Chapter 3.

HEAVY TRUCKS

Page

Contents

What Types of Trucks Are in Each Truck Class? 91
Heaviest Trucks Consume an Average of 6.5 Gallons per Thousand Ton-Miles 92
Medium and Heavy Truck Assembly Plants Are Located Throughout the United States 93
Class 3 Truck Sales Are Up in 2012 94
Class 4-7 Truck Sales Still Below 2008 Level 95
Class 8 Truck Sales Continue to Grow 96
Diesel Engine Use Declines for Class 4 Trucks 97
Cummins Supplies Diesel Engines for Many Manufacturers 98
Cummins Leads Heavy Truck Diesel Engine Market 99
Combination Trucks Average Over 66,000 Miles per Year 100
Study Conducted of Heavy Trucks at Steady Speed on Flat Terrain 101
Roadway Grade Affects Fuel Economy of Class 8 Trucks 102
Idling a Truck-Tractor's Engine Can Use a Gallon of Fuel per Hour 103
Truck Stop Electrification Reduces Idle Fuel Consumption 104
SuperTruck Project Achieves 10.7 Miles per Gallon 105

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What Types of Trucks Are in Each Truck Class?

There are eight truck classes, categorized by the gross vehicle weight rating that the vehicle is assigned when it is manufactured. The pictures below show examples of some of the different types of trucks that would be included in each class.

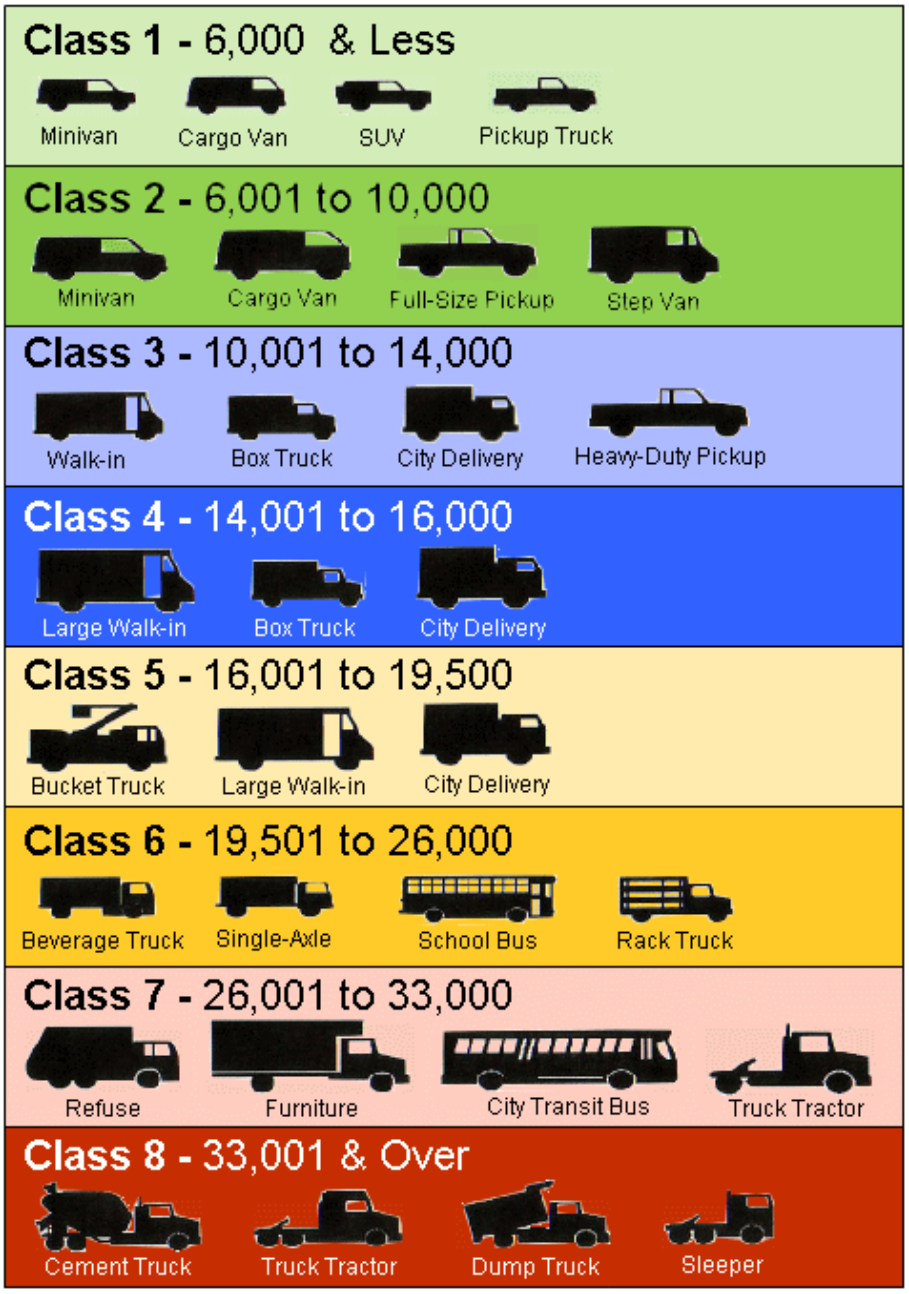

FIGURE 71. Examples of Trucks in Each Truck Class

Source:
Oak Ridge National Laboratory, Center for Transportation Analysis, Oak Ridge, TN. Weight category definitions from 49CFR565.6 (2000)

Heaviest Trucks Consume an Average of 6.5 Gallons per Thousand Ton-Miles

There are eight truck classes, categorized by the gross vehicle weight rating (GVWR) that the vehicle is assigned when it is manufactured. Cars and small pickups, vans, and sport-utility vehicles (SUVs) are shown here for comparison. Two truck classes are further subdivided into "a" and "b" designations. Class 2a and 2b are subdivided based on GVWR. Class 8a and 8b are subdivided based on the truck design (straight truck vs. combination truck).

TABLE 25. Typical Weights and Fuel Use by Truck Class

Class	Applications	Gross Weight Range (lbs.)	Empty Weight Range (lbs.)	Typical Payload Capacity Max (lbs.)	Typical Fuel Economy Range in 2007 (mpg)	Typical Fuel Consumed (gallons per thousand ton-miles)
1c	Cars *only*	3,200 - 6,000	2,400 - 5,000	250 - 1,000	25-33	69.0
1t	Minivans, Small SUVs, Small Pickups	4,000 - 6,000	3,200 - 4,500	250 - 1,500	20-25	58.8
2a	Large SUVs, Standard Pickups	6,001 - 8,500	4,500 - 6,000	250 - 2,500	20-21	38.5
2b	Large Pickups, Utility Van, Multi-Purpose, Mini-Bus, Step Van	8,501 - 10,000	5,000 - 6,300	3,700	10-15	38.5
3	Utility Van, Multi-Purpose, Mini-Bus, Step Van	10,001 - 14,000	7,650 - 8,750	5,250	8-13	33.3
4	City Delivery, Parcel Delivery, Large Walk-In, Bucket, Landscaping	14,001 - 16,000	7,650 - 8,750	7,250	7-12	23.8
5	City Delivery, Parcel Delivery, Large Walk-In, Bucket, Landscaping	16,001 - 19,500	9,500 - 10,800	8,700	6-12	25.6
6	City Delivery, School Bus, Large Walk-In, Bucket	19,501 - 26,000	11,500 - 14,500	11,500	5-12	20.4
7	City Bus, Furniture, Refrigerated, Refuse, Fuel Tanker, Dump, Tow, Concrete, Fire Engine, Tractor-Trailer	26,001 - 33,000	11,500 - 14,500	18,500	4-8	18.2
8a	Straight Trucks, e.g., Dump, Refuse, Concrete, Furniture, City Bus, Tow, Fire Engine	33,001 - 80,000	20,000 - 34,000	20,000 - 50,000	2.5-6	8.7
8b	Combination Trucks, e.g., Tractor-Trailer: Van, Refrigerated, Bulk Tanker, Flat Bed	33,001 - 80,000	23,500 - 34,000	40,000 - 54,000	4-7.5	6.5

Source:

The National Academies, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles*, 2010. http://www.nap.edu/catalog.php?record_id=12845

Medium and Heavy Truck Assembly Plants Are Located Throughout the United States

There are seven major manufacturers of class 7 and 8 trucks in the United States – Freightliner/Western Star, Hino, International, Kenworth, Mac, Peterbilt and Volvo. Two of those, Freightliner and International, also manufacture medium trucks (classes 3-6), along with Isuzu.

TABLE 26. Production of Medium and Heavy Trucks by Manufacturer, 2012

Freightliner & Western Star	Hino	International	Kenworth	Mack	Peterbilt	Volvo	Isuzu
56.9	8.2	41.0	32.7	25.0	29.4	26.1	2.6

Note: Production not available by plant site. Production not available for NEOPLAN, Sprinter, and Thomas.

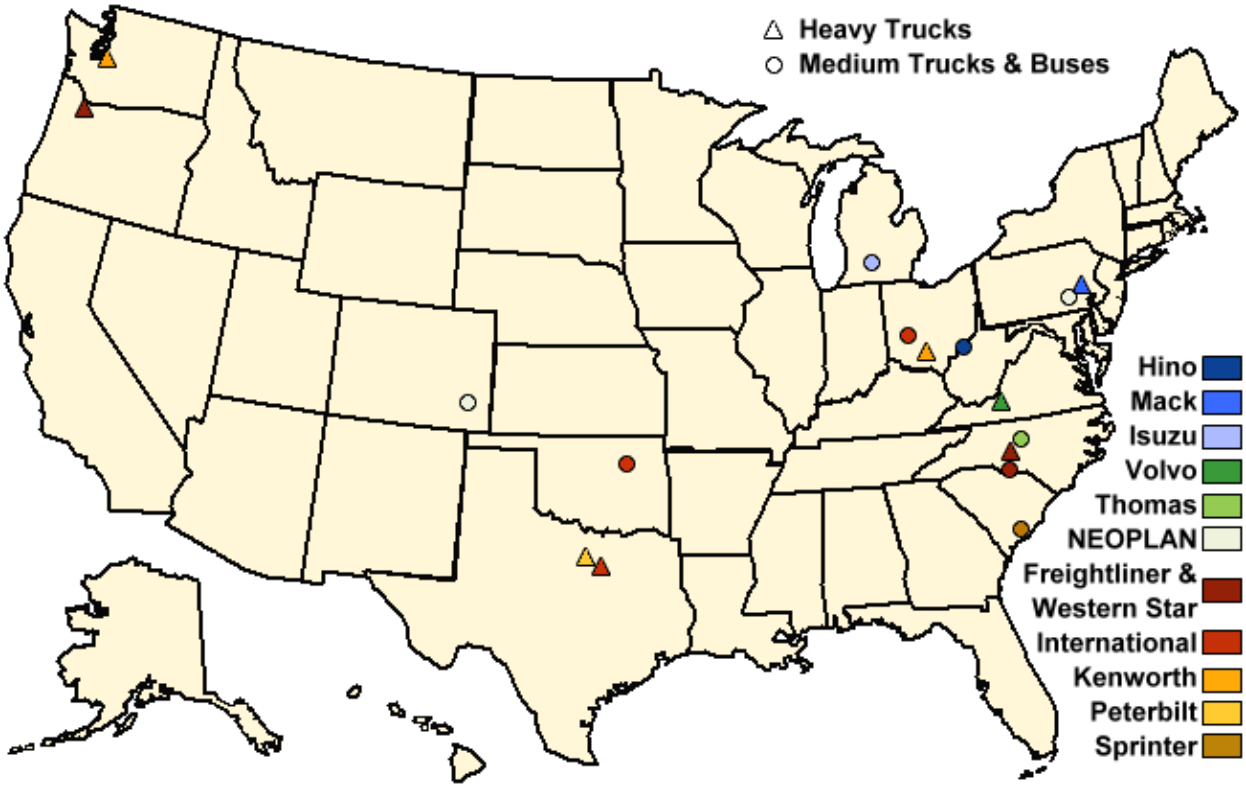

FIGURE 72. Heavy Truck Manufacturing Plants by Location, 2013

Source:
Ward's Autodata. http://wardsauto.com

Class 3 Truck Sales Are Up in 2012

Class 3 truck sales fell with the economy in 2008 and 2009, but recovered in 2010 through 2012. In fact, 2012 sales were 19% above 2008 sales. Chrysler, Ford, and General Motors continue to dominate the class 3 market.

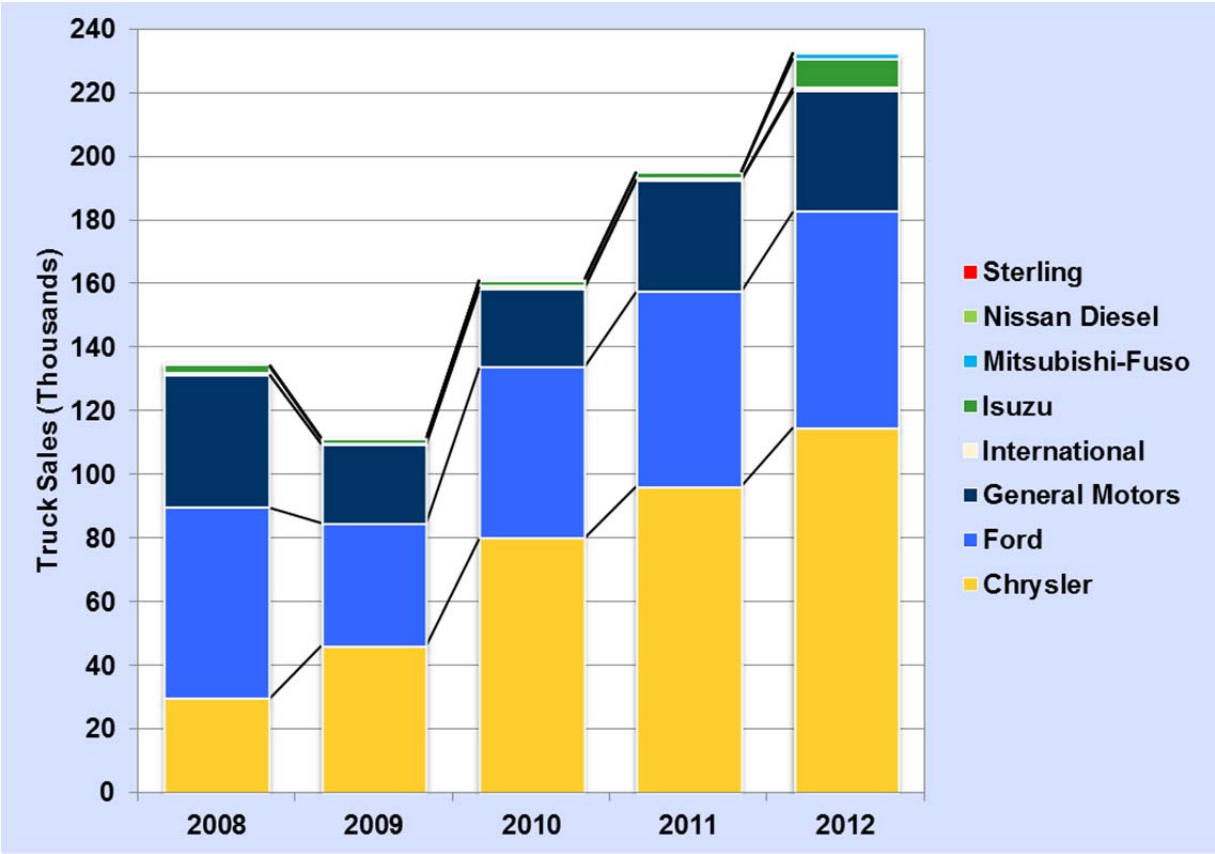

FIGURE 73. Class 3 Truck Sales by Manufacturer, 2008-2012

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2013*, Southfield, MI, 2013.
http://wardsauto.com

Class 4-7 Truck Sales Still Below 2008 Level

Though the sales of class 4-7 trucks continued to increase in 2012, they were still 5% below the 2008 level. However, most companies kept their market share of the significantly lower market, with General Motors (GM) being the notable exception. In 2008 GM sold almost 25,000 class 4-7 trucks, while in 2012 they sold none. Freightliner, Hino, Isuzu, Peterbilt, Ford, and Kenworth all gained one to three percent of the market share after GM's decline. Chrysler gained seven percent from 2008 to 2012.

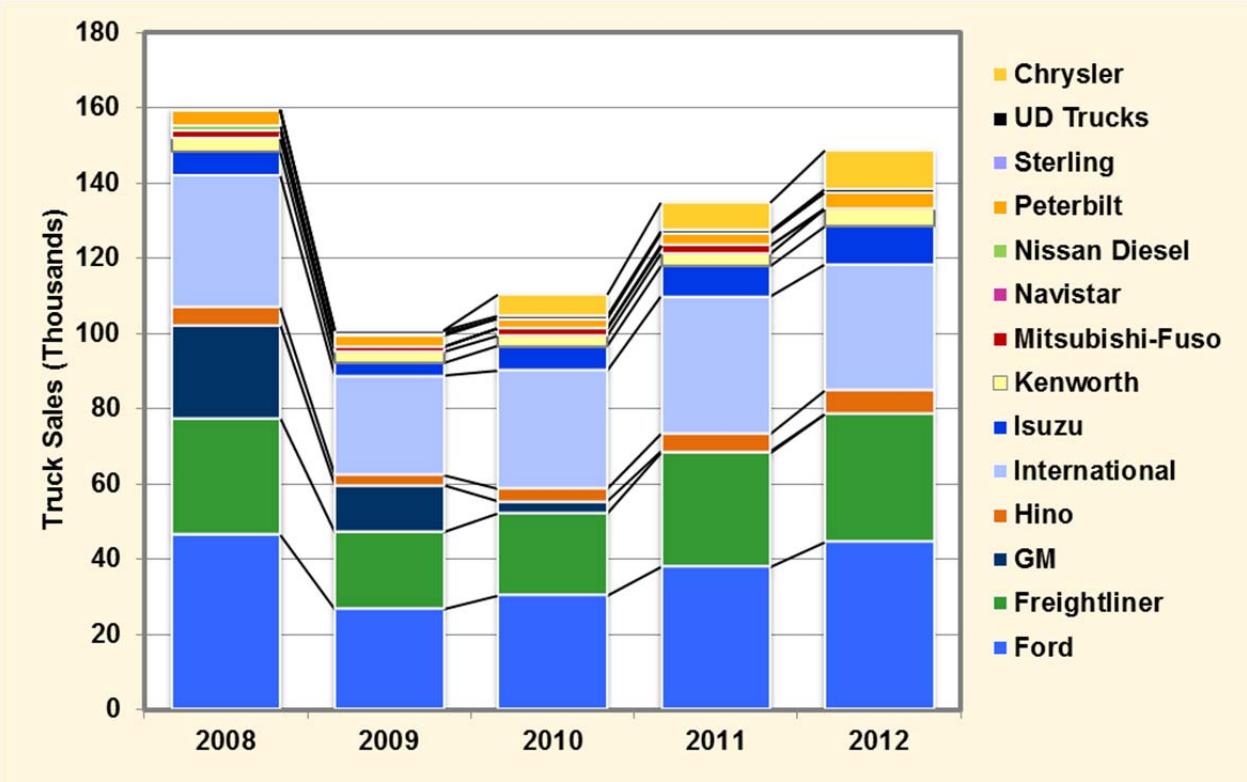

FIGURE 74. Class 4-7 Truck Sales by Manufacturer, 2008-2012

Note: Nissan Diesel was renamed UD Trucks at the end of 2009.

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2013*, Southfield, MI, 2013.
http://wardsauto.com

Class 8 Truck Sales Continue to Grow

Class 8 truck sales in 2012 were more than double that of 2009. There was not a large shift in market share among the manufacturers over the last five years. Freightliner had 34% of the market in 2012 and International had 18%. All other companies listed have less than a 15% share of the market.

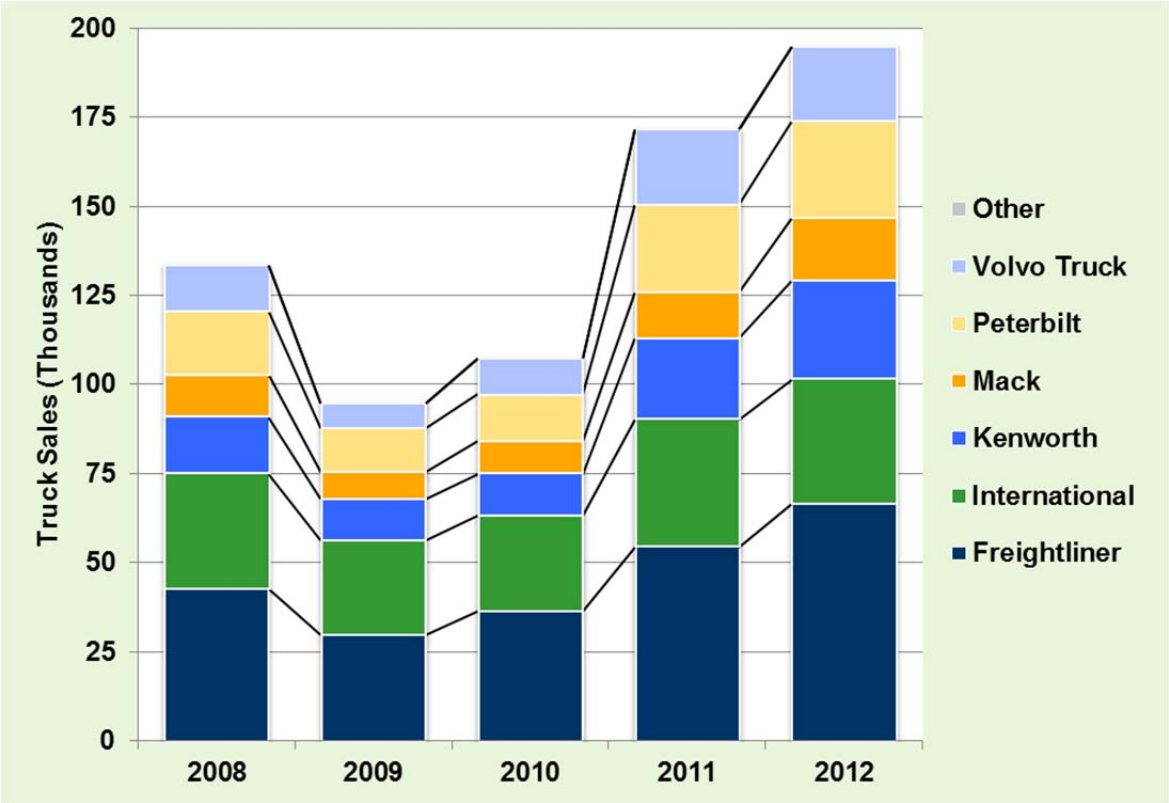

FIGURE 75. Class 8 Truck Sales by Manufacturer, 2008-2012

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2013*, Southfield, MI, 2013.
http://wardsauto.com

Diesel Engine Use Declines for Class 4 Trucks

In 2008, over half of class 6 trucks sold were diesel; in 2012, nearly all of class 6 trucks sold were diesel. Class 4 trucks were predominately diesel in 2008, but in 2012 were predominately gasoline. Classes 3 and 5 trucks also showed a decline in diesel share. However, class 6 trucks reversed the trend. Class 8 trucks have always been near 100% diesel and that has not changed. Overall, diesel comprised 74% of the class 3-8 trucks sold in 2012, up from 72% in 2008.

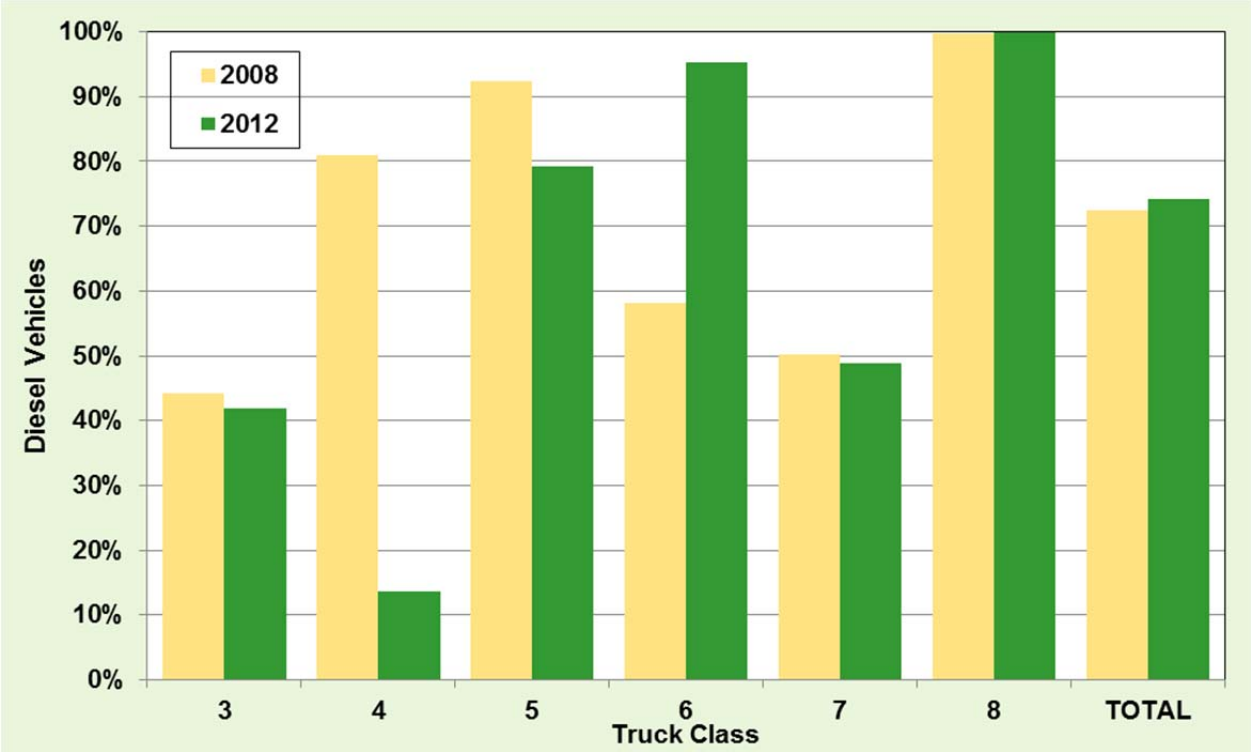

FIGURE 76. Share of Diesel Truck Sales by Class, 2008 and 2012

Note: These shares were derived using factory sales of trucks.

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2013*, Southfield, MI, 2013.
http://wardsauto.com

Cummins Supplies Diesel Engines for Many Manufacturers

Though some medium and heavy truck manufacturers also manufacture their own engines, others purchase engines from engine manufacturers. Cummins supplies diesel engines for Freightliner, International, Kenworth, Peterbilt, Volvo, and Western Star. Hino and Mack build their own diesel engines.

TABLE 27. Diesel Engine Suppliers by Manufacturer, 2012

Make	Engine Manufacturer	Share
Freightliner	Cummins	60.3%
	Detroit Diesel	38.8%
	Mercedes Benz	0.9%
	Total	**100.0%**
Hino	Hino	100.0%
International	Cummins	2.2%
	Navistar	97.8%
	Total	**100.0%**
Kenworth	Cummins	78.1%
	PACCAR	21.9%
	Total	**100.0%**
Mack	Mack	100.0%
Peterbilt	Cummins	75.4%
	PACCAR	24.6%
	Total	**100.0%**
Volvo	Cummins	22.9%
	Volvo	77.1%
	Total	**100.0%**
Western Star	Caterpillar	0.2%
	Cummins	25.5%
	Detroit Diesel	74.3%
	Total	**100.0%**
Other	Cummins	100%

Note: International's parent company is Navistar.

Source:
Ward's Automotive Group. http://wardsauto.com

Cummins Leads Heavy Truck Diesel Engine Market

In 2008, Navistar held a 65% share of the heavy truck diesel engine market. By 2012, Navistar's share had declined to 17% and Cummins held the largest share of the market (42%).

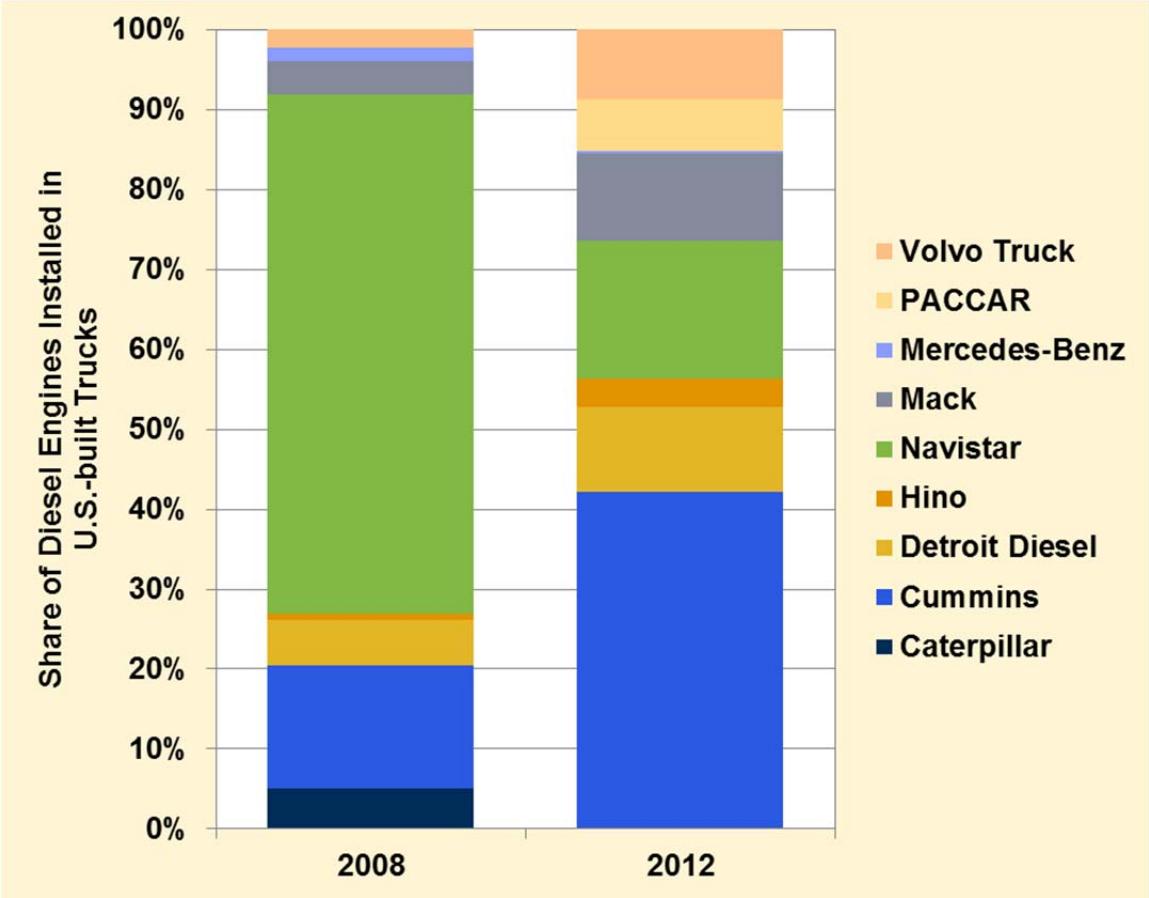

FIGURE 77. Diesel Engine Manufacturers Market Share, 2008 and 2012

Source:
Ward's Automotive Group. http://wardsauto.com

Combination Trucks Average Over 66,000 Miles per Year

According to the latest Federal Highway Administration estimates, the average miles traveled per truck was over 66,000 miles for a combination truck in 2011, up from over 64,000 miles in 2009. Because heavy truck duty-cycles vary, these averages have large standard deviations. Heavy single-unit trucks (above 10,000 lbs. and having at least six tires) were driven significantly fewer miles, because they are typically driven locally. The average fuel economy of single-unit trucks was 7.3 miles per gallon (mpg) in 2011 while the combination truck fuel economy was 5.8 mpg. The combination trucks typically have larger engines to carry heavier loads than the single-unit trucks.

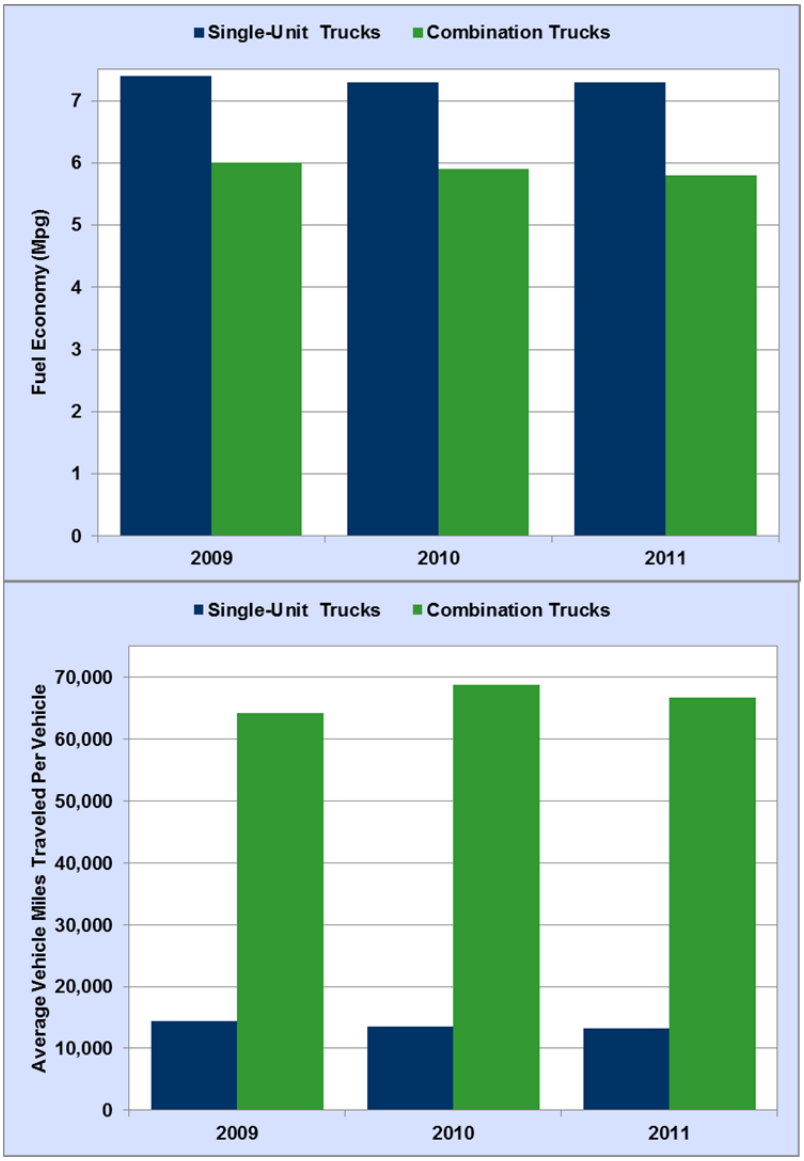

FIGURE 78. Vehicle-Miles of Travel and Fuel Economy for Heavy Trucks, 2009-2011

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2011*, Table VM-1, March 2013. http://www.fhwa.dot.gov/policyinformation/statistics/2011/vm1.cfm

Study Conducted of Heavy Trucks at Steady Speed on Flat Terrain

A study conducted by Oak Ridge National Laboratory outfitted Class 8 trucks with monitoring equipment which tracked the weight, speed, and fuel efficiency of the truck along with the global position of the truck. Using only data where the roadway grade was 1% to -1% grade (flat terrain) the study showed the difference in fuel efficiency for different truck weights at the speed of 65 miles per hour (mph).

TABLE 28. Fuel Efficiency of Class 8 Trucks by Vehicle Weight Range on Flat Terrain

Weight Range (Pounds)	Average Weight (Pounds)	Distance Traveled (Miles)	Fuel Consumed (Gallons)	Fuel Efficiency (Miles per Gallon)	Fuel Efficiency (Ton-miles per Gallon)	Average Speed (mph)
20,000-30,000	21,222	51.4	5.4	9.5	101	65.0
30,000-40,000	34,285	505.9	53.0	9.5	164	65.0
40,000-50,000	44,911	537.8	58.7	9.2	206	65.0
50,000-60,000	55,468	541.2	63.3	8.6	237	64.9
60,000-70,000	66,558	1,356.9	171.9	7.9	263	65.0
70,000-80,000	73,248	1,363.1	172.3	7.9	290	65.0

Note: Ton-miles per gallon calculated as average weight multiplied by miles per gallon.

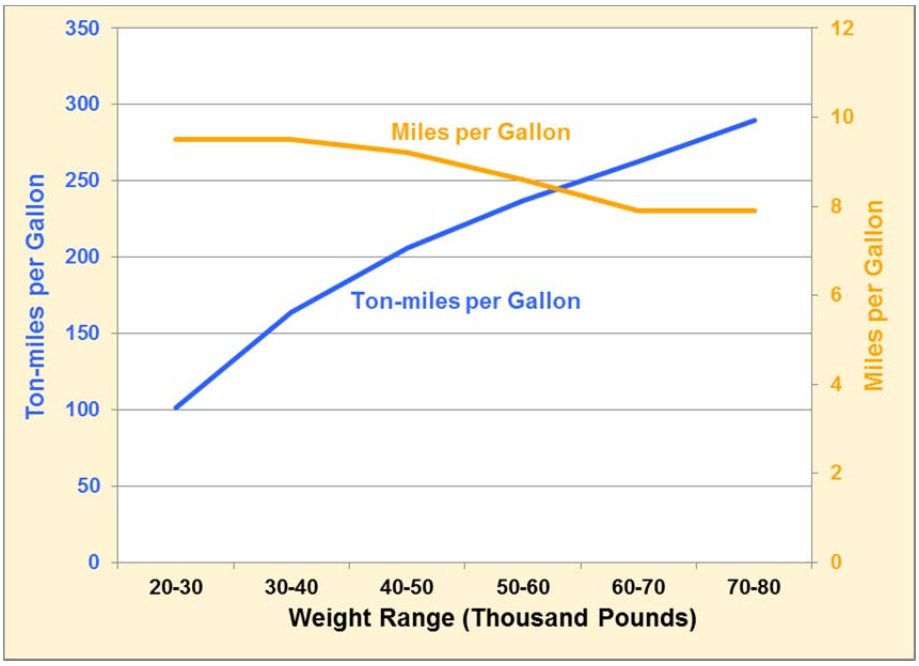

FIGURE 79. Fuel Efficiency of Class 8 Trucks by Vehicle Weight Range on Flat Terrain

Source:

Franzese, Oscar, *Effect of Weight and Roadway Grade on the Fuel Economy of Class-8 Freight Trucks*, Oak Ridge National Laboratory, ORNL/TM-2011/471, October 2011. http://cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2011_471.pdf

Roadway Grade Affects Fuel Economy of Class 8 Trucks

A study conducted by Oak Ridge National Laboratory outfitted Class 8 trucks with monitoring equipment which tracked the weight, speed, and fuel efficiency of the truck along with the global position of the truck. The average for all trucks in the study at all speeds on flat terrain was 7.3 miles per gallon (mpg). However, the fuel economy of those same vehicles on different roadway grades was significantly different. On average, trucks on a severe downslope gained 221% of their fuel economy, while trucks on a severe upslope lost 60% of their fuel economy.

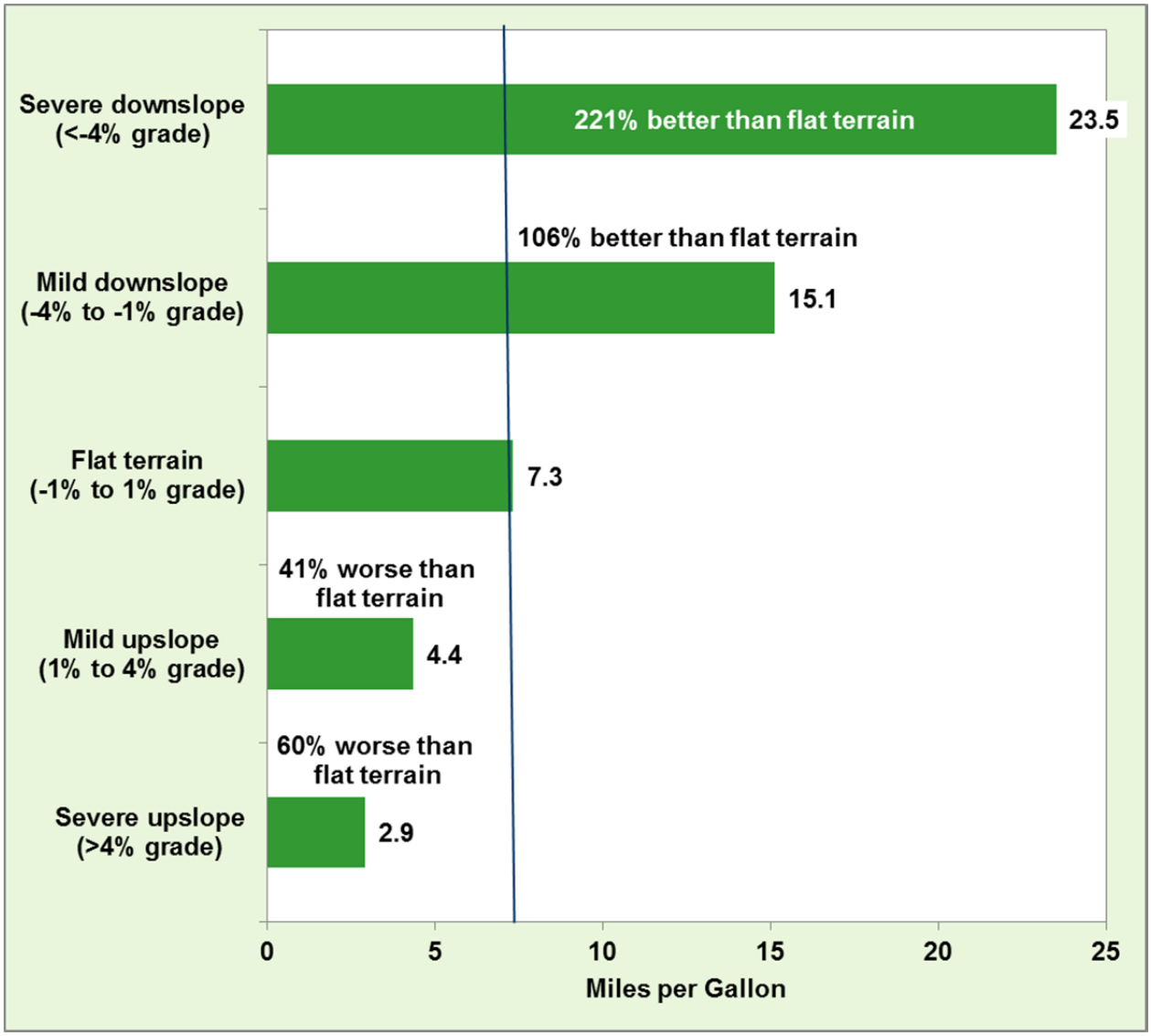

FIGURE 80. Fuel Efficiency of Class 8 Trucks by Roadway Grade

Source:

Franzese, Oscar, *Effect of Weight and Roadway Grade on the Fuel Economy of Class-8 Freight Trucks*, Oak Ridge National Laboratory, ORNL/TM-2011/471, October 2011. http://cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2011_471.pdf

Idling a Truck-Tractor's Engine Can Use a Gallon of Fuel per Hour

Drivers of truck-tractors often idle the engine to provide heating, cooling, or electric power during Federally-mandated breaks. Estimates show that an engine at 1,200-rpm without the use of air conditioning (AC) uses 1.03 gallons of fuel per hour. Having the AC on even half of the time makes a difference. The graph below shows the fuel used when idling the engine for one hour with different engine idle speed (rpm) and air conditioning scenarios. Newer tractors can idle at 800-900 rpm, but older tractors are smoother at higher idle speeds.

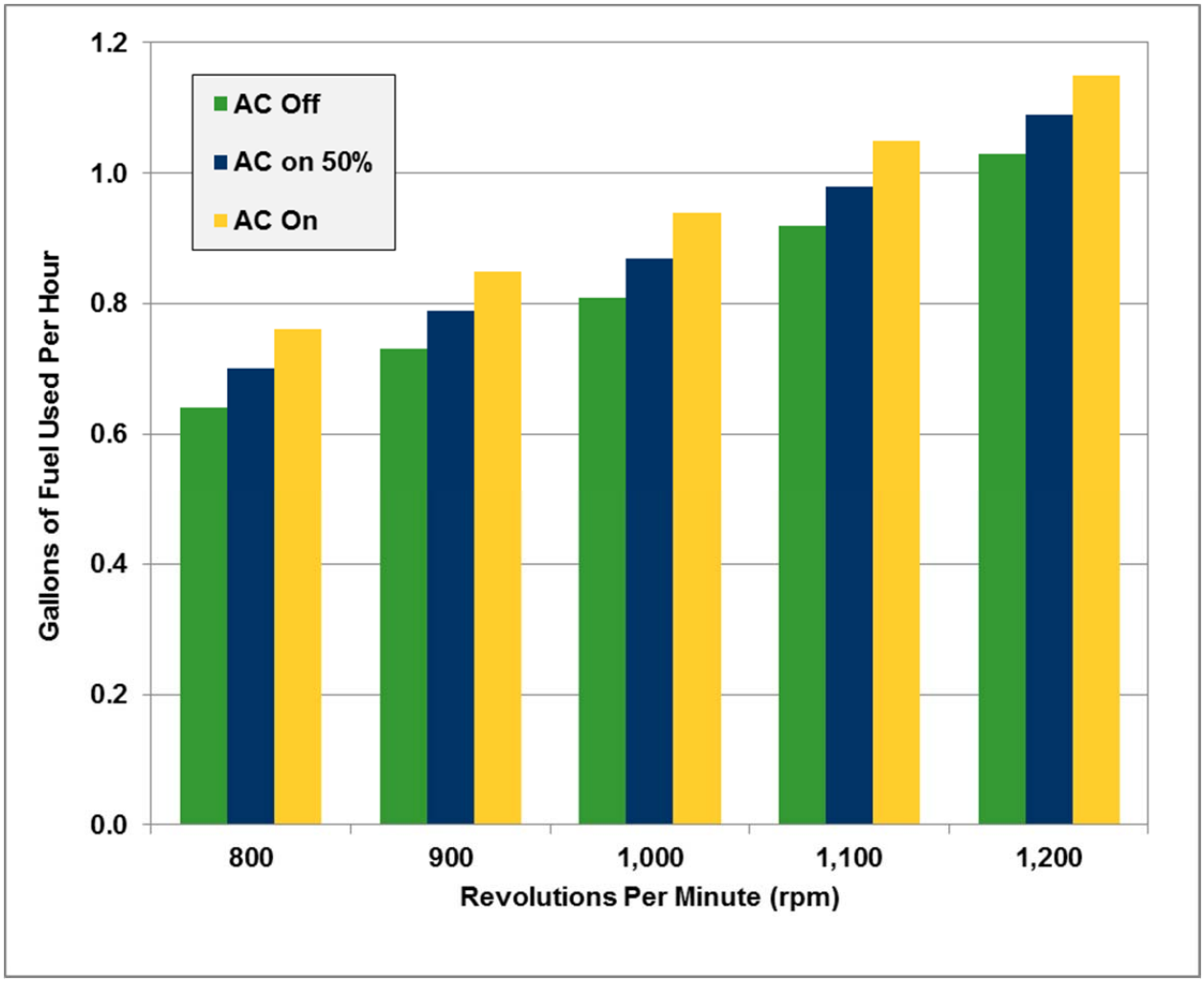

FIGURE 81. Average Amount of Fuel Used for Idling a Truck-Tractor

Source:
Argonne National Laboratory, "How Much Could You Save by Idling Less?"
http://www.transportation.anl.gov/pdfs/TA/361.pdf

Truck Stop Electrification Reduces Idle Fuel Consumption

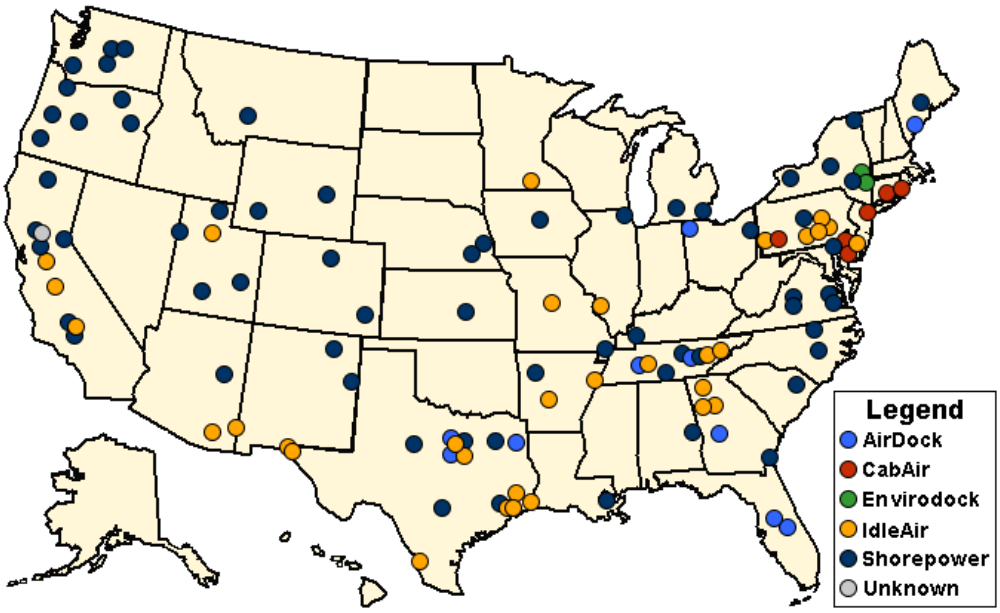

FIGURE 82. Map of Truck Stop Electrification Sites, 2013

TABLE 29. Number of Truck Stop Electrification Sites by State, 2013

State	Number of Sites	State	Number of Sites
Alabama	1	Missouri	2
Arizona	3	Montana	1
Arkansas	3	Nebraska	2
California	10	New Jersey	2
Colorado	2	New Mexico	2
Connecticut	2	New York	6
Delaware	2	North Carolina	2
Florida	2	Ohio	2
Georgia	5	Oregon	6
Illinois	2	Pennsylvania	7
Iowa	1	South Carolina	1
Kansas	1	Tennessee	9
Louisiana	1	Texas	18
Maryland	1	Utah	5
Maine	2	Virginia	4
Michigan	2	Washington	4
Minnesota	1	Wyoming	2
Total	**116**		

The U.S. Department of Transportation mandates that truckers rest for 10 hours after driving for 11 hours, during which time they often park at truck stops idling the engines to provide heating, cooling and use of electrical appliances. Electrification at truck stops allows truckers to "plug-in" vehicles to operate the necessary systems without idling the engine. There are currently 116 publicly accessible electrification sites across the nation. Some of these sites require special equipment to be installed on the truck and others do not. Presently, five companies equip electrification sites: Shorepower, CabAire, EnviroDock, AireDock, and IdleAir.

Source:
Alternative Fuels and Advanced Vehicles Data Center. (Data through 1/28/14).
http://www.afdc.energy.gov/afdc/tse_locator

SuperTruck Project Achieves 10.7 Miles per Gallon

The U.S. Department of Energy partnered with industry to explore fuel economy improvements for class 8 trucks. In February 2014, the Cummins/Peterbilt team announced that their fully-loaded class 8 truck achieved a fuel economy of 10.7 miles per gallon, which was a 75% increase in fuel economy, a 43% reduction in greenhouse gas (GHG) emissions and an 86% gain in freight efficiency in testing against a 2009 baseline truck.

Figure 83. Change in GHG Emissions, Fuel Economy, and Freight Efficiency for the SuperTruck Project, February 2014

Source:
Cummins Social Media News Hub, accessed February 24, 2014.
http://social.cummins.com/cummins-peterbilt-supertruck-passes-important-milestone/

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