
  - Vocational Vehicles, incl. buses
  - Combination Tractors
- Both standards allow early compliance from 2013
- Standards will be subject to future tightening (post 2020)



# Pro-rated Speed Limiters Credit Generators

Allows for:

- Expiration
- Increased speed for passing
- Benefit is most sensitive to expiration mileage values

Effective speed =  $ExF * \{STF * STSL + (1 - STF) * DSL\} + (1 - ExF) * 65 \text{ MPH}$

- $ExF$  = expiration point miles / 1,259,000 miles
- $STF$  = max # of allowable soft top operation hours per day / 3.9 hours for day cabs
- $STF$  = max # of allowable soft top operation hours per day / 7.3 hours for sleeper cabs
- $STSL$  = the soft top speed limit
- $DSL$  = default speed limit



# Anti-idle Credit Generators

Prorated credit factors:

- Expiration
- Allowable idle time per year
- More sensitive to expiration mileage

Effective AES Input :

$$\bullet = 5 \text{ g CO}_2/\text{ton-mile} \times (\text{miles at exp.} / 1,259,000 \text{ miles}) \times [1 - (\text{maximum allowable number of idling hours per year} / 1,800 \text{ hours})]$$



# Fuel Consumption & GHG

## Truck Tractors Class 7 and 8

- NHTSA fuel consumption standards

<b>Fuel consumption standards MY 2016 (gallons/1000 ton miles)</b>			
	Day cab		Sleeper cab
	Class 7	Class 8	Class 8
Low roof	10.5	8.0	6.7
Mid roof	11.7	8.7	7.4
High roof	12.2	9.0	7.3
<b>Fuel consumption standards MY 2017 and later (gallons/1000 ton miles)</b>			
	Day cab		Sleeper cab
	Class 7	Class 8	Class 8
Low roof	10.2	7.8	6.5
Mid roof	11.3	8.4	7.2
High roof	11.8	8.7	7.1





# Fuel Consumption & GHG

## Heavy-Duty Vocational Vehicle

- NHTSA fuel consumption standards

<b>Fuel consumption standards MY 2016 (gallons/1000 ton miles)</b>			
	Light Heavy Vehicles	Medium Heavy Vehicles	Heavy Heavy Vehicles
	Class 2b-5	Class 6-7	Class 8
Standard	38.1	23.0	22.2
<b>Fuel consumption standards MY 2017 and later (gallons/1000 ton miles)</b>			
	Light Heavy Vehicles	Medium Heavy Vehicles	Heavy Heavy Vehicles
Standard	36.7	22.1	21.8

Source: Page 920



# Fuel Efficiency

## Class 2b-8 Vocational Vehicles

- Vehicle-based standard calculated via a vehicle simulation model (GEM)
- Only one input parameter
  - tire rolling resistance

<b>CO<sub>2</sub> (gram/ton-mile) standards for Vocational vehicles</b>		
	<b>MY 2014-2016</b>	<b>MY 2017-</b>
Light Heavy-Duty Class 2b-5	388	373
Medium Heavy-Duty Class 6-7	234	225
Heavy Heavy-Duty Class 8	226	222

Source: Page 668

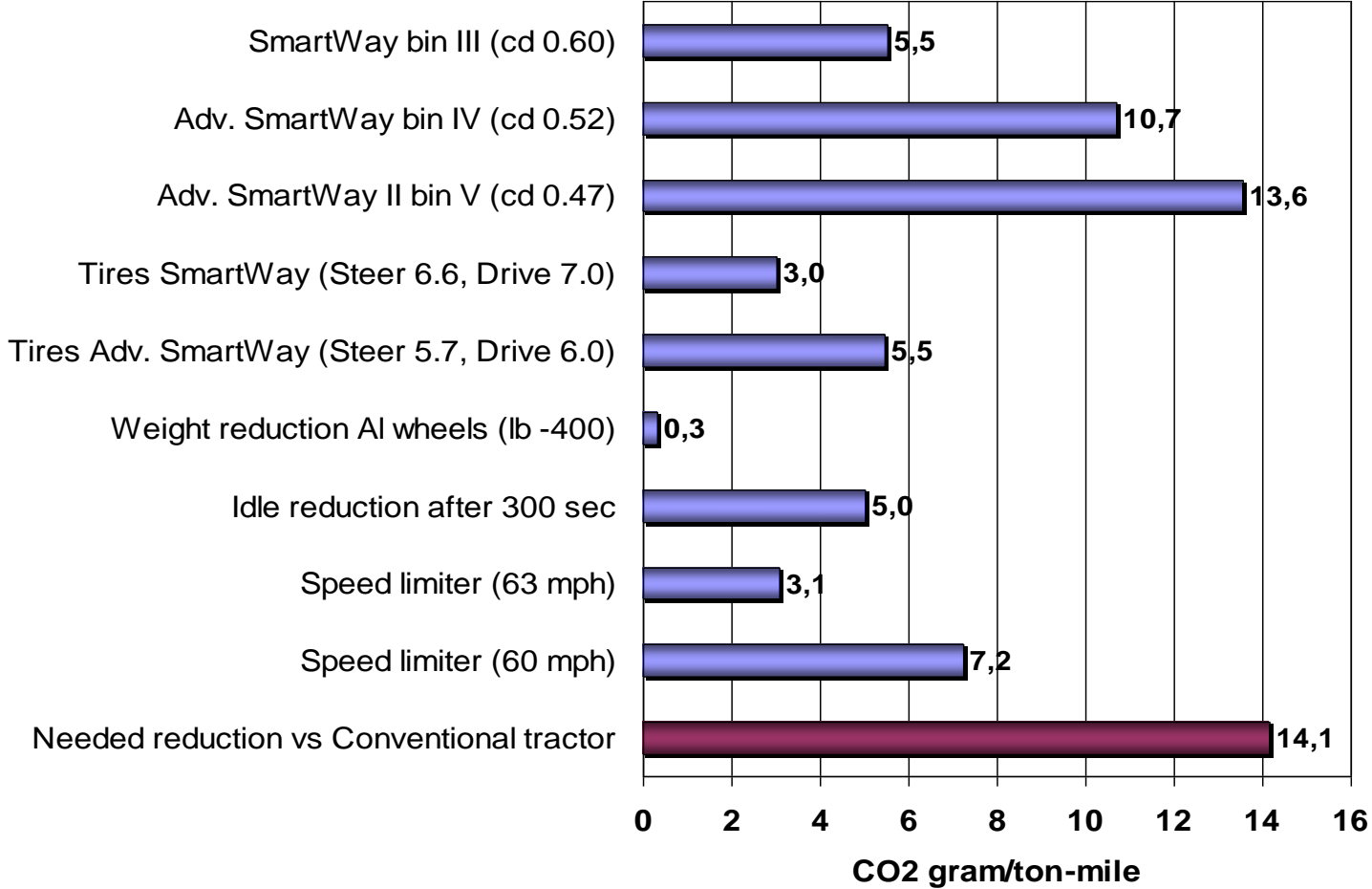




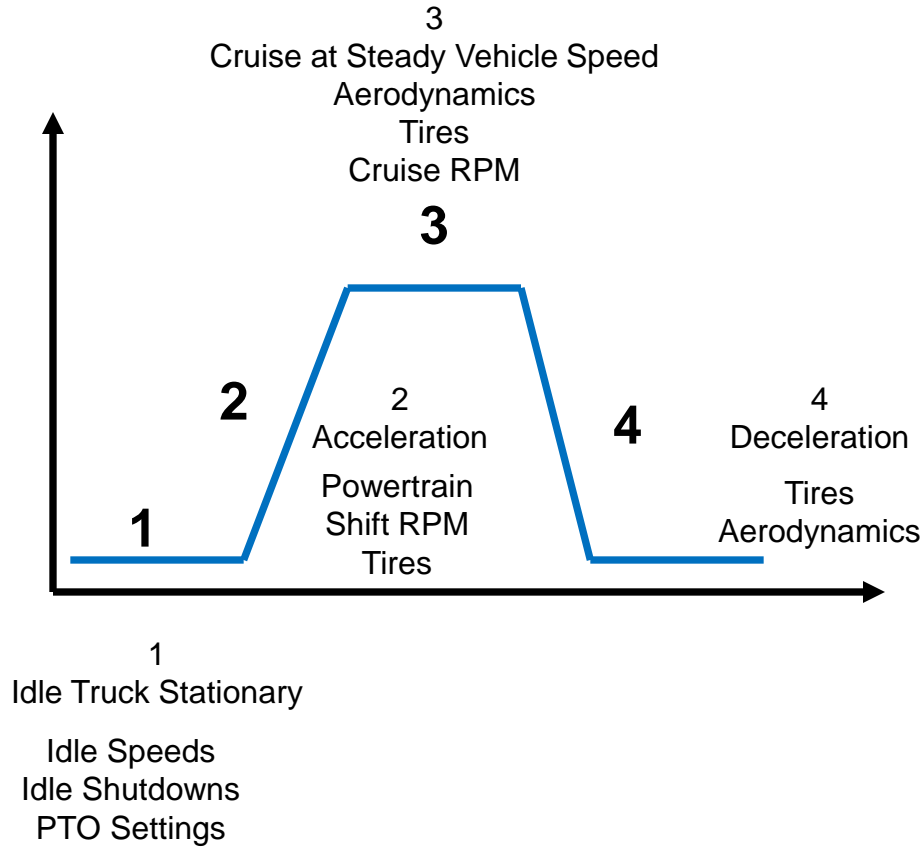
# Fuel Consumption Impactors

## CO<sub>2</sub> reduction for different features

- Example: Class 8 high roof sleeper cab



# Fuel Consumption Profile



- Duty Cycles
- What uses Fuel When



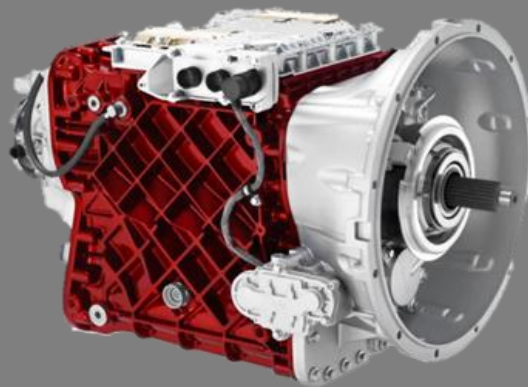
## Innovative Technologies are Required



# **SUPER** **ECONODYNE** = Total Integration



High engine fuel efficiency



*mDRIVE* transmission optimization



Super C125 overdrive axles

*Result:* Complete system optimization, including hardware and software



# **SUPER ECONODYNE** : What Is It?

- Complete vehicle system evolution, providing exceptional fuel efficiency while maintaining excellent performance and drivability
- Evolution on all the Powertrain and vehicle components MP8-445SE, *mDRIVE*, C125 axles and software
- The SE package is designed to “down speed” the engine speed by approximately 200 rpm at highway speeds
- This reduces CO<sub>2</sub> and increases highway fuel economy about 2% over today’s vehicle performance
- At 65 mph, the engine will cruise at 1160 rpm (instead of 1380 rpm)

1160 RPM →

62 MPH →

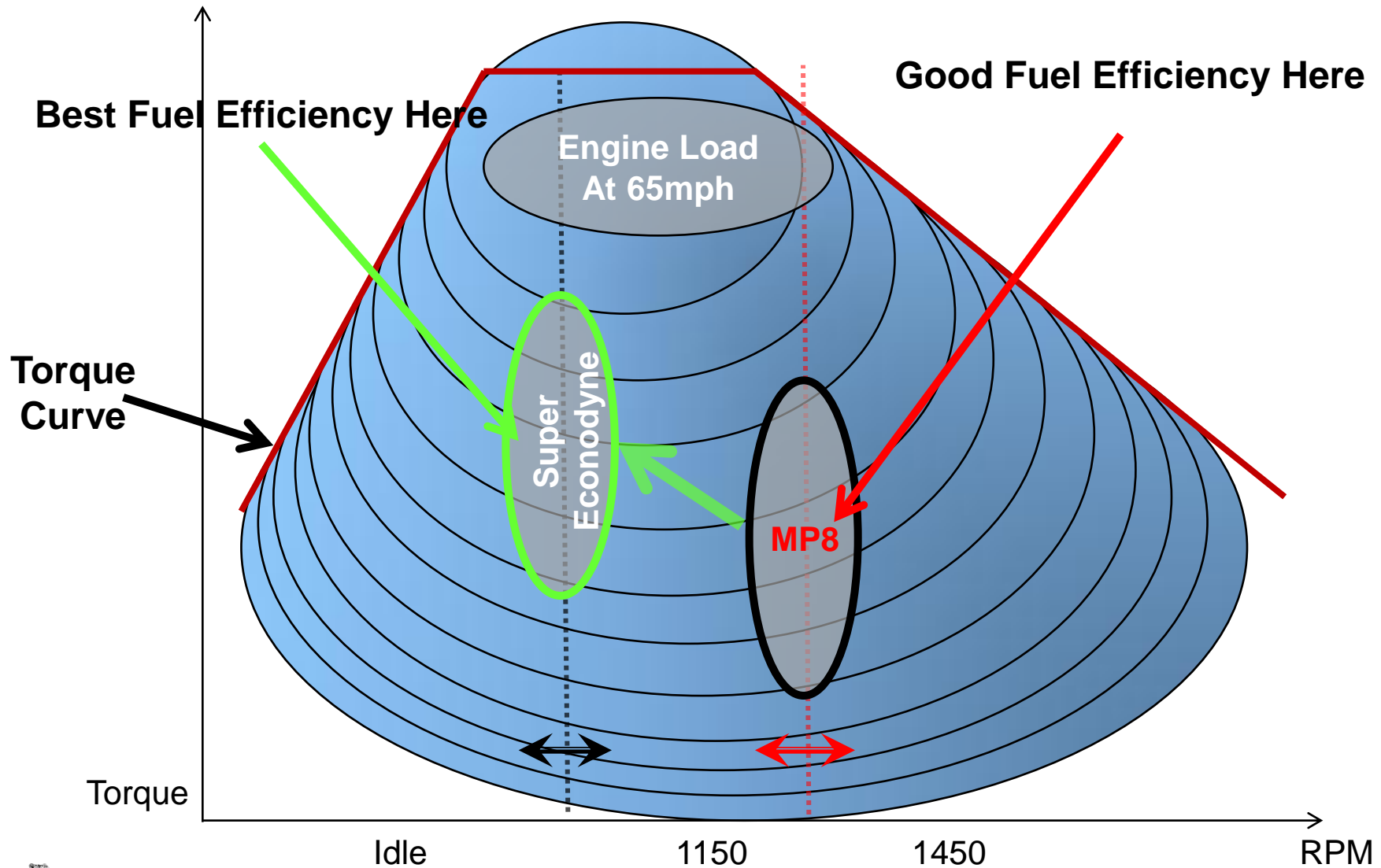
12<sup>th</sup> GEAR →



**CoPilot  
Readout  
Screen**



# Sweet Spot Target



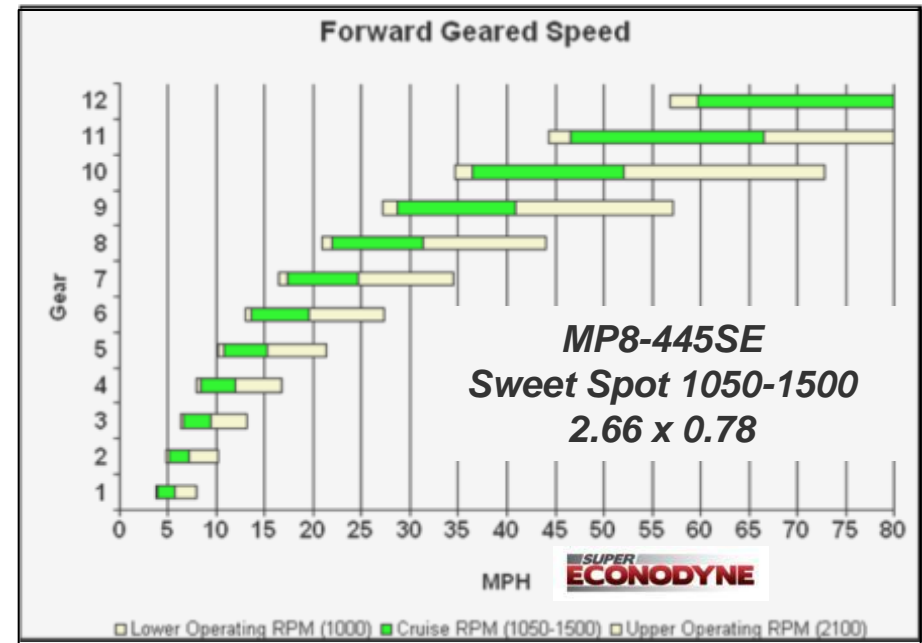
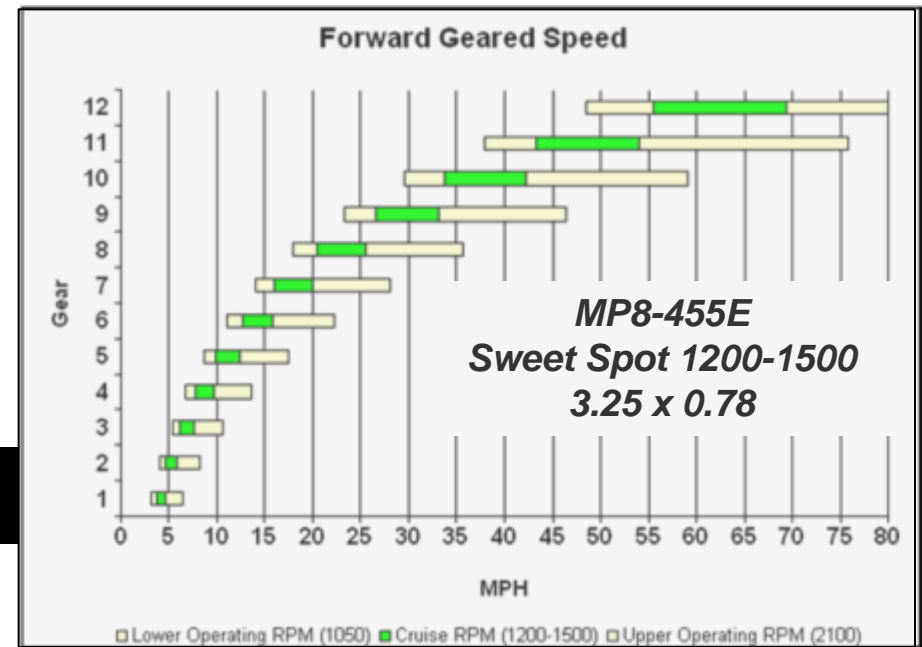


# SUPER ECONODYNE

## Sweet Spot Optimization

### MP8-445SE Package

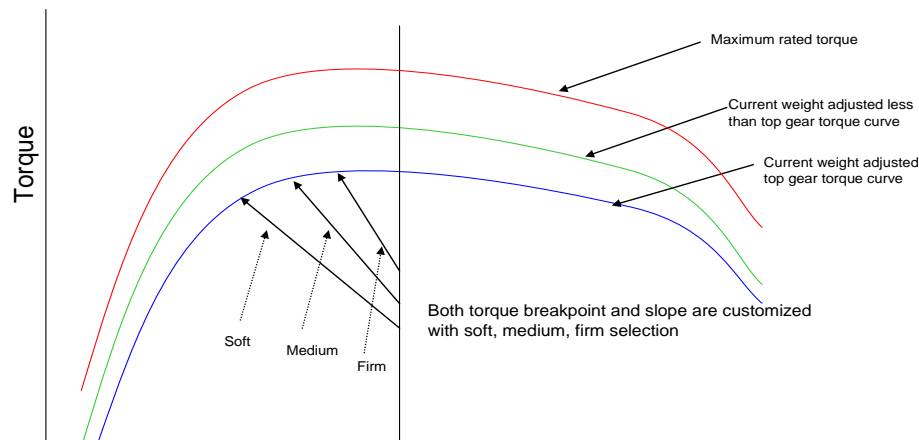
- Much broader “sweet spot” of engine operation than typical Mack Econodyne engine
- Allows engine to operate at maximum efficiency, even at road speeds higher than 65 mph



# Fuel Efficiency

## LoadSense Variable Torque

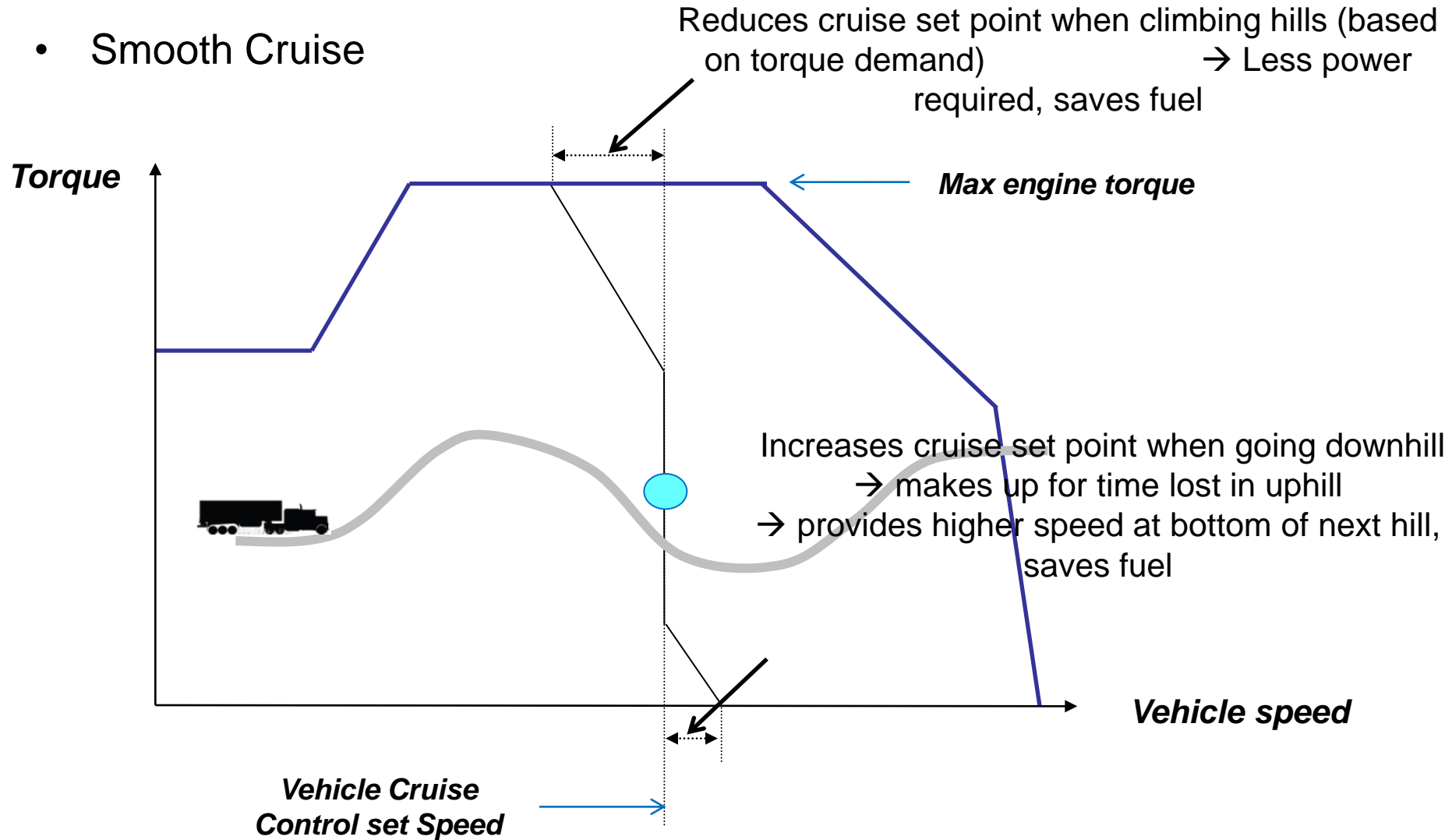
- Adjusts the usable engine torque to suit the vehicle's overall weight
- Time to speed is the same empty or loaded
- Maximum engine power is always available on GCW's of 74,000 lbs. or higher
- mDRIVE and Manuals





# Fuel Efficiency

- Smooth Cruise



# Fuel Consumption Top 10 Impactors

## Top 10 Controllable Fuel Economy Factors

RANK		IF YOU USE OR HAVE:	INSTEAD OF:	MPG IMPROVES BY:
1	<b>DRIVERS</b>	Best Drivers	Worst Drivers	Up to 35%
2	<b>SPEED</b> With Poor Aerodynamics	If you go slower by: 5 MPH	No Change	10 - 15%
3	<b>TIRES</b> Deep Lug > Rib	STEER / DRIVE / TRAILER Rib / Rib / Shallow Rib	STEER / DRIVE / TRAILER Rib / Deep Lug / Rib	6 - 14%
4	<b>IDLING</b> With A/C on @ 1000 RPM	Zero Idle Time	50%	7 - 10%
5	<b>TRAILERS</b>	Single Van	Double Van	6 - 10%
6	<b>AERODYNAMICS</b> With Cab Roof Devices	Full Roof Fairing	Nothing	Up to 15%
7		Full Roof Fairing	Raised Roof Sleeper	4 - 10%
8	<b>SPEED</b> With Excellent Aerodynamics	If you go slower by: 5 MPH	No Change	5 - 8%
9	<b>TIRES</b> Lug > Rib	STEER / DRIVE / TRAILER Rib / Rib / Shallow Rib	STEER / DRIVE / TRAILER Rib / Lug / Standard Rib	4 - 9%
10	<b>ENGINES</b>	Cruise Control	No Cruise Control	Up to 6%



