Michael Coates
14-3-2
4/24/14

DIESEL TECHNOLOGY FORUM

April 24, 2014

Mary D. Nichols
Chair, California Air Resources Board
1001 I Street,
P.O. Box 2815
Sacramento, CA 95812-2815

IN RE: 14-3-2 Comments Submitted by the Diesel Technology Forum concerning proposed amendment to the Air Resources Board's Truck and Bus rule.

Chairperson Nichols,

On behalf of the Diesel Technology Forum, we submit these comments to the Board regarding the matter of Board Item 14-3-2: "Truck and Bus" rulemaking concerning the adoption of new technology diesel engines in heavy duty vehicles and trucks.

Summary of Comments: While we do not take a formal position in favor of nor opposed to the amendments under consideration, we believe the Board's decision making would be further informed by the latest information on diesel technology specific for California. This includes the growing share of clean diesel trucks and vehicles on the road in California, the important contribution these clean vehicles are generating to improved air quality and fuel savings in California, and the options available for modernizing and upgrading existing vehicles.

By way of background, the Diesel Technology Forum represents manufacturers of diesel engines, components, emission control devices and producers of ultra-low sulfur and bio-based diesel fuels. The Forum's members are committed to advancing state-of-the-art diesel equipment to reduce smog-forming pollutants and greenhouse gases while greatly improving fuel economy--exactly the targets of the "Truck and Bus" rule to improve air quality from the heavy duty fleet in California.

California Embraces Clean Diesel Technology

Heavy duty vehicle and truck owners are adopting new clean diesel technology. According to the latest vehicle registration data for 2013 compiled by R.L. Polk, 25% of all heavy duty vehicles registered in the state are deployed with an engine that meets or exceeds the first clean diesel emission standards established by the U.S. Environmental Protection Agency (EPA) for model year 2007. The number of clean diesel trucks and other heavy duty vehicles on the road in California is up from about 21% of all vehicles in 2012. Another almost 10% of heavy duty vehicles are deployed with an engine that meets the stricter diesel emission standard beginning with model year 2010. The growing adoption of clean diesel technology by vehicle owners in California demonstrates that the technology is accepted.

New Technology Clean Diesel Engines Provide Benefits to Owners

One of the leading factors inducing equipment owners to purchase new clean diesel equipment are fuel savings that accrue from newer technology. Advanced engines, components and emissions solutions deployed in newer heavy duty vehicles provide substantial fuel savings. On average, a Class 8 line haul truck driving 100,000 miles a year will save 876 gallons of fuel or $3,500 in fuel costs each year while a Class 5 delivery box truck in service for 35,000 miles a year will save $640 in fuel costs. These savings that accrue to owners each year become substantial when compounded over the life of the vehicles. Our

presentation to the California Energy Commission last July provides further details on these savings and is attached for your review.

Improved Emissions Performance Helps Improve Air Quality

As equipment owners adopt new clean diesel technology to reduce fuel costs, California benefits from improved air quality from advanced emission controls and other technologies to reduce emissions. That same Class 8 line haul truck that saved $3,500 a year in fuel also reduces oxides of nitrogen (NOx) by 1.1 metric tons, carbon emissions by 8.9 metric tons and particulate matter (PM) by 26 kilograms. Emissions reductions from the entire clean diesel fleet on the road in California are substantial.

Nationwide, almost 1 million tons of NOx and 27,000 tons of PM have been eliminated from the growing population of Class 3-8 clean diesel trucks and vehicles on the road. Meanwhile, fuel savings technologies deployed saved 560 million gallons of diesel fuel and 5.7 million tons of carbon emissions. This reduction is equivalent to removing roughly 1.2 million light duty cars and pickups from the road for one year. California is a leader in adopting these clean diesel technologies as it is the #2 state with 209,000 clean diesel trucks vehicles on the road. (Note: while we recognize that the Truck and Bus rule applies only to Class 4-8 vehicles, our current data captures a broader class of vehicles that includes Class 3. Typically the bulk of the emissions impacts are typically achieved in the larger classes of vehicles, which are included in our population.)

According to the California Air Resources Board's California Emission Projection Analysis Model, the deployment of new clean diesel vehicles and the retrofit of older engines will have substantial air quality benefits to the state. By 2015, the model estimates that diesel equipment and vehicles including on- and off-road vehicles will represent less than 9% of particulate matter emissions in the state. Residential heating and road dust will contribute more to soot emissions than diesel sources. Thanks to the rapid adoption of clean diesel technologies, diesel engines will fall from the 6th largest contributor in soot emissions in 2010 to the 12th largest by 2015.

	2013 Class 3-8 Vehicle Registrations: Model Year 2007 & Newer
TEXAS	345,456
CALIFORNIA	**209,098**
INDIANA	204,653
ILLINOIS	130,423
PENNSYLVANIA	123,313
Source: R.L. Polk	

Further improvements to fuel economy and emissions reductions in the heavy duty fleet are deployed in trucks that hit showroom floors this year. The first round of heavy duty fuel economy and greenhouse gas reduction rules promulgated jointly by the Environmental Protection Agency, the National Highway Traffic Safety Administration (NHTSA) and the California Air Resources Board (CARB) apply to heavy duty vehicles manufactured between 2014 and 2018. Technologies designed to meet these standards are expected to reduce 530 million barrels of oil and reduce carbon emissions by 270 million tons. The trucking industry's continued adoption of these new clean diesel vehicles in greater numbers will contribute to fuel savings, emissions reductions and cleaner air.

Proven Solutions are Available for Existing Vehicles In addition to the legendary fuel economy and performance of diesel engines, they are also known for their longevity and reliability. For existing truck owners, with proper maintenance and operation, diesel engines can last a million miles or more; a valuable attribute for many small businesses with limited access to capital. To reduce emissions of these vehicles, there are over 30 Level 3 verified retrofit devices that are available which when installed and maintained properly, can effectively reduce emissions from existing vehicles by over 85 percent.

Conclusion

Diesel truck and engine manufacturers are attacking the emissions challenge on both ends; producing near zero emissions new technology clean diesel engines and working to help find solutions to modernize and upgrade existing engines and equipment.

The Truck and Bus rule has been a significant factor encouraging equipment owners to adopt new low-emissions technologies either through retrofitting existing vehicles or the purchase of new or newer vehicles.

The widespread adoption of available technologies demonstrates that these solutions work for owners while also providing significant fuel savings for owners and air quality improvements for the state.

We appreciate the opportunity to provide this information about the increasing adoption of clean diesel technologies in California and to highlight the emissions reductions and fuel savings that accrue statewide.

If you have any questions or concerns, please feel free to contact us at (301) 668-7230.

Thank you,

Allen R. Schaeffer

Allen Schaeffer
Executive Director

/ars

ATTACHMENT
DTF Presentation to California Energy Commission, July 2013

Diesel Technology Report for the California Energy Commission Integrated Energy Policy Report

Allen Schaeffer
Executive Director
www.dieselforum.org.
July 31, 2013 Sacramento, CA

DIESEL TECHNOLOGY FORUM

Agenda

* Overview
* Observations on diesel fuel and technology
* New Research – Current and Future Benefits of Diesel Technology For California
* Conclusions

DIESEL TECHNOLOGY FORUM

About the Diesel Technology Forum

www.dieselforum.org

*AGCO
*BP
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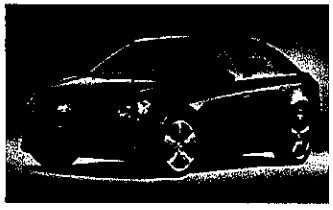
*BOSCH
*Caterpillar Inc.
*Chrysler
*Cummins Inc
*Daimler
*Delphi Automotive
*Deere & Company
*Ford Motor Company
*General Motors
*Honeywell
*Johnson Matthey
*Mazda North American Operations
*Navistar
*Terra Environmental
*Volvo Group
*Volkswagen Group of America
*Yanmar

Allied Members

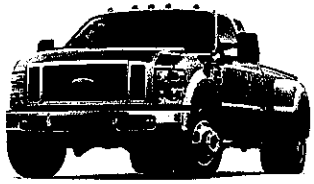
*Association of Diesel Specialists
*National Biodiesel Board
*Western States Petroleum Association

Definitions Used Today

* Light Duty

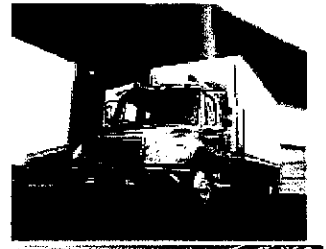



Cars, SUVs, and Heavy-duty pick up trucks (Class 1-2)



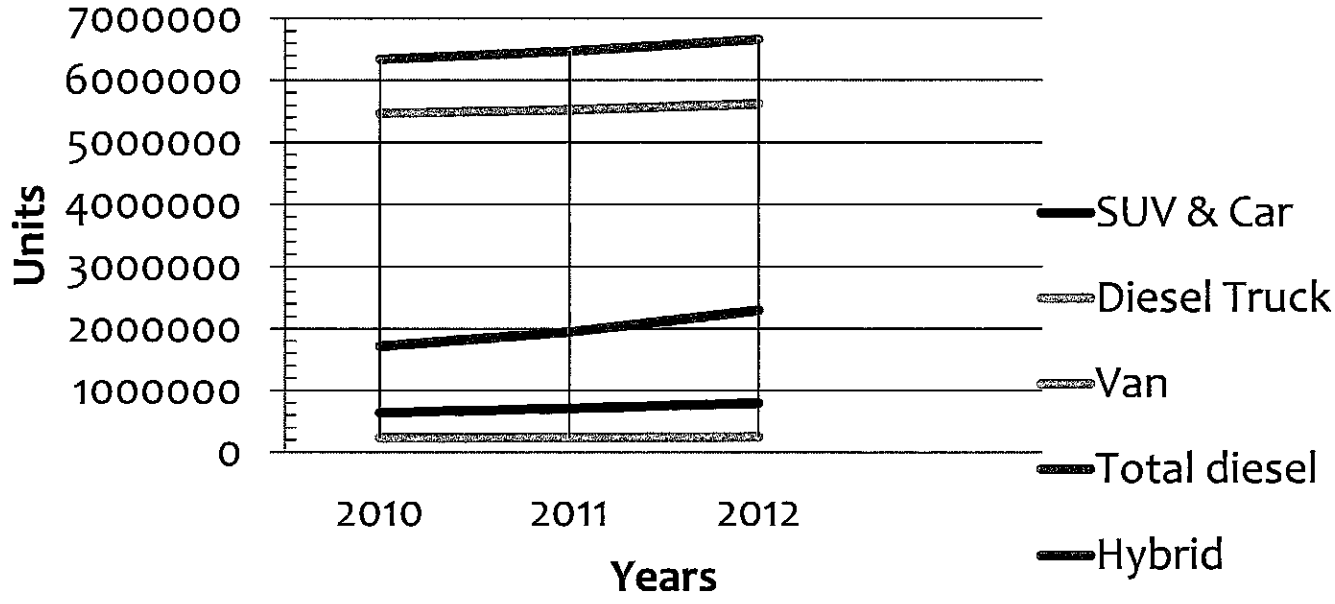

* Heavy Duty


Medium, Heavy-duty and Vocational Commercial Trucks Weight Class 3-8



Consumer acceptance of new clean diesel technology in light-duty vehicles is growing

Registrations of Diesel Cars and Trucks >3.5 that of hybrids



Source R.L. Polk and Company, March 2013

* **Diesel car registrations up 24%; Hybrids up 33%**

2010-2012

California: #1 in Diesel Vehicle Registrations & Fastest Growing Car & SUV (2012)

Top 10 states by numbers of diesel vehicles **registered** 2012

* CALIFORNIA (84,000)
* TEXAS
* FLORIDA
* NEW YORK
* ILLINOIS
* PENNSYLVANIA
* OHIO
* MICHIGAN
* NEW JERSEY
* NORTH CAROLINA

Fastest growing states for diesel cars and SUV registrations (2010-2012)

* CALIFORNIA
* MASSACHUSETTS,
* NEW YORK

Source: 2012 Data from R.L. Polk and Company

New Research on Current and Projected Future Fuel Savings and GHG reduction Benefits of Light & Heavy Duty Diesel Vehicles

DIESEL TECHNOLOGY FORUM

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Final

U.S. Light & Heavy Duty Diesel Engine Benefits

DIESEL TECHNOLOGY FORUM

June 25, 2013

DETROIT • CHICAGO • FRANKFURT • SHANGHAI • BEIJING

Light Duty Objectives

Analyze historic fuel savings and CO2 reductions for 2005-2012 light duty diesel vehicles

- Aggregated by cars, trucks, and HD pickups
- National and state specific fuel savings
  - *Targeted states to include CA, NY, TX, VA*

Project potential future fuel savings and CO2 reductions for 2013-2020 for the same scenario of vehicles and markets as above

- This projection will be based on available 3rd party forecasting information, CAFÉ regulation estimates for diesel technology adoption, and projected future diesel powertrain announcements

Biodiesel benefit analysis

- The above forecasting scenario will then be run with various levels of biodiesel in place of B0 reference fuel and the benefits will be recalculated for B5.

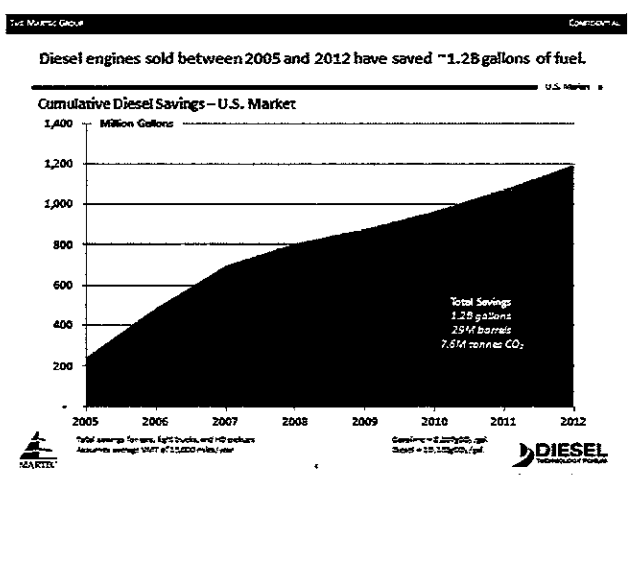
Analyze the potential fuel and CO2 savings and generate an appropriate comparisons

Analysis of registration data for diesel vehicles in the U.S. yields a cumulative savings curve for fuel and CO_2 savings.

Methodology for Historic Diesel Vehicle Savings

Inputs and Assumptions

- Polk registration data for U.S. and state specific registrations of passenger cars, light trucks, and HD pickups.
- Actual fuel economy benefits for diesel options over equivalently performing gasoline option.
- Average vehicle miles traveled (VMT) of 15,000 miles per year



Output and Analysis

- Vehicle level savings for each model year by U.S. total and for selected states based on actual registrations and average savings over gasoline equivalent powertrains.
- These vehicle level savings are summed up to generate a cumulative savings to date for diesel powertrains.

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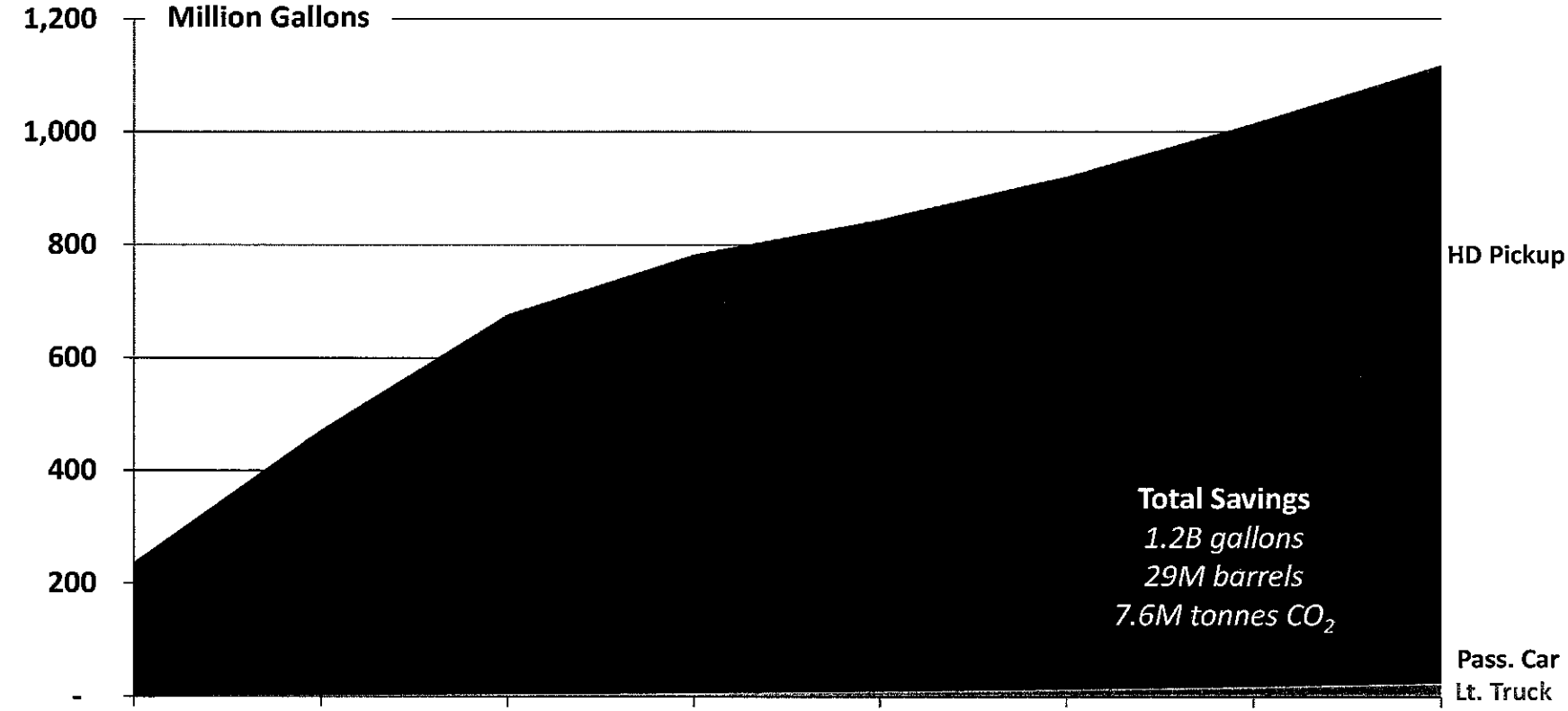
Diesel engines sold between 2005 and 2012 have saved ~1.2B gallons of fuel.

U.S. Market ■

Cumulative Diesel Savings – U.S. Market



Number of Models	2005	2006	2007	2008	2009	2010	2011	2012
	11	14	11	11	16	15	17	19

Total savings for cars, light trucks, and HD pickups
Assumes average VMT of 15,000 miles/year

Gasoline = 8,887gCO_2 /gal.
Diesel = 10,180gCO_2 /gal.

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Putting the numbers into perspective…

The 2.9M light-duty new clean diesels introduced from 2005 through 2012 have saved the American consumer:

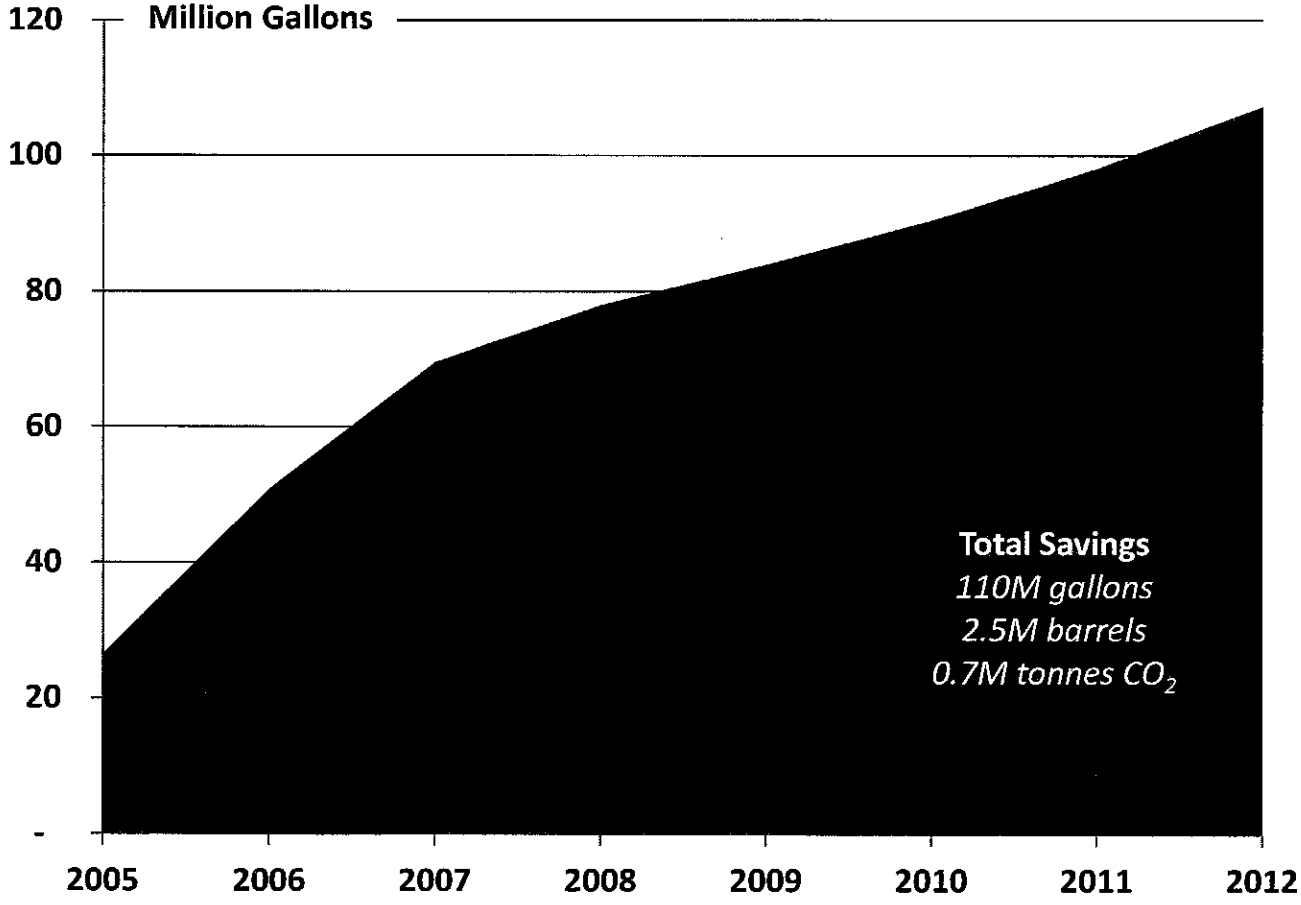
- 7.6M tonnes of CO_2
- 1.2B gallons of gasoline
- 29M barrels of crude oil

These reductions are equivalent to:

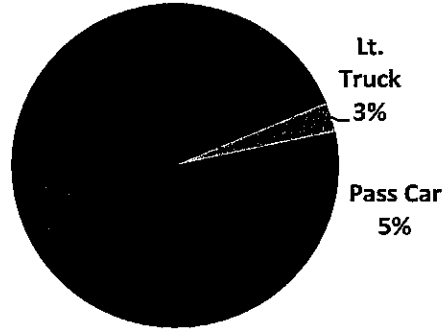
- Removing 1.6M vehicles from the road for a year
- Carbon sequestration from 6.2M acres of forests
  - *This is an equivalent forest the size of Vermont*
- Removing the annual emissions from 2.2 coal fired power plants
  - *32,000 railcars of coal stretching continuously from Boston to Philadelphia*
- Roughly 11% of the Strategic Petroleum Reserve for sweet crude.

Since 2005, new diesel vehicles in the state of California have saved the environment nearly 700,000 tonnes of CO_2.

Cumulative Diesel Savings – California



Benefits by Vehicle Type



Total savings for cars, light trucks, and HD pickups
Assumes average VMT of 15,000 miles/year

Gasoline = 8,887gCO_2 /gal.
Diesel = 10,180gCO_2 /gal.

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Passenger car diesel owners will stop to refuel 9 less times per year.

Passenger Car

Savings to the clean diesel buyer	Per Year	54 Month Ownership
Fuel savings - gallons	128	578
Fuel savings - bbl	3	14
Fuel cost savings	$340	$1,530
CO_2 savings – metric tones	0.6	2.5
Refueling trips saved	9	40

Assumptions:

- Fuel savings based on Polk sales weighted average of diesel vehicles for 2012.
- DOE Average gasoline and diesel prices for the U.S. as of 4/29/13. Gasoline = $3.59 Diesel = $3.85
- CO2 conversion based on EPA's content per gallon.
- While not specifically evaluated in this study, other reports and data from used car sales indicate that diesel powered vehicles retain a higher residual value compared to gasoline counterparts.

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Customers that choose the light duty diesel in a SUV will reduce their carbon footprint by 3.5 metric tons.

Light Duty Truck

Savings to the clean diesel buyer	Per Year	54 Month Ownership
Fuel savings - gallons	192	860
Fuel savings - bbl	4.6	21
Fuel cost savings	$502	$2,300
CO_2 savings – metric tones	0.8	3.5
Refueling trips saved	8	35

Assumptions:

- Fuel savings based on Polk sales weighted average of diesel vehicles for 2012.
- DOE Average gasoline and diesel prices for the U.S. as of 4/29/13. Gasoline = $3.59 Diesel = $3.85
- CO2 conversion based on EPA's content per gallon.
- While not specifically evaluated in this study, other reports and data from used car sales indicate that diesel powered vehicles retain a higher residual value compared to gasoline counterparts.

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The average diesel engine in a heavy duty pickup saves the customer ~$5,600 in fuel over the typical ownership cycle.

Heavy Duty Pickup Truck

Savings to the clean diesel buyer	Per Year	54 Month Ownership
Fuel savings - gallons	425	1,900
Fuel savings - bbl	10	45
Fuel cost savings	$1,307	$5,600
CO_2 savings – metric tones	2.7	12.2
Refueling trips saved	15	66

Assumptions:

- Fuel savings based on Polk sales weighted average of diesel vehicles for 2012.
- DOE Average gasoline and diesel prices for the U.S. as of 4/29/13. Gasoline = $3.59 Diesel = $3.85
- CO2 conversion based on EPA's content per gallon.
- While not specifically evaluated in this study, other reports and data from used car sales indicate that diesel powered vehicles retain a higher residual value compared to gasoline counterparts.

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National – Light Duty

Lumber Stakes – Light Duty

Vehicle to Diesel Buyer – Light Duty

National – Forecast

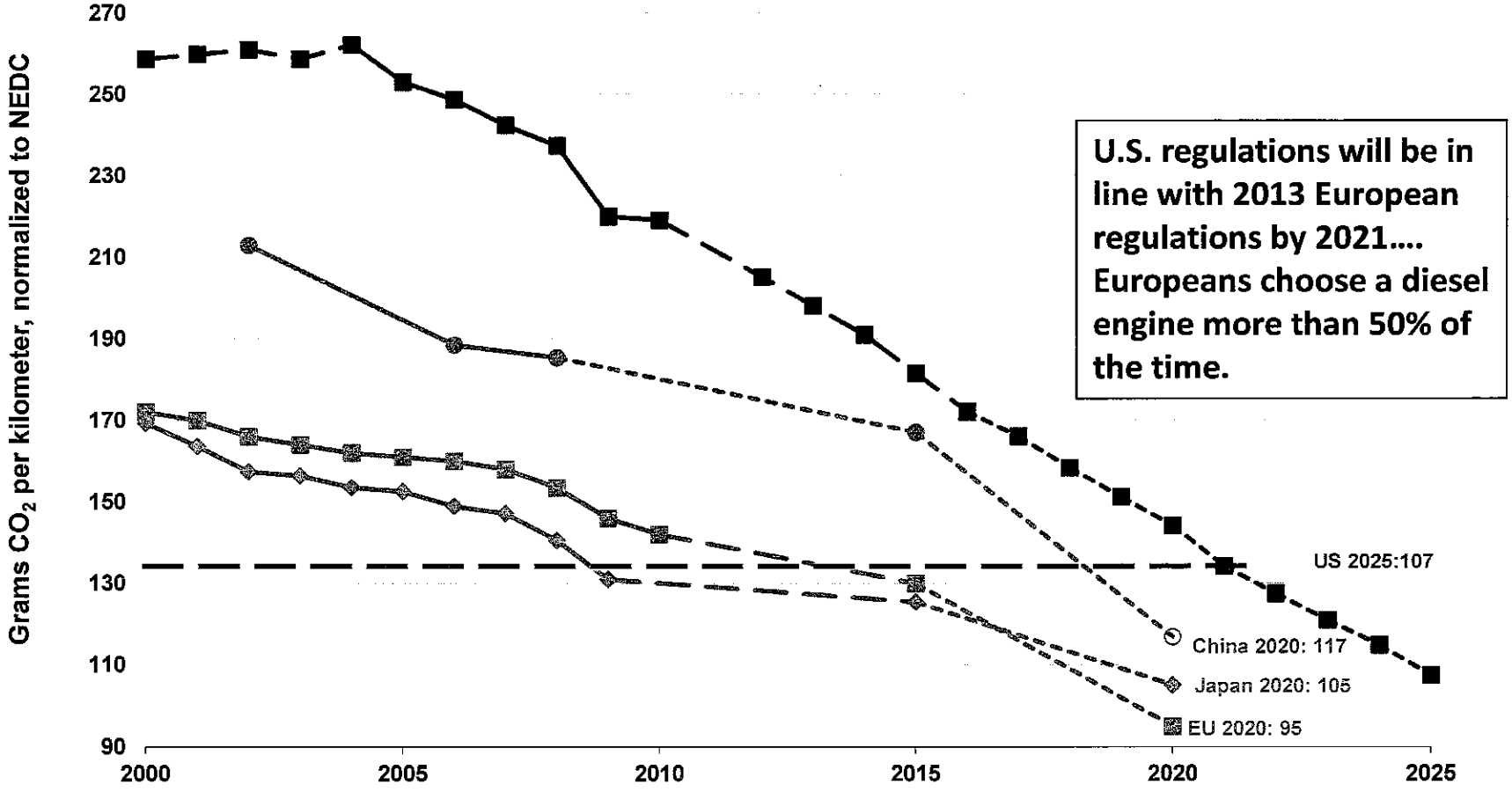
National – Heavy Duty

Vehicle to Diesel Buyer – Heavy Duty

Future CO_2 legislation will continue to require greater advances in technology.

Regulations ▪

Global Light Duty CO_2 Standards



U.S. regulations will be in line with 2013 European regulations by 2021…. Europeans choose a diesel engine more than 50% of the time.

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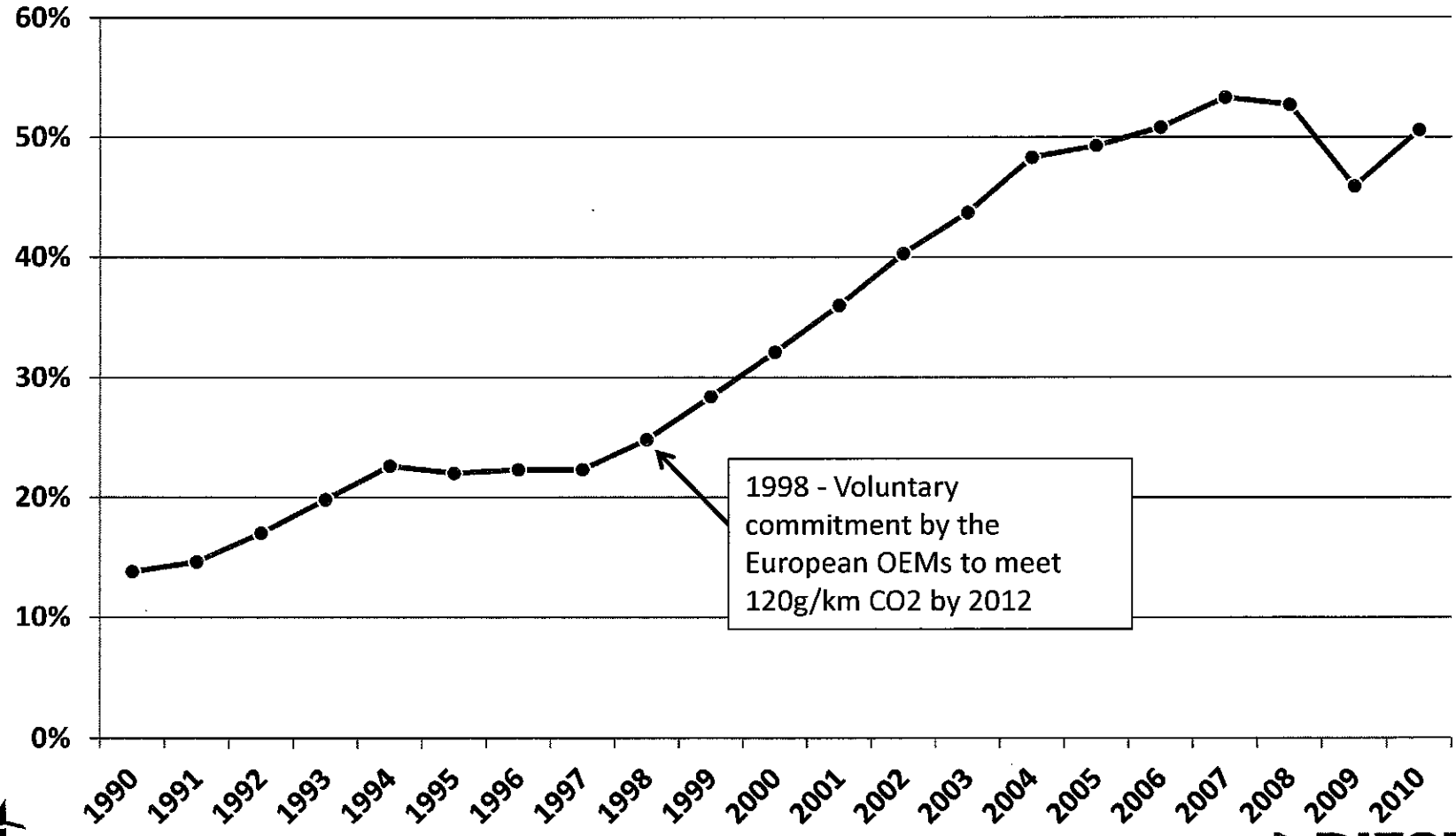
Diesel acceptance in Europe exploded with the introduction of direct injection and turbocharging to meet CO_2 objectives.

Historic Diesel Engine Market Share - Europe



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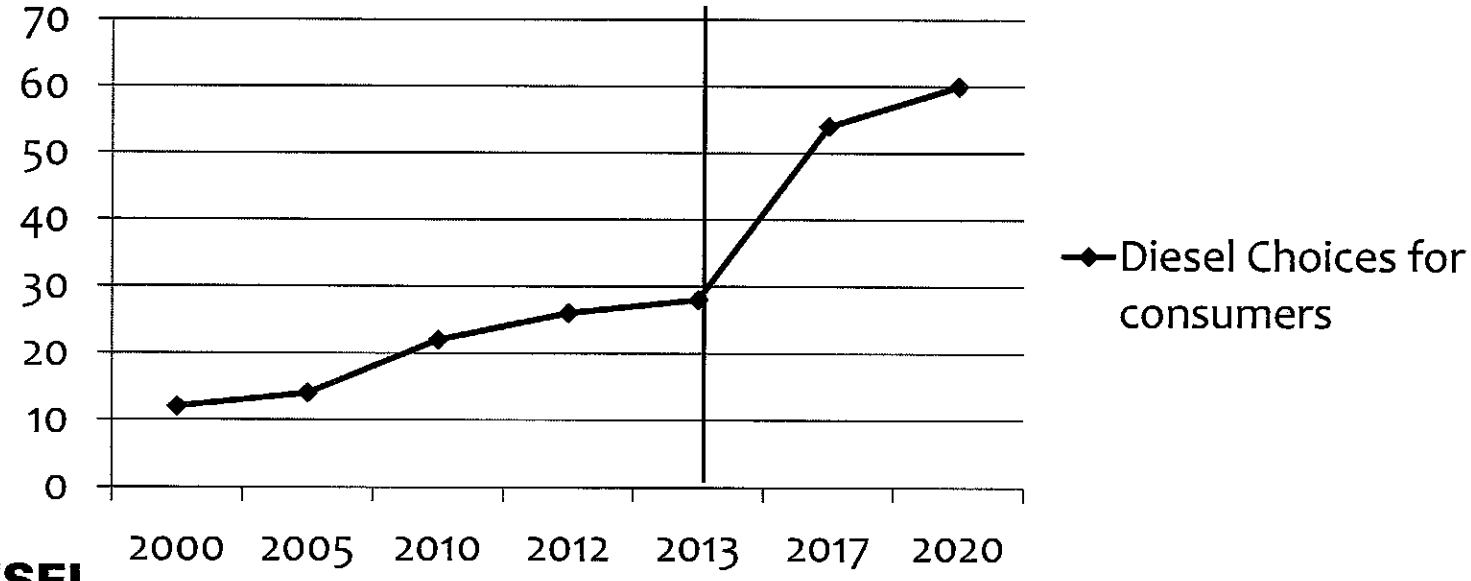
Twice as many clean diesel choices today.. More on the way

Diesel Choices for Consumers

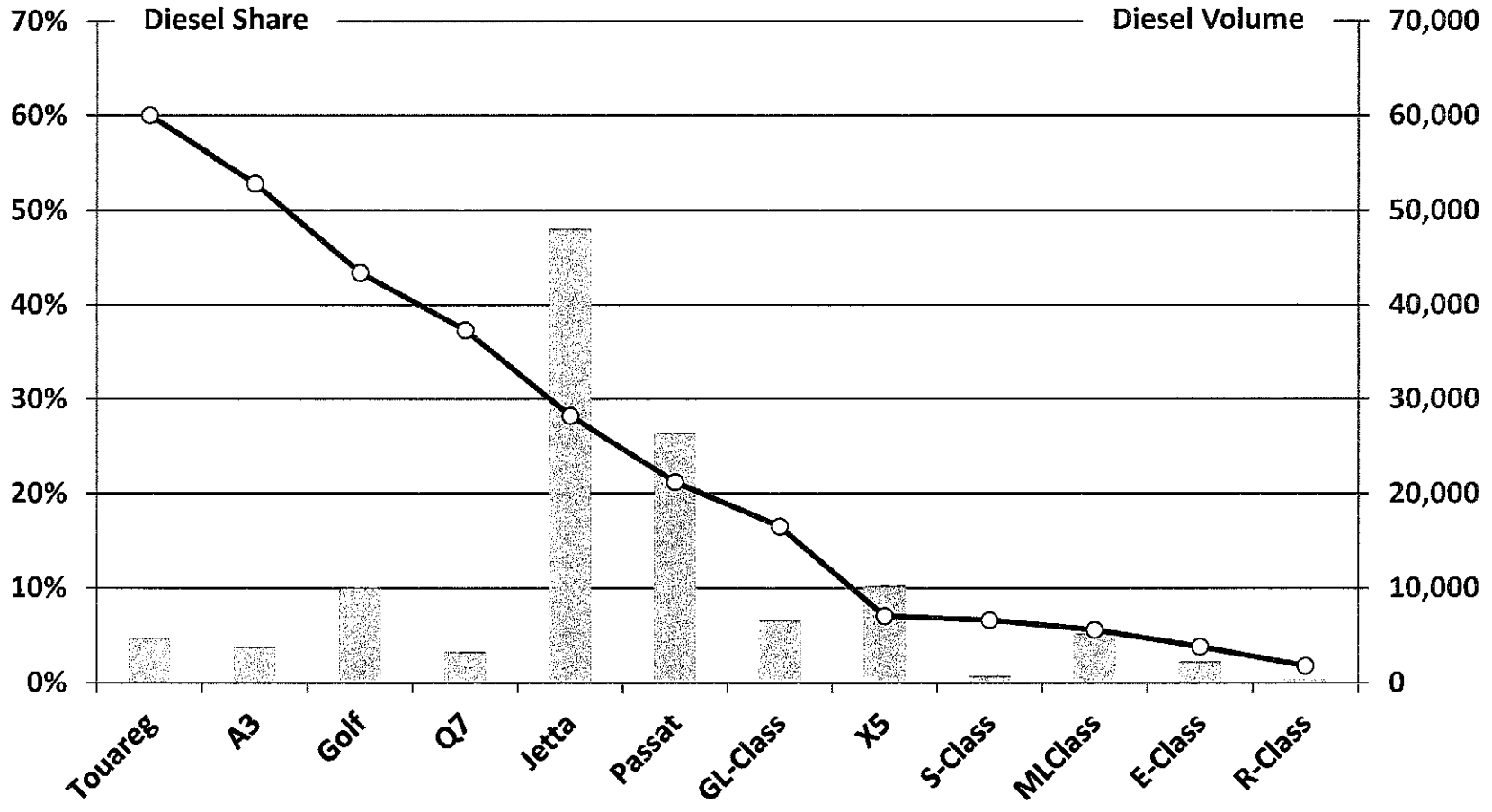
(Cars, SUVs, Vans and HD Diesel Pick Ups)



DIESEL TECHNOLOGY FORUM

New clean diesel engine sales show strong customer acceptance.

New Clean Diesel Engine Sales – 2012 U.S. Market



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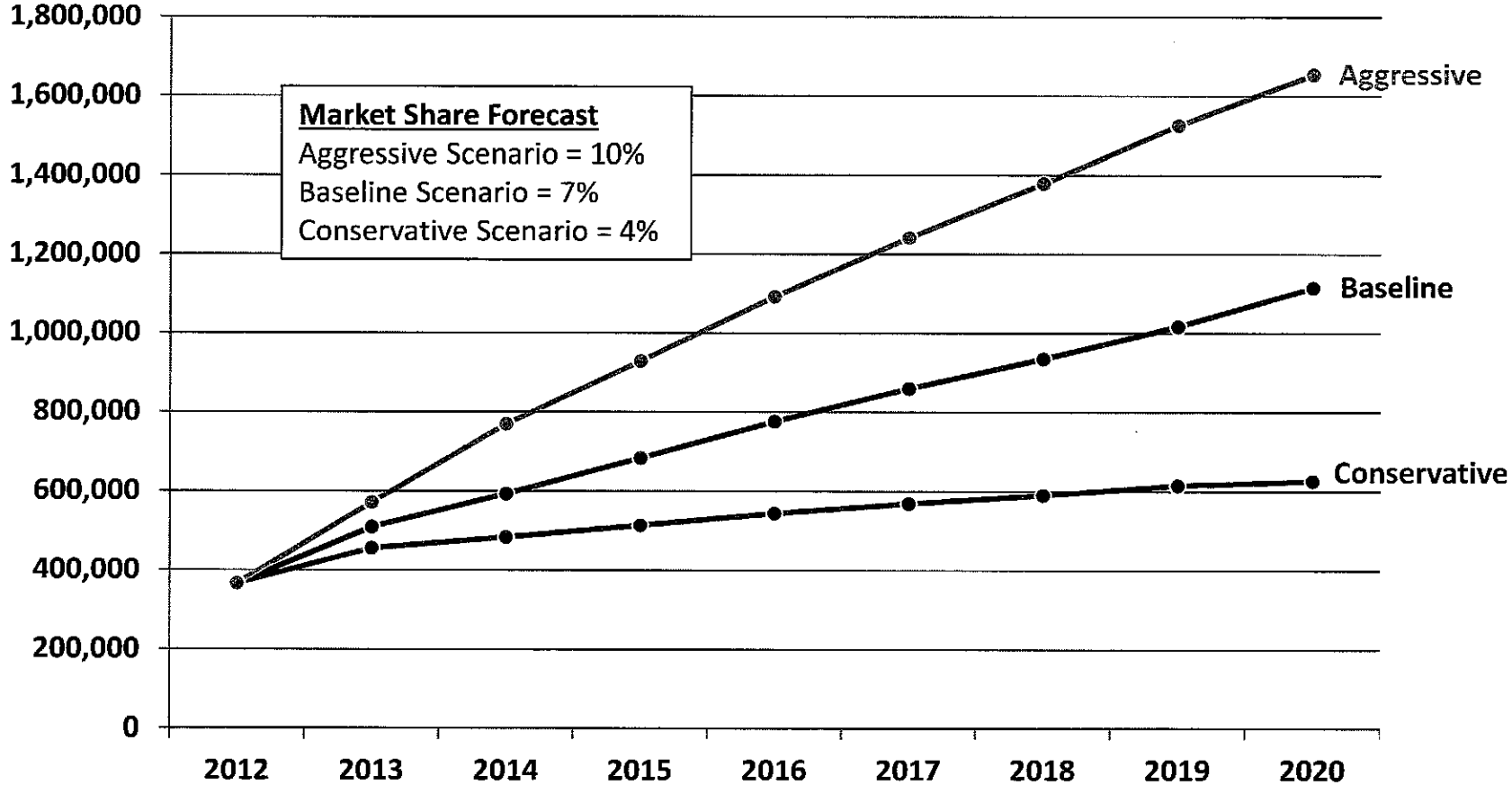
Sales based on http://www.hybridcars.com/december-2012-dashboard

DIESEL TECHNOLOGY FORUM

Baseline assumptions for diesel engine growth yield a 7% market share and over 1M new diesel sales per year by 2020.

Forecast

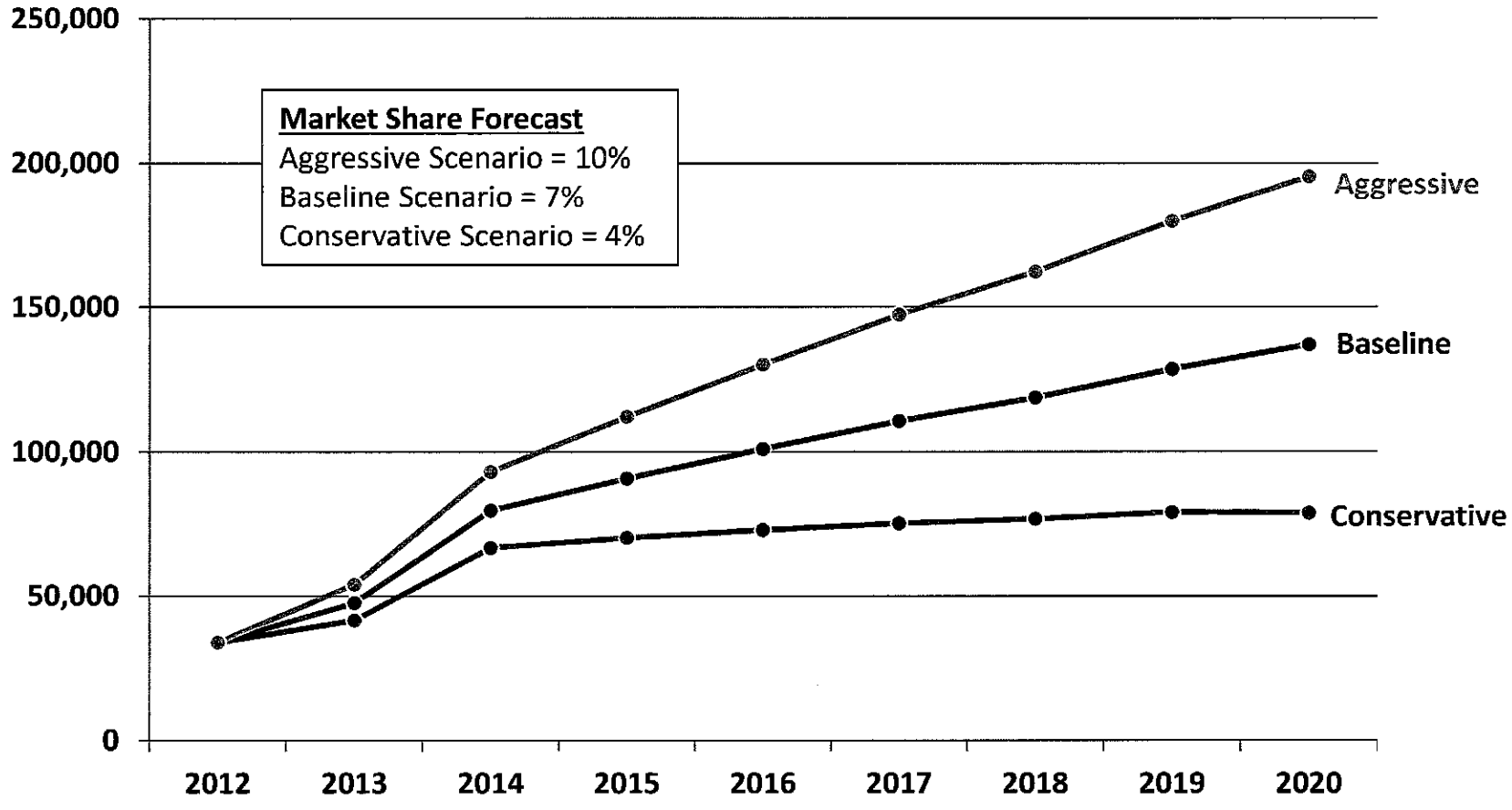
New Clean Diesel Engine Sales Forecast – U.S. Market



Total sales for cars, light trucks, and HD pickups based on future EPA compliance paths, fuel requirement changes under RFS2 and ARB LCFS and announced OEM diesel vehicle introductions.

Baseline assumptions for diesel engine growth yield a 7% market share and over 130,000 new diesel sales per year by 2020.

New Clean Diesel Engine Sales Forecast – California

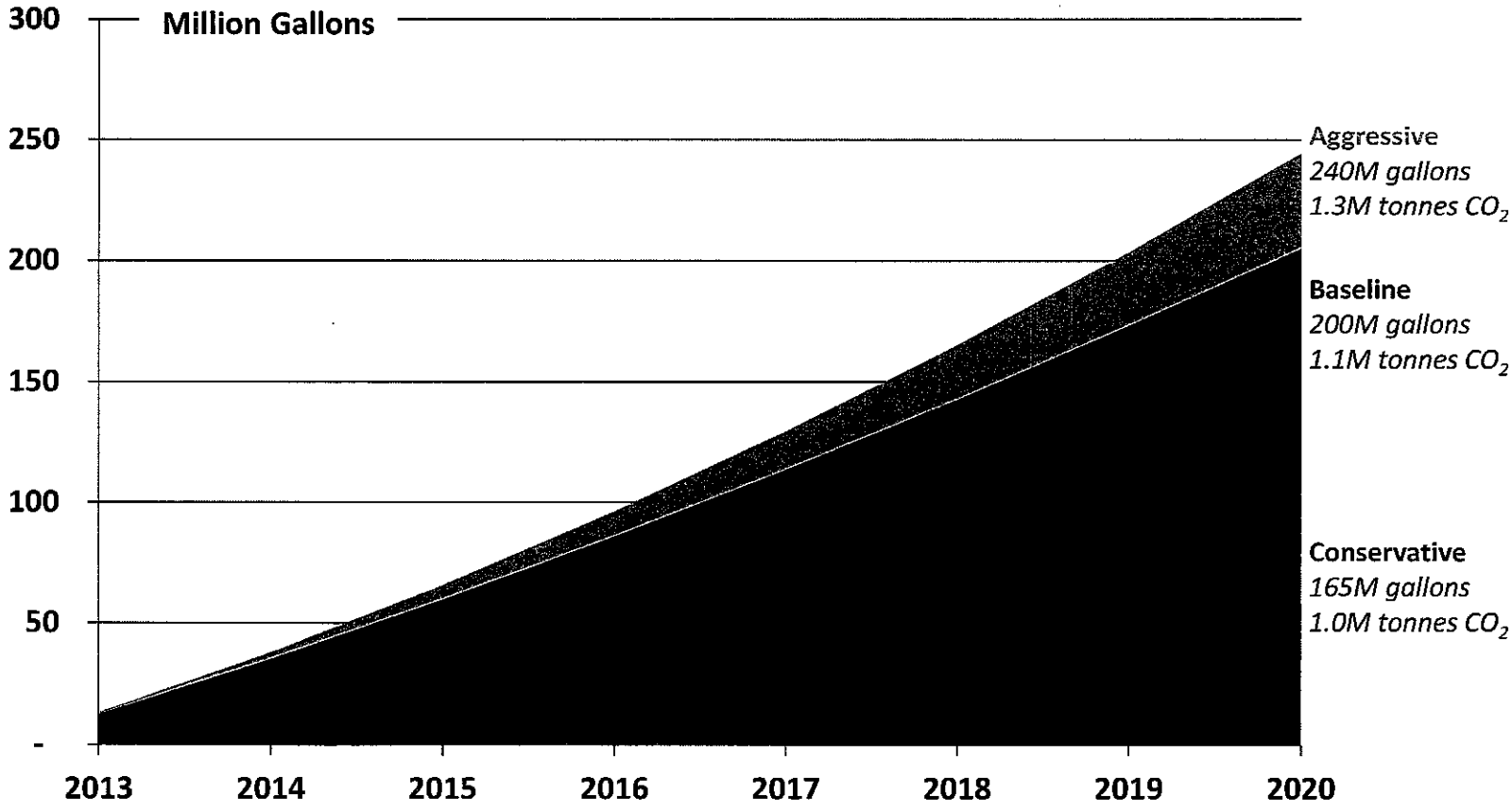


Total sales for cars, light trucks, and HD pickups based on future EPA compliance paths, fuel requirement changes under RFS2 and ARB LCFS and announced OEM diesel vehicle introductions.

Forecasted diesel savings for new diesel sales are expected to save 165-240M gallons of gasoline.

Forecast

Cumulative Diesel Engine Savings – California



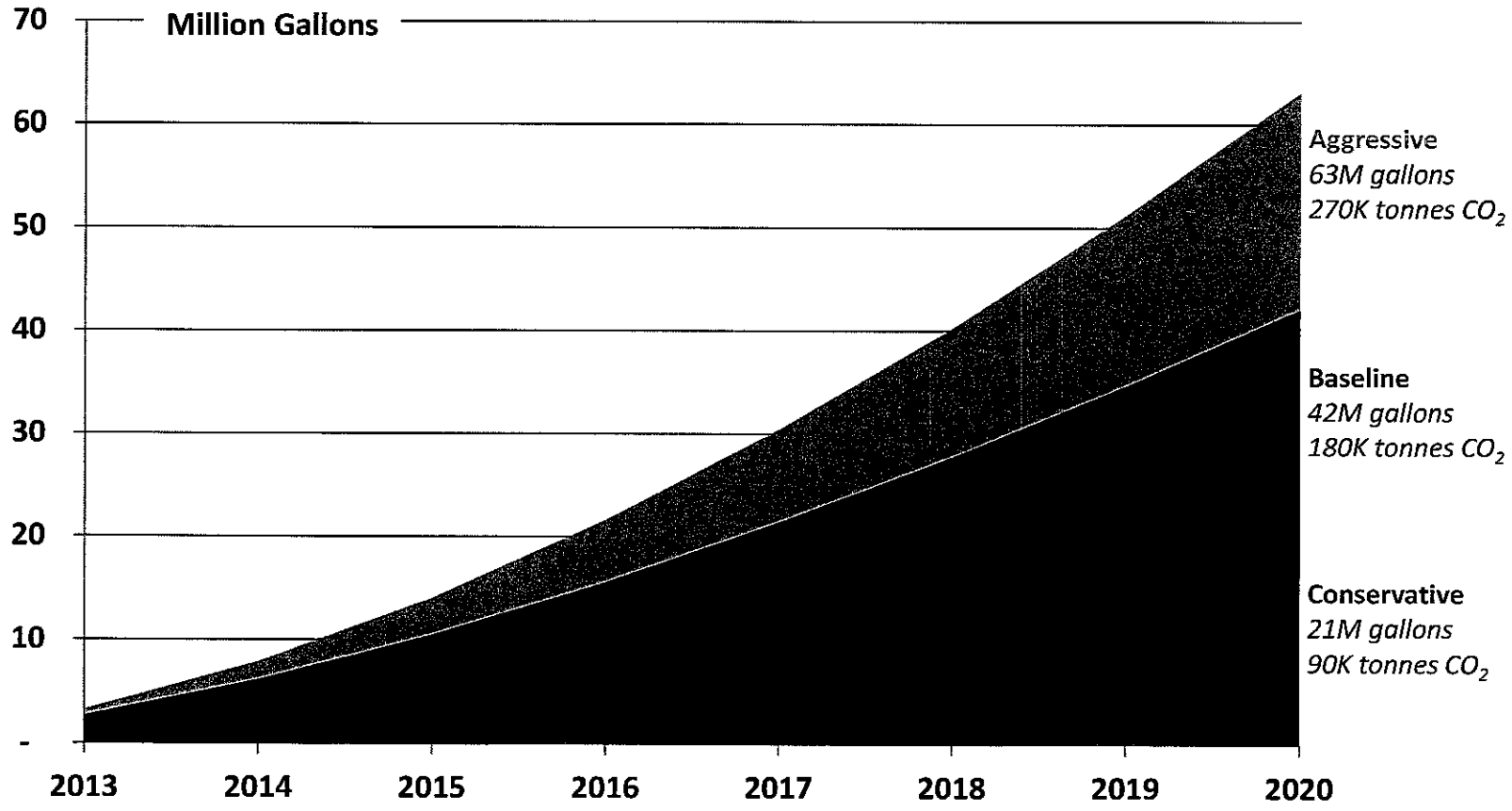
Total savings for cars, light trucks, and HD pickups
Assumes average VMT of 15,000 miles/year

Gasoline = 8,887gCO_2 /gal.
Diesel = 10,180gCO_2 /gal.

Forecasted diesel savings for new passenger car diesel sales are expected to save 21-63M gallons of gasoline.

Forecast

Cumulative Diesel Engine Savings – California Passenger Cars



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Total savings for passenger cars
Assumes average VMT of 15,000 miles/year

Gasoline = 8,887gCO_2 /gal.
Diesel = 10,180gCO_2 /gal.

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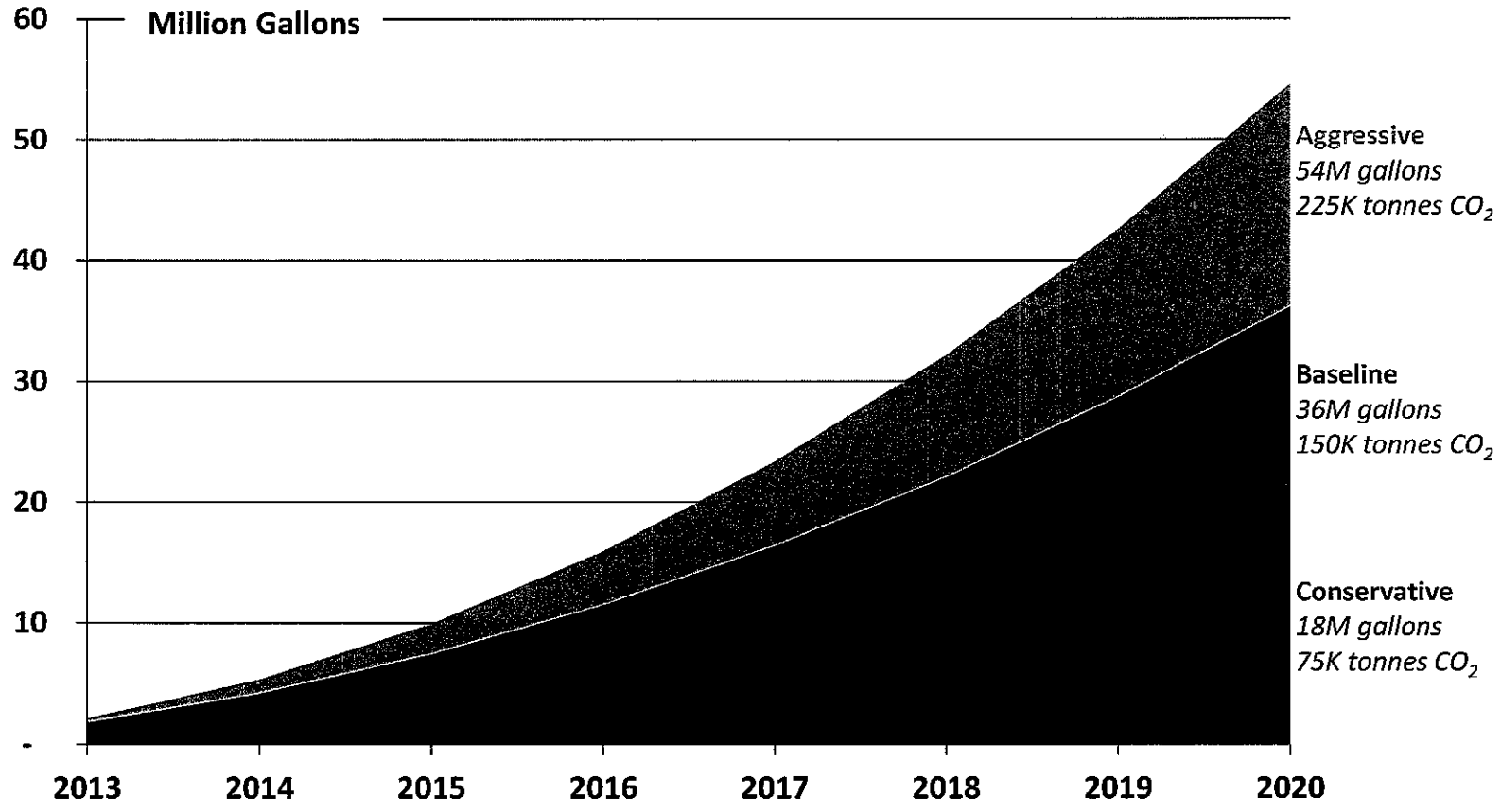
Forecasted diesel savings for new light truck diesel sales are expected to save 18-54M gallons of gasoline.

Forecast

Cumulative Diesel Engine Savings – California Light Trucks



Total savings for light trucks
Assumes average VMT of 15,000 miles/year

Gasoline = 8,887gCO_2 /gal.
Diesel = 10,180gCO_2 /gal.

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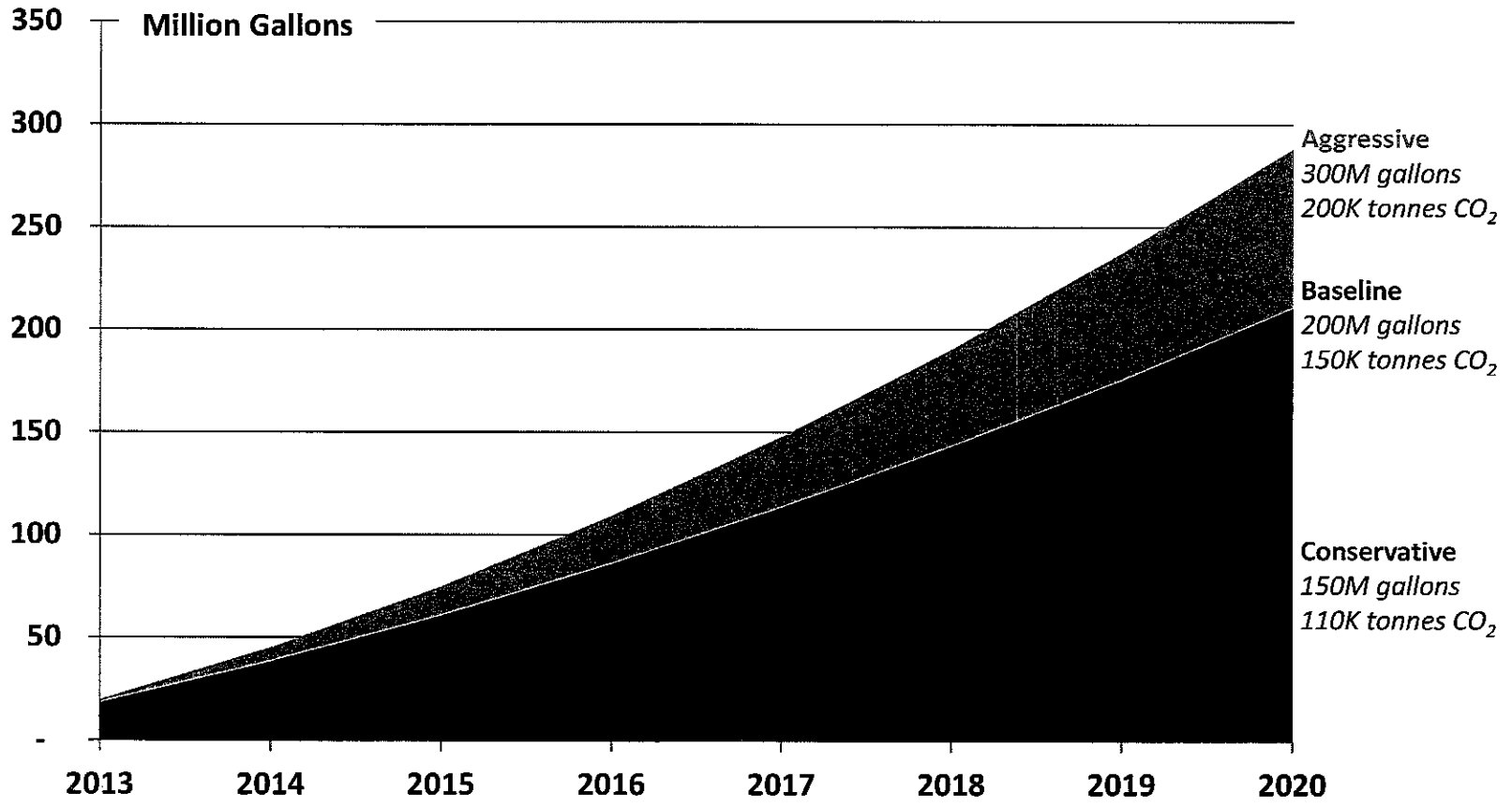
If all new light-duty diesel vehicles are fueled with B5 biodiesel, the US will save an additional 150-300M gallons as compared to diesel fuel alone.

Biodiesel

Cumulative B5 Biodiesel Fuel Savings – U.S. Market



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Total savings for cars, light trucks, and HD pickups
Assumes average VMT of 15,000 miles/year

Gasoline = 8,887gCO_2 /gal.
Diesel = 10,180gCO_2 /gal.
Biodiesel = 9,460gCO_2 /gal.

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Light-duty Diesel Engine Summary

2005-2012 light duty diesel engines have saved the American consumer:

- 7.6M tonnes of CO_2
- 1.2B gallons of gasoline
- 29M barrels of crude oil

Conservative estimates of fuel savings and CO2 reductions for new light duty diesel engines introduced between 2013-2020 will save American consumers an additional:

- 7.7M tonnes of CO_2
- 1.3B gallons of gasoline
- 31M barrels of crude oil

Increased usage of biodiesel will have an additional positive savings for America.

- Up to a conservatively estimated 260M gallons of gasoline

National – Heavy Duty

Heavy Duty Objectives

Goal is to understand the market adoption and benefits of Clean Diesel Engines (2007 and later MY) three key categories of trucks

- Line-haul trucks Class 8
- Medium duty pick up and delivery (classes 3-7)
- Vocational vehicles

For new clean diesel engines/trucks (produced after 2007):

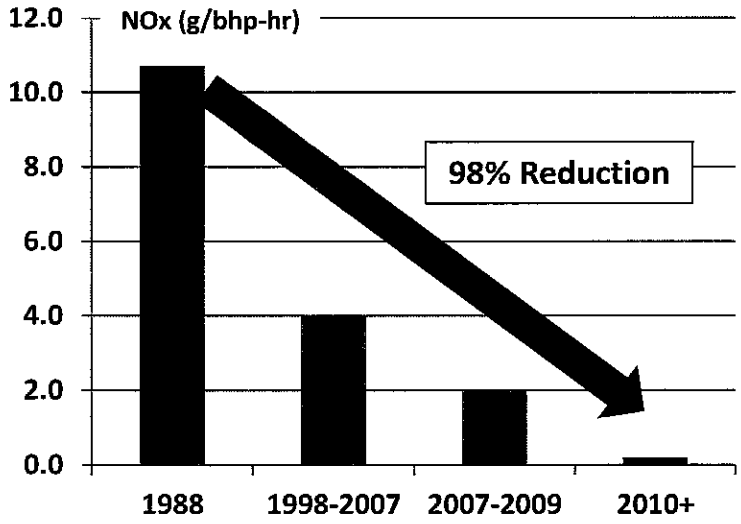
- What is the penetration of Clean Diesel trucks in the total population of commercial vehicles in operation, both on a 2007 and later model year basis and a 2010 and later model year basis, on a National basis and on a state by state basis ?
- What are the benefits - emissions reductions (NOx and PM and CO2) and fuel savings achieved from the adoption of the clean diesel trucks since 2007 on a nationwide and state by state basis?

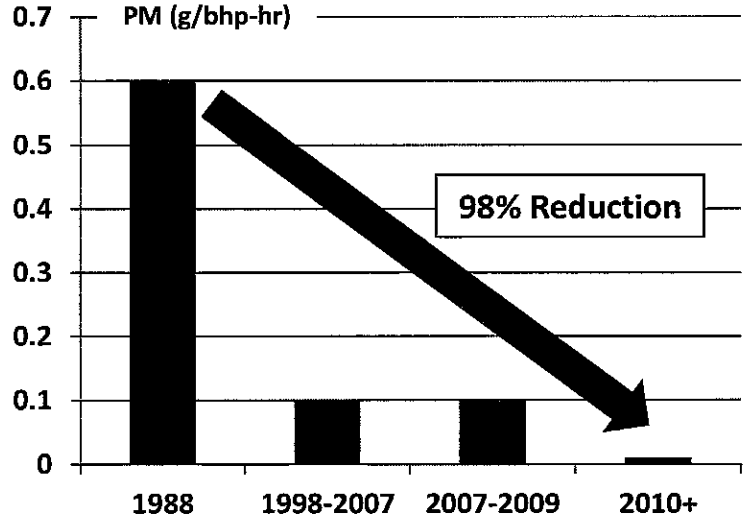
Based on available information on pre-2010 vehicles, generate an example for each key category of trucks listed above.

- A new (Class 8, pick up and delivery, or vocational) is getting on average 8.5 mpg; an X percent improvement over a pre-2010 similarly equipped vehicle.
- At an annual average mileage for this type of truck (125,000 miles per year), this translates into XXXX gallons of annual fuel savings, and a savings of $$ at 3.50 a gallon diesel and YY at $4.00 gallon diesel and ZZ at $4.25 gallon diesel.
- This annual fuel savings translates into XXXX fewer tons of CO2 emitted, on average for each class of truck.

New clean diesel engines have reduced NOx and PM emissions by more than 95% over the last 25 years.

U.S. Emission Standards – Heavy Duty Trucks





HD Emission Standard	NOx (g/bhp-hr)	PM (g/bhp-hr)
1988	10.7	0.6
1998-2007	4.0	0.1
2007-2009	2.0*	0.1
2010+	0.2	0.01

*Actual standard is NMHC*NOx with a 0.5g/bhp*hr maximum on NMHC

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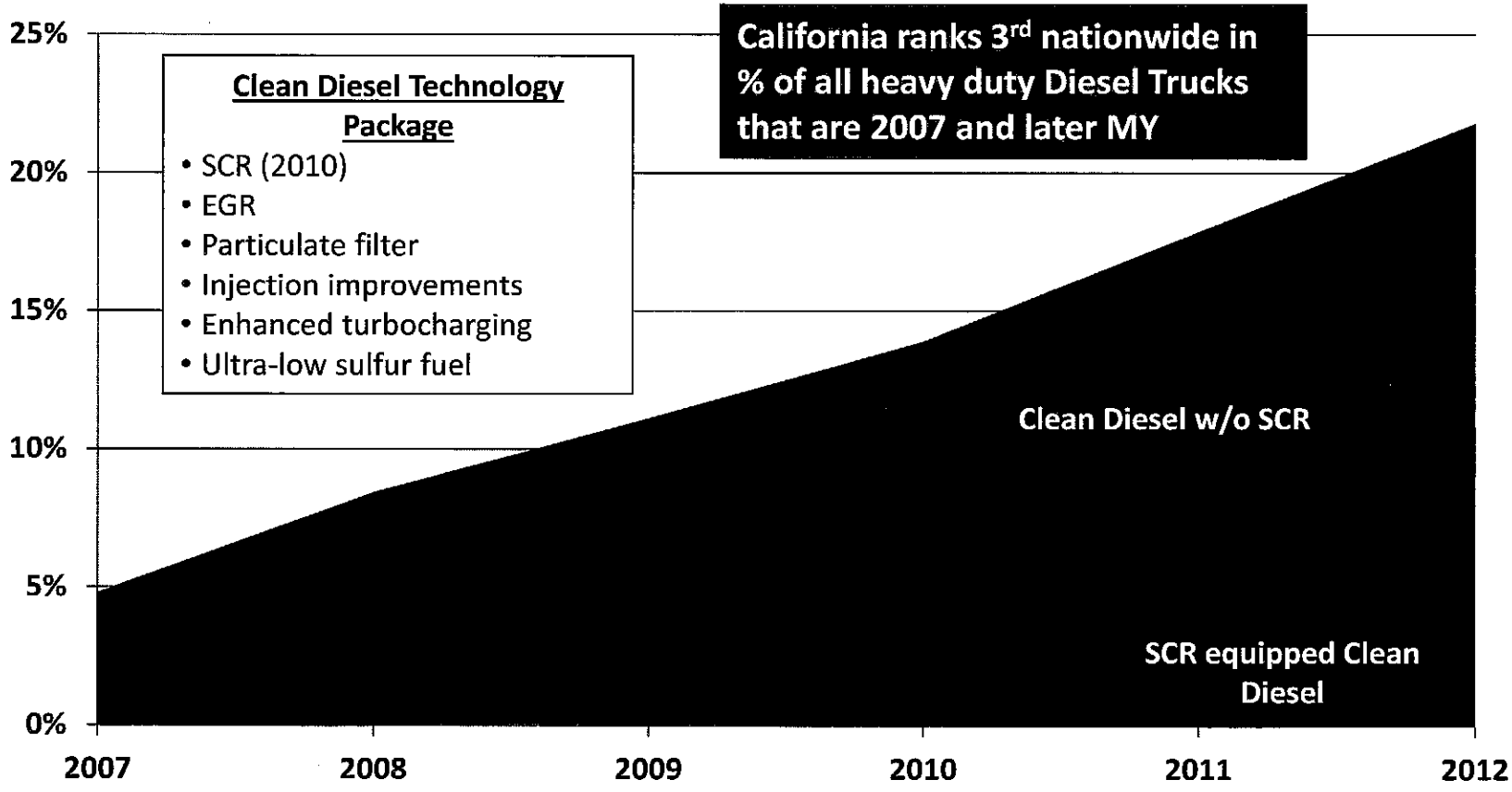
Over 20% of the 2012 heavy duty fleet are powered with new clean diesel engines built after 2006.

U.S. New Clean Diesel Engines in Operation – Heavy Duty



Based on Polk HD class 4-8 registrations and vehicles in operation for the U.S.

In-use emission rates for 2010MY and beyond class 4-8 trucks has dropped by over 90% since 2007.

U.S. In-use Emissions by Vehicle Class – Heavy Duty Trucks

Class	Example Production Vehicle	VMT Range	In-use NOx Emissions (g/mi)	In-use PM Emissions (g/mi)
4	Ford F-450	30-35,000	Pre-2007: 4.35 2007-2009: 1.66 2010+: 0.26	Pre-2007: 0.096 2007-2009: 0.0133 2010+: 0.013
5	Kenworth T170	30-40,000	Pre-2007: 4.55 2007-2009: 1.79 2010+: 0.28	Pre-2007: 0.085 2007-2009: 0.014 2010+: 0.014
6	Peterbilt Model 330	40-50,000	Pre-2007: 5.99 2007-2009: 2.20 2010+: 0.35	Pre-2007: 0.186 2007-2009: 0.017 2010+: 0.017
7	Kenworth T370	40-50,000	Pre-2007: 7.47 2007-2009: 2.73 2010+: 0.43	Pre-2007: 0.192 2007-2009: 0.022 2010+: 0.022
8	Freightliner Cascadia	110-140,000	Pre-2007: 9.19 2007-2009: 2.94 2010+: 0.50	Pre-2007: 0.233 2007-2009: 0.025 2010+: 0.025

Methodology Details

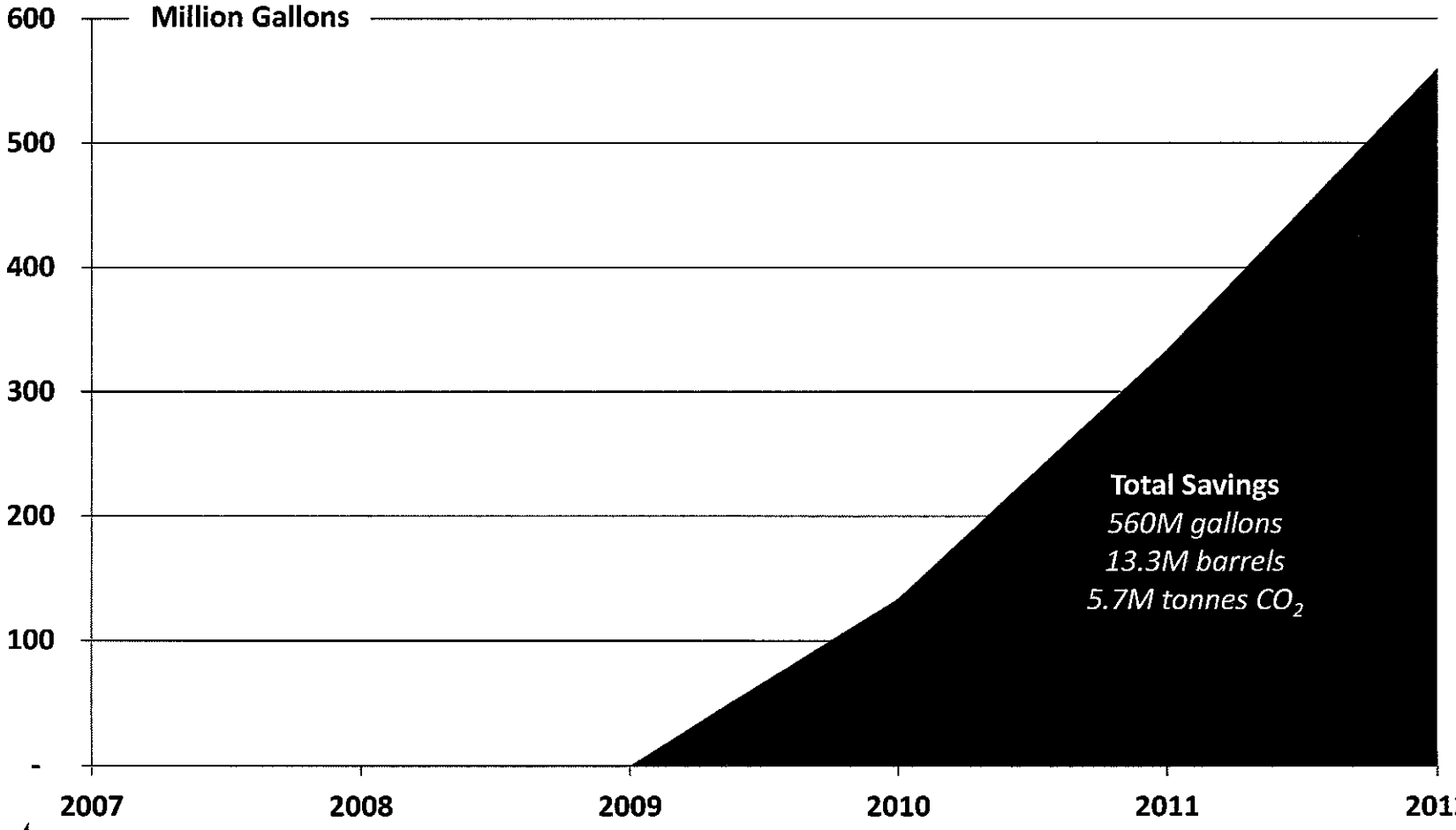
Due to the various different engines used by heavy truck manufactures, the EPA made the heavy duty certification standards engine based. These engine based standards, rated in g/bhp-hr, are converted by EPA for use in modeling emissions of the fleet through the MOBILE6 emission modeling software. The emission rates shown above (in g/mi) are based on the EPA's modeling of the heavy duty fleet output necessary for the MOBILE6 model. These factors combined with the average emission rates used by EPA to model the heavy duty fleet are used on the following pages to generate a fleet wide savings for new technology diesel engines operating in the U.S. today.

Source: "Average in-use emissions from heavy-duty trucks", Table 2, EPA420-F-08-027; "Update to the Accounting for the Tier 2 and Heavy-Duty 2005/2007 Requirements in MOBILE6", Table 16, EPA420-R-03-012

2010-2012 new clean diesel engines in heavy duty trucks have saved 5 million tonnes of CO_2.

U.S. Market

Cumulative Diesel Savings – Heavy Duty Trucks



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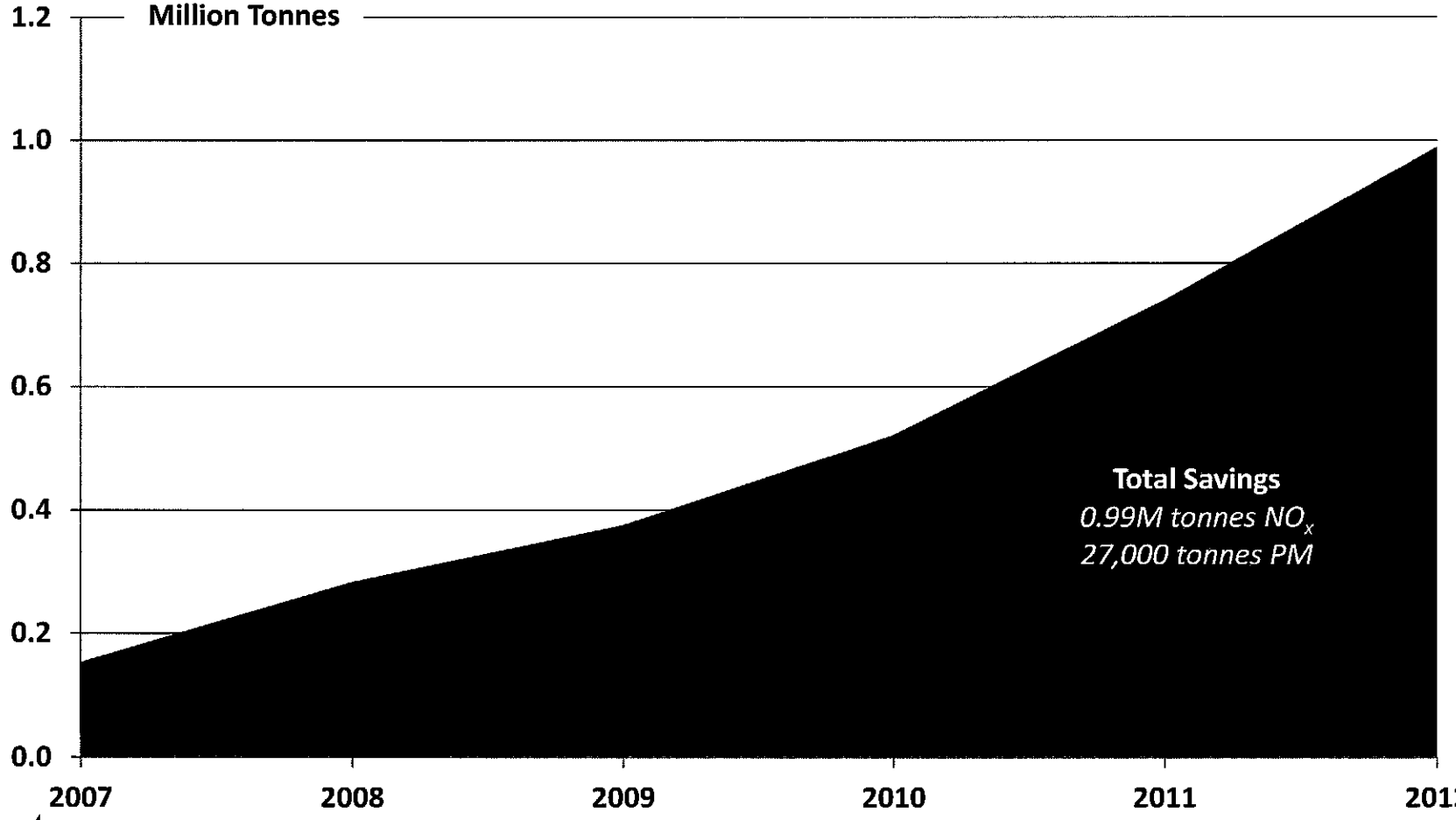
2007-2012 new clean diesel engines have removed 1 million tonnes of NOx from the atmosphere.

U.S. Market

Cumulative Diesel Savings – Heavy Duty Trucks



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Putting the numbers into perspective…

The 1.9M heavy-duty diesels introduced from 2007 through 2012 have saved the American consumer:

- 5.7M tonnes of CO_2
- 560M gallons of diesel
- 13.3M barrels of crude oil
- 1M tonnes of NOx
- 27,000 tonnes of PM

These reductions are equivalent to:

- Removing the CO_2 emissions from 1.2M light-duty vehicles from the road for one year
  - *NOx emissions from 87M and PM from 225M light-duty vehicles for one year*
- The CO_2 emissions from 235M home barbeque cylinders
- Carbon sequestration from 4.6M acres of forests
  - *This is an equivalent forest half the size of Maryland*
- Removing the annual CO_2 emissions from 1.6 coal fired power plants
  - *24,000 railcars of coal stretching continuously from New York City to Washington, DC*
  - *NOx emissions from 105 coal power plants*
- Roughly 5% of the Strategic Petroleum Reserve for sweet crude.

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Savings to Diesel Buyer – Light Duty

Savings to Diesel Buyer – Light Duty

Savings to Diesel Buyer – Light Duty

Methodology – Forecast

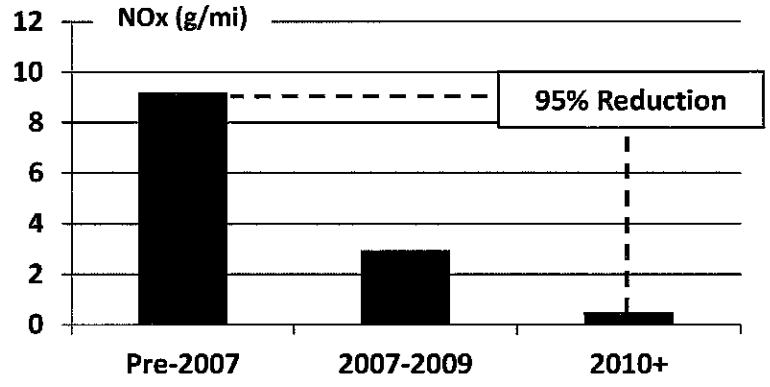
Savings to Diesel Buyer – Heavy Duty

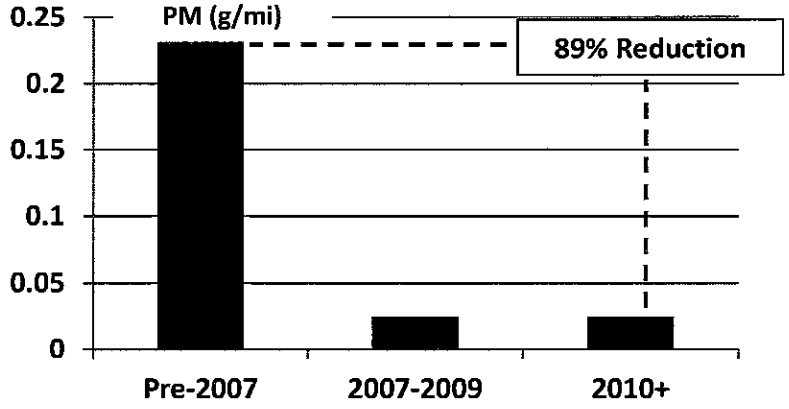
Savings to Diesel Buyer– Heavy Duty

New clean diesel engines in class 8 trucks save ~$3,500/year in fuel costs.

Class 8 Line Haul Savings from clean diesel

Savings to the new clean diesel buyer	Per Year
Average vehicle miles traveled	125,000
Fuel savings - gallons	875
Fuel savings - bbl	21
Fuel cost savings @ $4.00/gal	$3,500
CO_2 savings – metric tonnes	8.9
NO_x savings – metric tonnes	1.1
Particulate matter savings – kg	26





EPA estimates for in-use distance based output. Phase-in for 2004 and 2007 rulemaking is averaged across 2007-2009 and 2010 and beyond respectively. Pre-2007 estimates are based on an estimate of all vehicles in operation before 2007.

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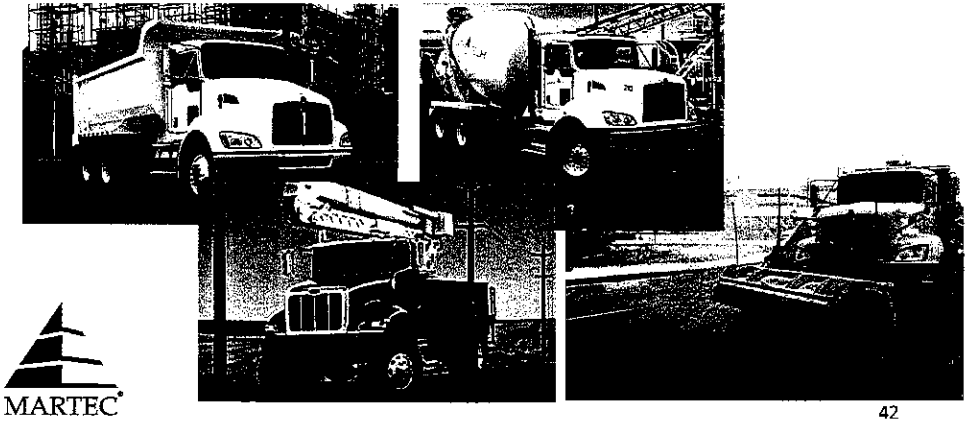
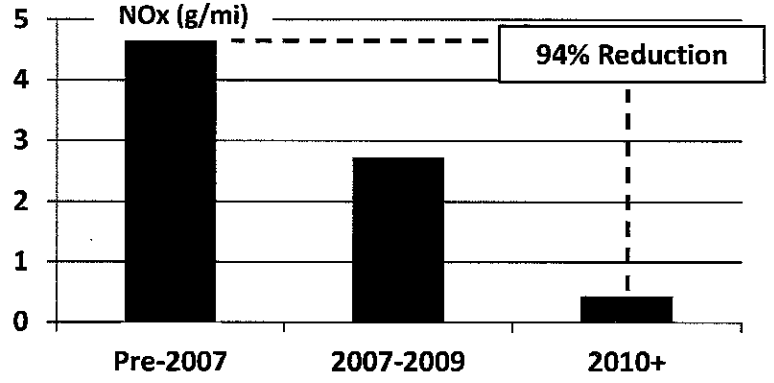
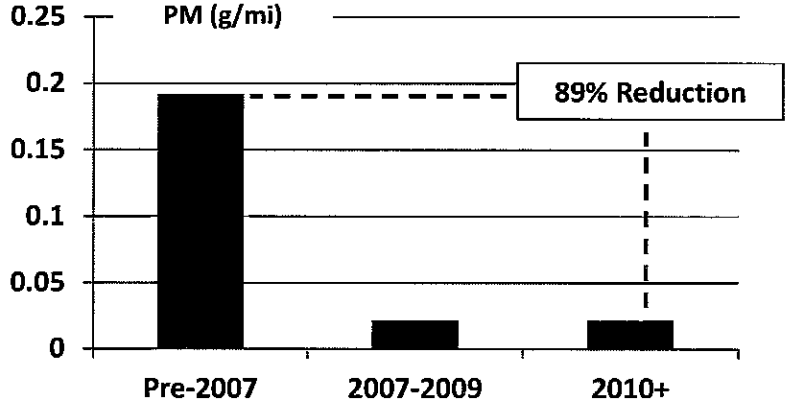
Class 7 vocational trucks with new clean diesel engines save 3.1 tonnes of CO2 per year.

Class 7 Vocational Savings from clean diesel

Savings to the new clean diesel buyer	Per Year
Average vehicle miles traveled	45,000
Fuel savings - gallons	310
Fuel savings - bbl	7
Fuel cost savings @ $4.00/gal	$1,240
CO_2 savings – metric tonnes	3.1
NO_x savings – metric tonnes	0.32
Particulate matter savings – kg	8







EPA estimates for in-use distance based output. Phase-in for 2004 and 2007 rulemaking is averaged across 2007-2009 and 2010 and beyond respectively. Pre-2007 estimates are based on an estimate of all vehicles in operation before 2007.

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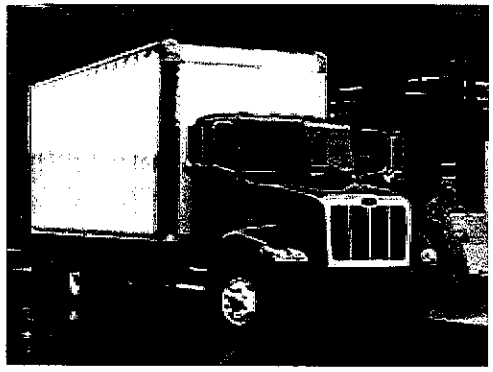
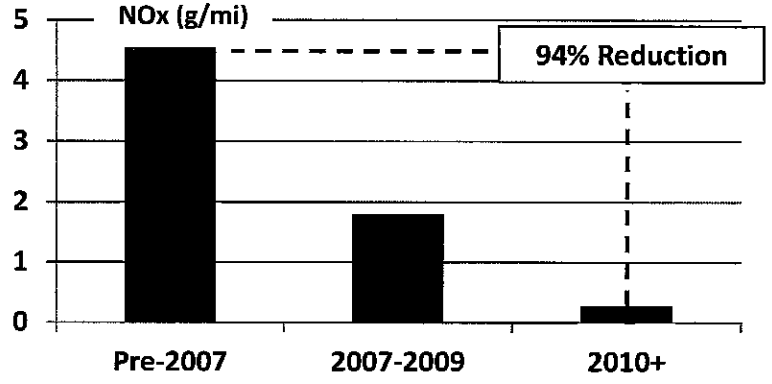
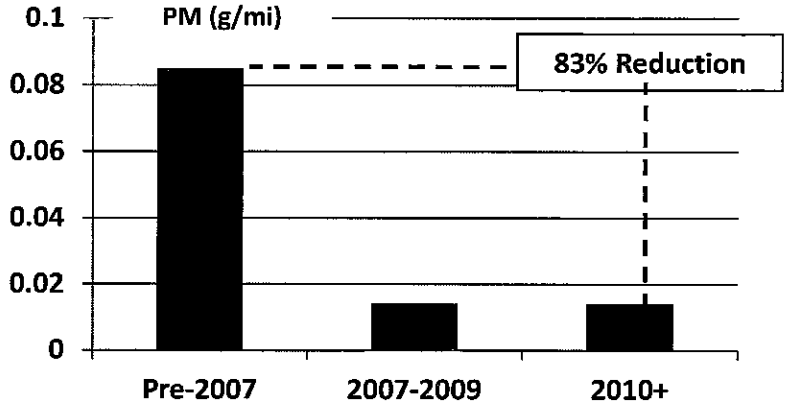
Pick up and delivery vehicles have achieved a 20X reduction in real world NOx emissions with new clean diesel engines.

Class 5 Pick Up & Delivery Savings from Clean Diesel

Savings to the new clean diesel buyer	Per Year
Average vehicle miles traveled	35,000
Fuel savings - gallons	160
Fuel savings - bbl	4
Fuel cost savings @ $4.00/gal	$640
CO_2 savings – metric tonnes	1.6
NO_x savings – metric tonnes	0.15
Particulate matter savings – kg	2







EPA estimates for in-use distance based output. Phase-in for 2004 and 2007 rulemaking is averaged across 2007-2009 and 2010 and beyond respectively. Pre-2007 estimates are based on an estimate of all vehicles in operation before 2007.

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Conclusions

DIESEL TECHNOLOGY FORUM

Summary

* Transformation to clean diesel fuel and engine technology, the significant penetration of diesel in key sectors of California's economy, and the inherent energy efficiency, positions diesel to play a key role in meeting future GHG and clean air objectives in California.
* Significant fuel savings and clean air benefits are accruing from existing new clean diesel engines, and have already saved California 2.5M barrels of oil and 0.7 million tonnes of CO2.
* Increasing use of diesel in passenger cars, light trucks and SUVs will deliver significant future national savings, in the range of displacing 31 Million bbl of crude oil (1.3 Billion gallons gasoline).

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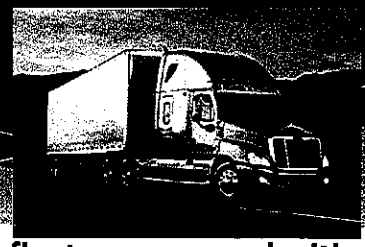
Summary – National



2005-2012 light duty diesel engines have saved the American consumer:

- 7.6M tonnes of CO_2
- 1.2B gallons of gasoline
- 29M barrels of crude oil

Conservative estimates of fuel savings and CO2 reductions for new light duty diesel engines introduced between 2013-2020 will save American consumers an additional:

- 7.7M tonnes of CO_2
- 1.3B gallons of gasoline
- 31M barrels of crude oil

Increased usage of biodiesel will have an additional positive savings for America.

- Up to a conservatively estimated 260M gallons of gasoline.

Over 20% of the 2012 heavy duty fleet are powered with new clean diesel engines built after 2006.

- Over 95 % reductions in NOx and PM over the last 25 years.
- Savings from 2006-2012:
  - *~1M tonnes NOx, or emissions from 105 coal power plants over one year.*
  - *27,000 tonnes of particulate matter, or emissions from 225 light duty vehicles*

~ 11% of all on-highway diesel engines in operation are built after 2010 and equipped with SCR emission control technology saving GHG and fuel. This fuel savings equates to:

- 560M gallons of diesel, average class 8 truck savings of ~$3,500/year
- 13.3M barrels of crude, roughly 5% of the SPR for sweet crude
- 5.7M tonnes of CO_2, the carbon sequestration from a forest half the size of Maryland

Summary – California

CURRENT : 2005-2012 light duty diesel engines have saved California:

- 7.6M tonnes of CO_2
- 1.2B gallons of gasoline
- 29M barrels of crude oil

FUTURE: Conservative estimates of fuel savings and CO2 reductions for new light duty diesel engines introduced between **2013-2020** will save California consumers an additional:

- 165 M to 240 M gallons of Gasoline
- 1.0M to 1.3M tonnes CO2

New generation clean diesel Heavy-duty vehicles now account for 21.1 % of all HD vehicles registered in CA *(805,542)*

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Diesel to be # 1 Transport Fuel by 2020

ExxonMobil: Diesel will surpass gasoline as the number one global transportation fuel by 2020. Diesel demand will account for 70% of the growth in demand for all transportation fuels through the forecast period to 2040. Although natural gas will play a greater role as a transportation fuel by 2040, it will remain only a small share of the global transportation fuel mix, at 4 percent by 2040, up from today's 1 percent, according to ExxonMobil's forecast.

The World Energy Outlook: Diesel fuel will remain the "dominant" growth fuel between now and 2035, according to the International Energy Agency. Globally, the report suggests the possibility of only a two percent share of natural gas in the heavy-duty transport market by 2035.

The National Petroleum Council in its 2012 report "Advancing Technology for America's Transportation Future" for the U.S. Department of Energy stated: "Diesel engines will remain the powertrain of choice for HD (heavy-duty) vehicles for decades to come because of their power and efficiency."

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Thank You

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