Chapter 3.

HEAVY TRUCKS

Page

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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.

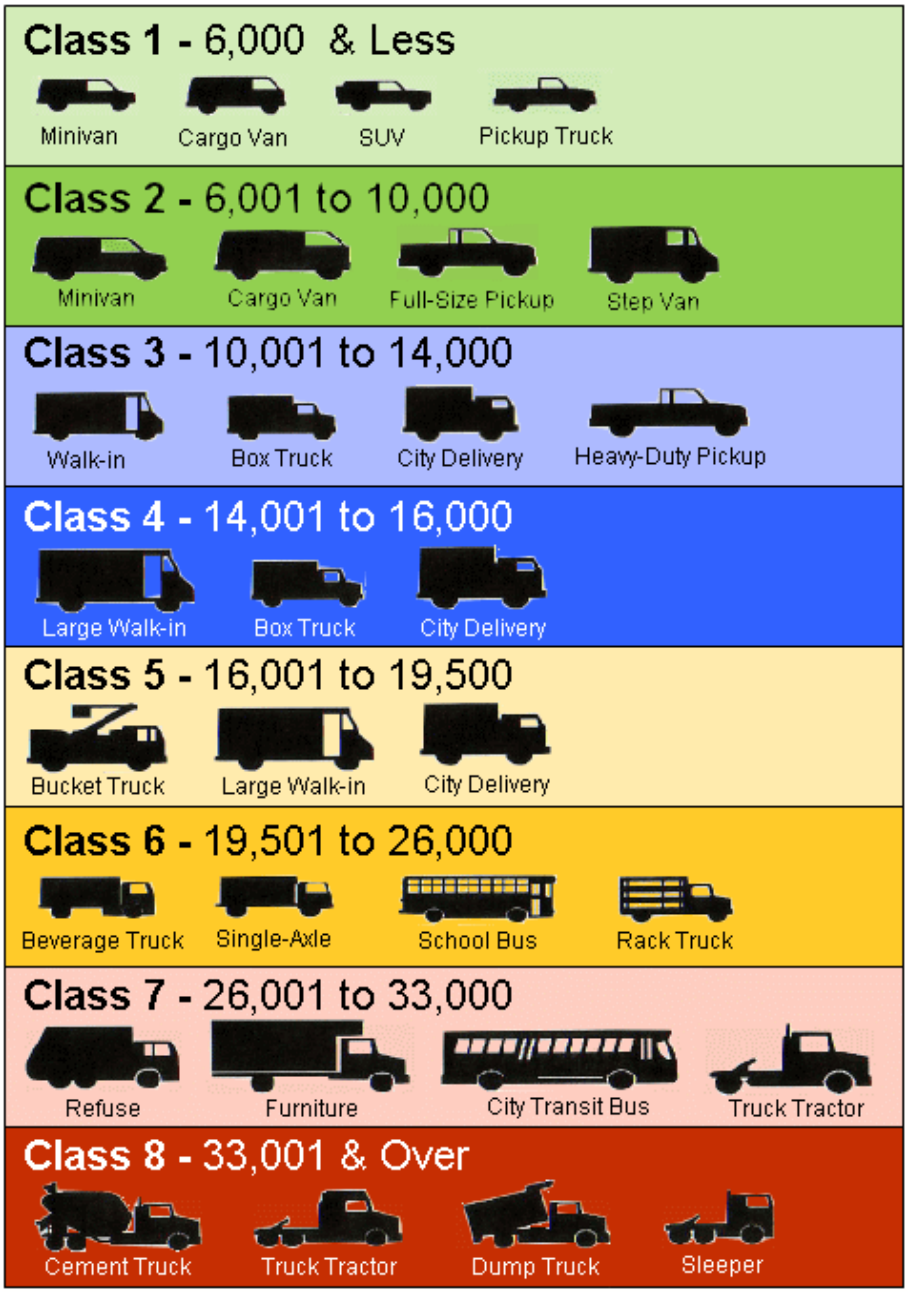

FIGURE 57. Examples of Trucks in Each Truck Class

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 7. 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 Pick-Ups	4,000 - 6,000	3,200 - 4,500	250 - 1,500	20-25	58.8
2a	Large SUVs, Standard Pick-Ups	6,001 - 8,500	4,500 - 6,000	250 - 2,500	20-21	38.5
2b	Large Pick-Ups, 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).

TABLE 8. Production of Medium and Heavy Trucks by Manufacturer, 2011

Freightliner & Western Star	Hino	International	Kenworth	Mack	Peterbilt	Volvo
45.5	4.8	43.0	30.6	20.3	28.1	25.2

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

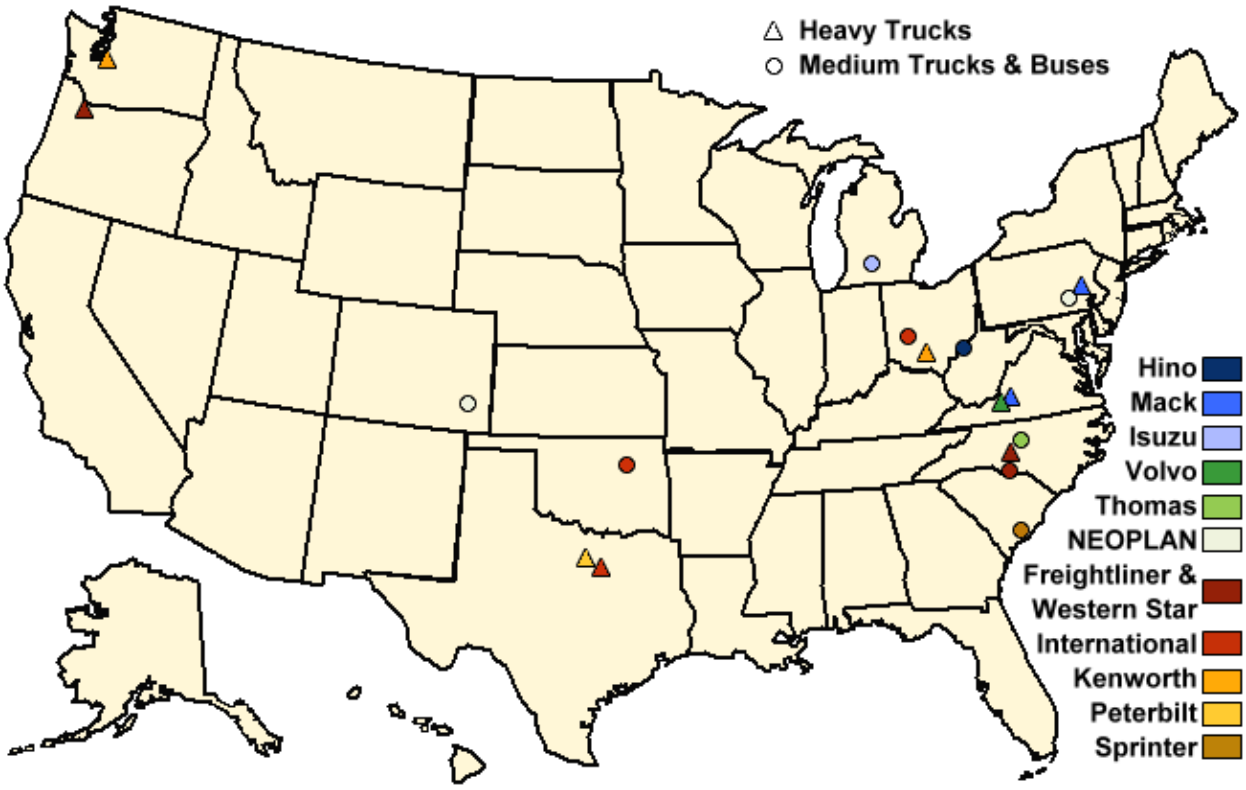

FIGURE 58. Heavy Truck Manufacturing Plants by Location, 2012

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

Class 3 Truck Sales Are Up in 2011

Class 3 truck sales fell with the economy in 2008 and 2009, but recovered in 2010 and 2011. In fact, 2011 sales were 18% above 2007 sales. Chrysler, Ford, and General Motors continue to dominate the class 3 market.

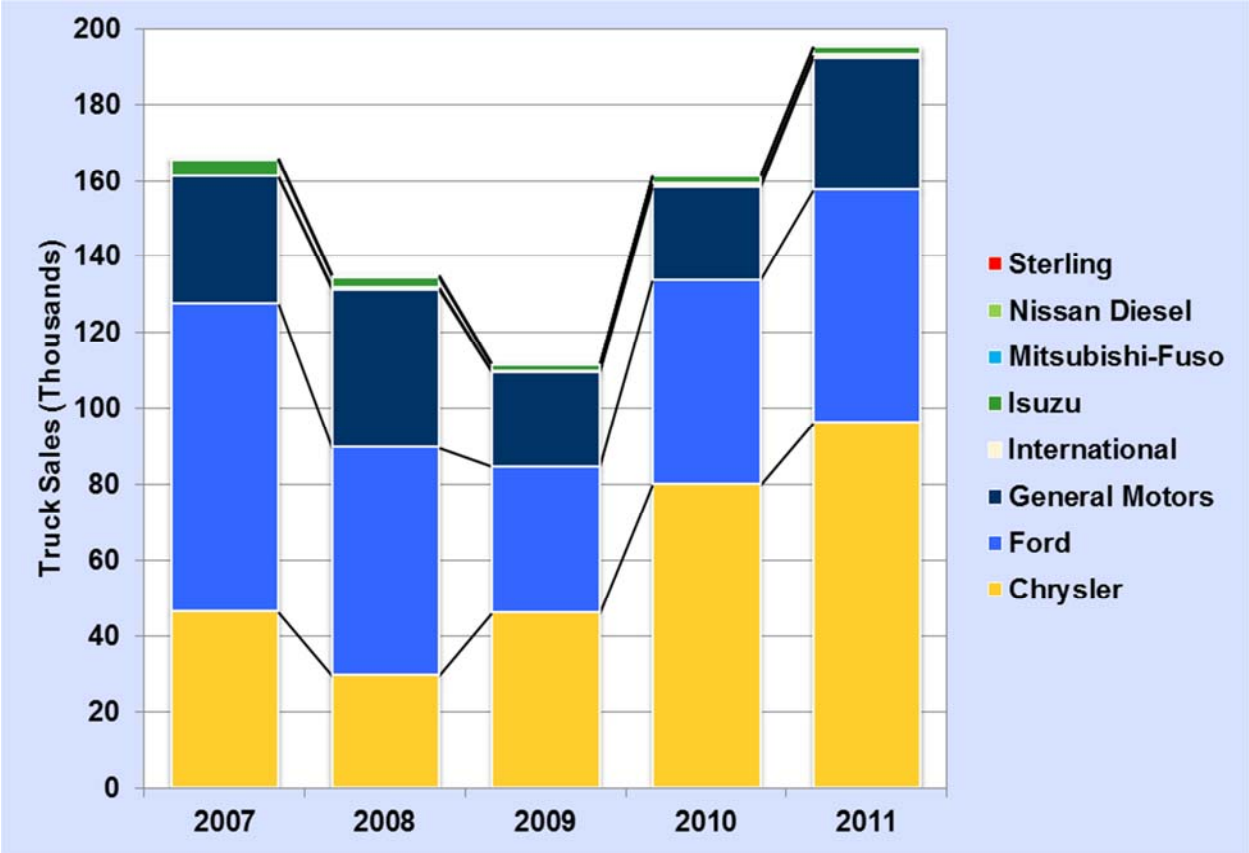

FIGURE 59. Class 3 Truck Sales by Manufacturer, 2007-2011

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2012*, Southfield, MI, 2012.
http://wardsauto.com

Class 4-7 Truck Sales Continue to Be Low

Though the sales of class 4-7 trucks were up slightly in 2011, they were 39% below the 2007 level. However, most companies kept their market share of the significantly lower market, with General Motors (GM) being the notable exception. In 2007 GM sold over 34,000 class 4-7 trucks, while in 2011 they sold almost none. Freightliner, Hino, Isuzu, Mack, and Kenworth all gained one or two percent of the market share after GM's decline. International gained nine percent from 2007 to 2011.

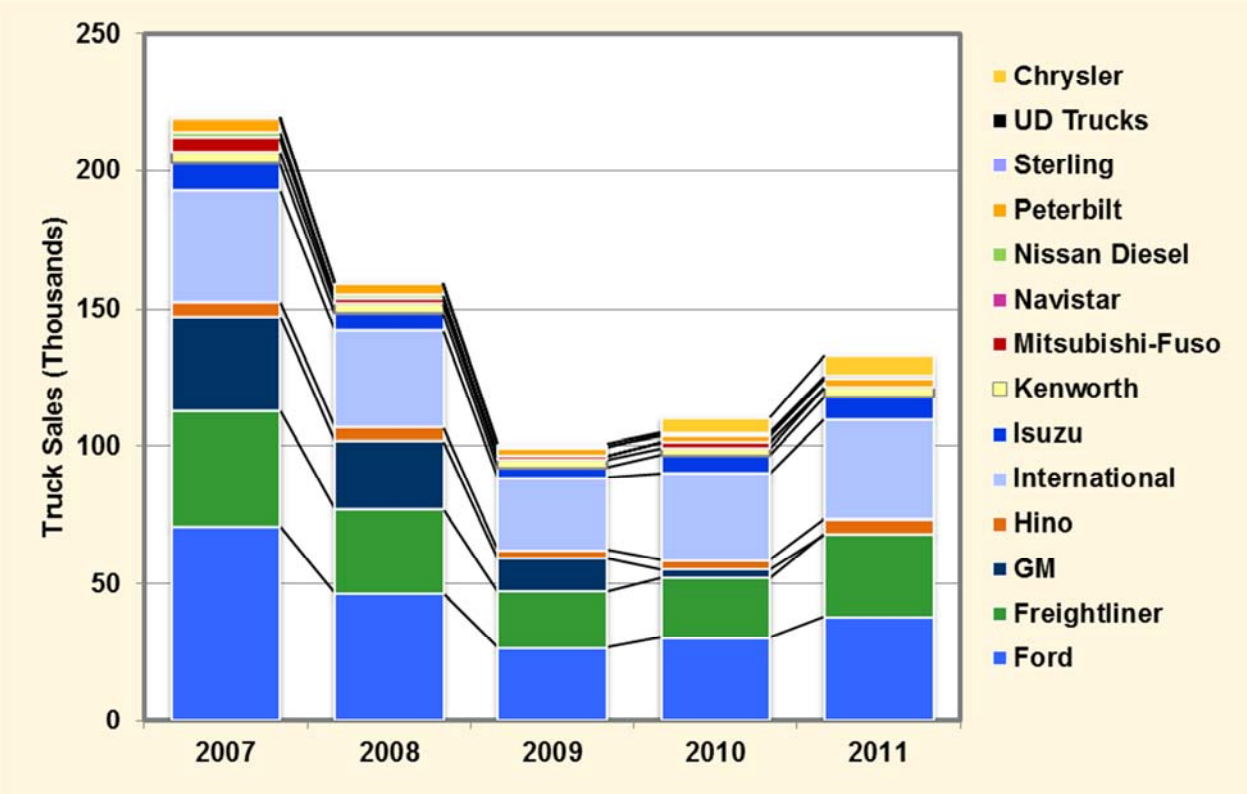

FIGURE 60. Class 4-7 Truck Sales by Manufacturer, 2007-2011

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

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2012*, Southfield, MI, 2012.
http://wardsauto.com

Class 8 Truck Sales Are Up in 2011

Mainly due to the economic recession, class 8 truck sales in 2008 and 2009 declined, but grew in 2010 and 2011. There was not a large shift in market share among the manufacturers over the last five years. Freightliner had 32% of the market in 2011 and International had 21%. All other companies listed have less than a 15% share of the market.

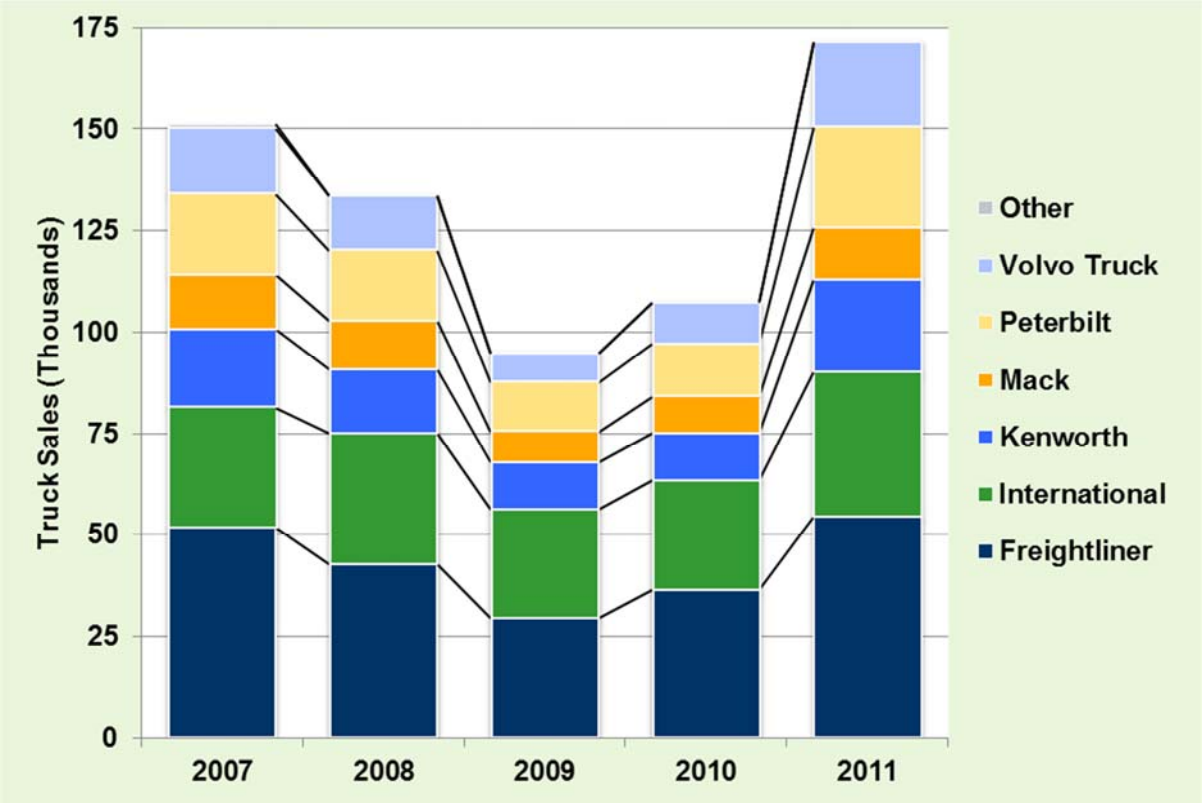

FIGURE 61. Class 8 Truck Sales by Manufacturer, 2007-2011

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2012*, Southfield, MI, 2012.
http://wardsauto.com

Diesel Engine Use Increases for Medium Trucks

In 2007, about half of class 6 trucks sold were diesel; in 2011, nearly all of class 6 trucks sold were diesel. Class 8 trucks have always been near 100% diesel and that has not changed. Overall, diesel comprised 75% of the class 3-8 trucks sold in 2011, up from 68% in 2007.

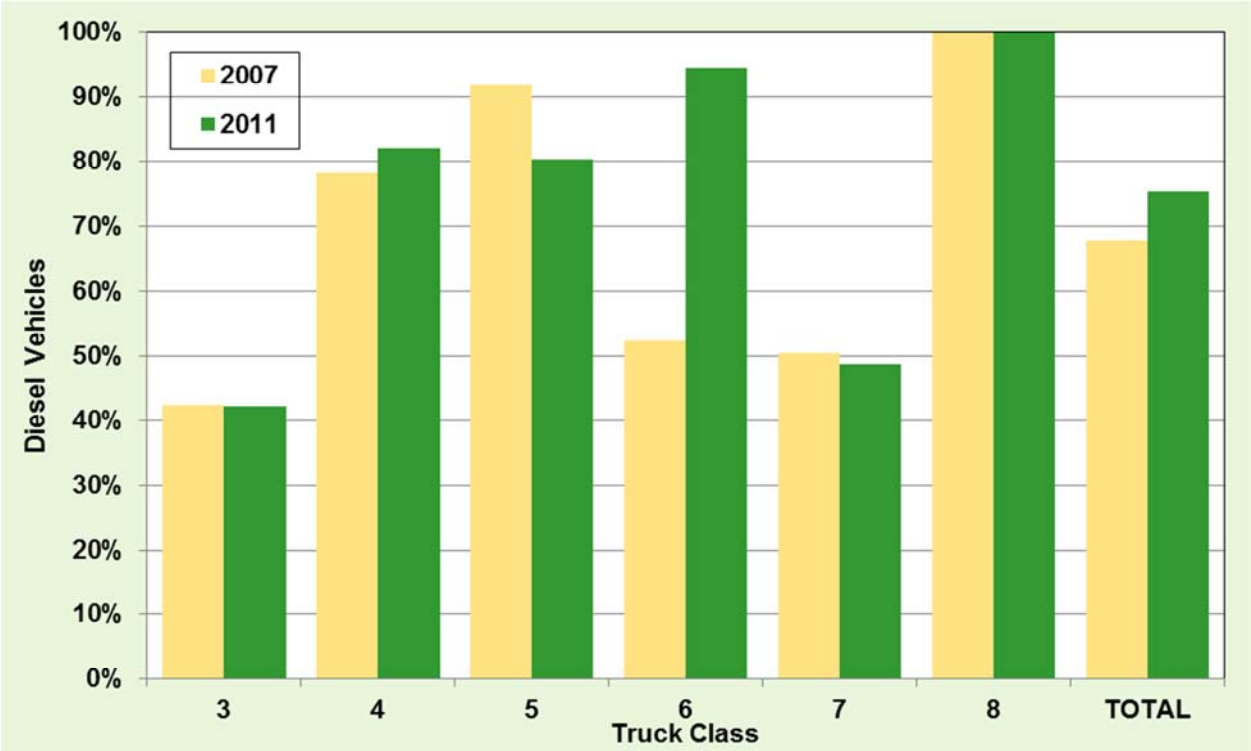

FIGURE 62. Share of Diesel Truck Sales by Class, 2007 and 2011

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

Source:
Ward's Automotive Group, *Motor Vehicle Facts and Figures 2012*, Southfield, MI, 2012.
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 9. Diesel Engine Suppliers by Manufacturer, 2011

Make	Engine Manufacturer	Share
Freightliner	Cummins	59.1%
	Detroit Diesel	40.2%
	Mercedes Benz	0.7%
	Total	**100.0%**
Hino	Hino	100%
International	Caterpillar	0.1%
	Cummins	2.4%
	International	97.5%
	Total	**100.0%**
Kenworth	Caterpillar	0.2%
	Cummins	75.5%
	PACCAR	24.3%
	Total	**100.0%**
Mack	Mack	100%
Peterbilt	Cummins	76.2%
	PACCAR	23.8%
	Total	**100.0%**
Volvo	Cummins	23.2%
	Volvo	76.8%
	Total	**100.0%**
Western Star	Caterpillar	0.6%
	Cummins	17.6%
	Detroit Diesel	81.8%
	Total	**100.0%**
Other	Cummins	100.0%

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

Cummins Leads Heavy Truck Diesel Engine Market

In 2007, International (also known as Navistar) held a 67% share of the heavy truck diesel engine market. By 2011, International's share had declined to 20% and Cummins held the largest share of the market (42%).

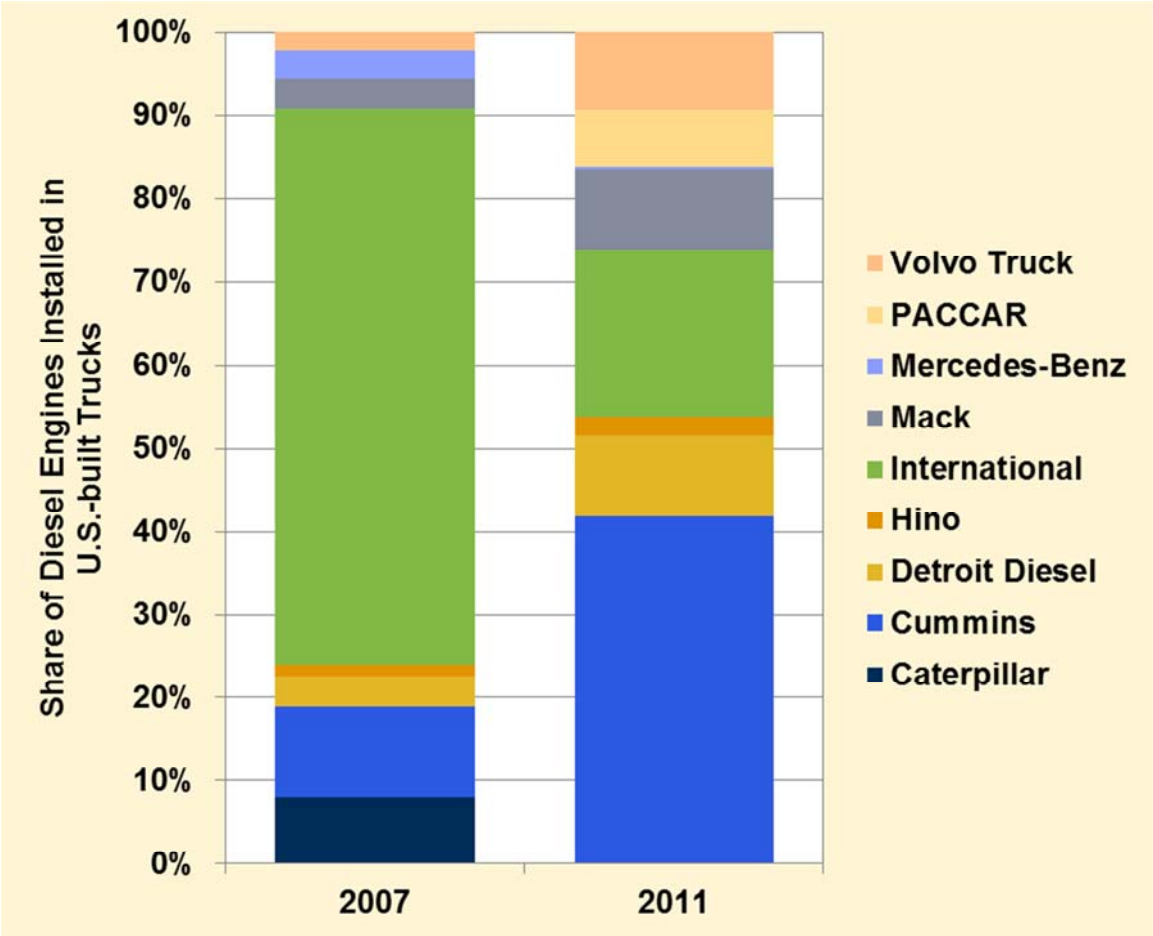

FIGURE 63. Diesel Engine Manufacturers Market Share, 2007 and 2011

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

Combination Trucks Average Over 68,000 Miles per Year

According to the latest Federal Highway Administration estimates, the average miles traveled per truck was over 68,000 miles for a combination truck in 2010, down from over 70,000 miles in 2008. 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 2010 while the combination truck fuel economy was 5.9 mpg. The combination trucks typically have larger engines to carry heavier loads than the single-unit trucks.

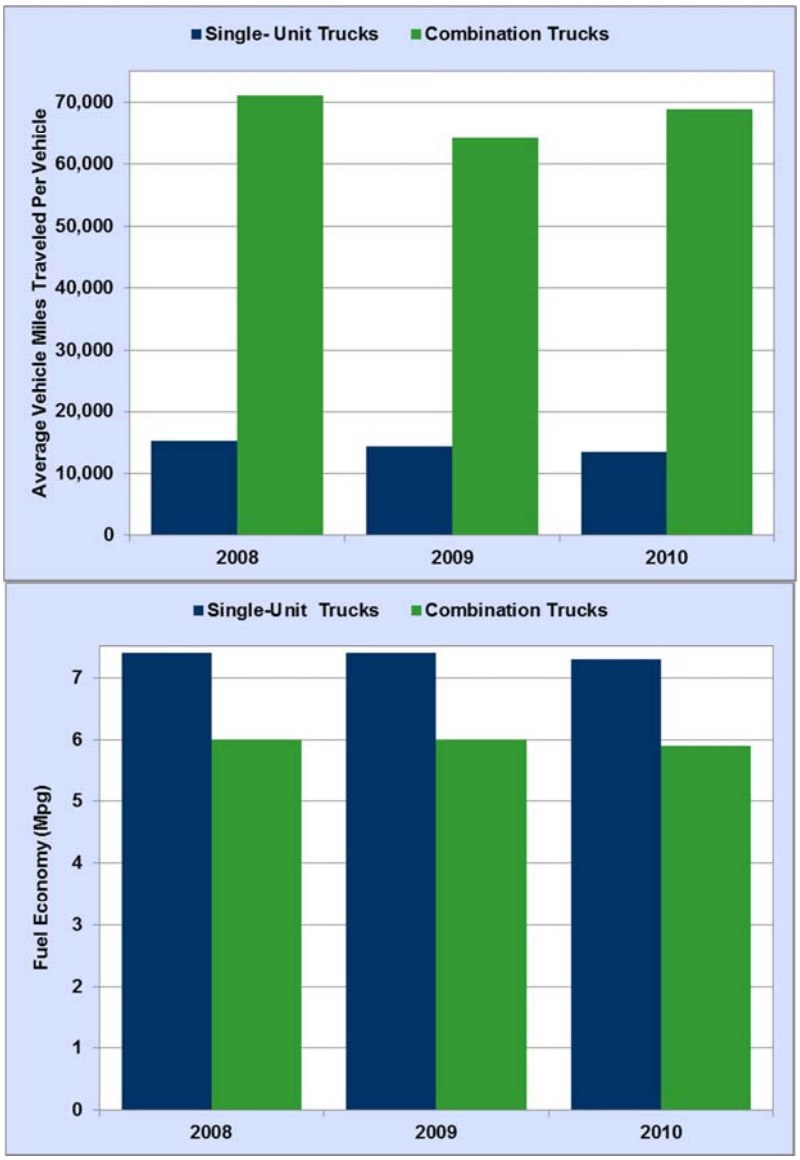

FIGURE 64. Vehicle-Miles of Travel and Fuel Economy for Heavy Trucks, 2008-2010

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2010*, Table VM-1, April 2011. http://www.fhwa.dot.gov/policyinformation/statistics/2010/vm1.cfm

Real-World Class 8 Fuel Economy Ranges from 7.9 to 9.5 mpg

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 10. 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.

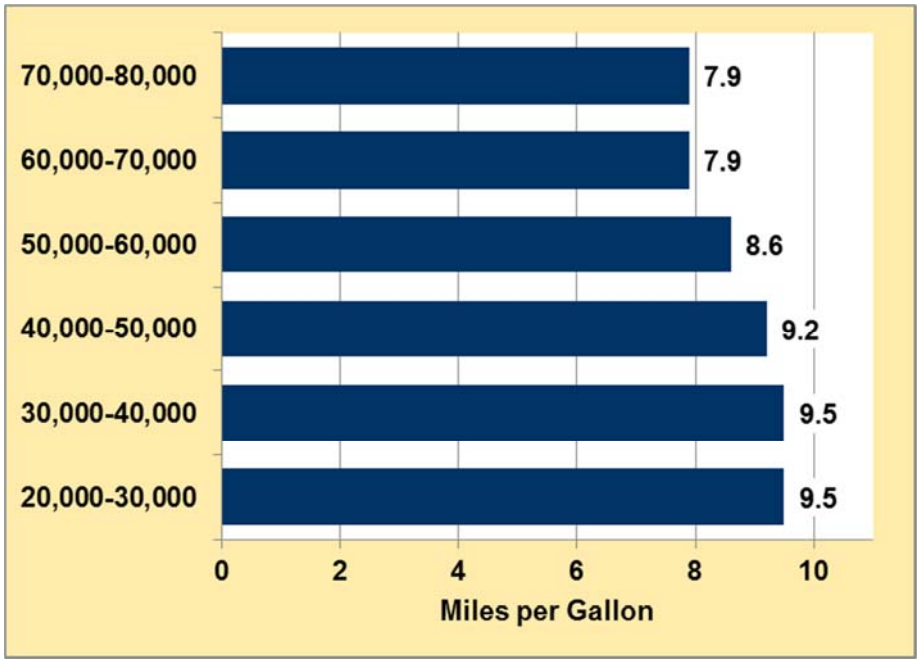

FIGURE 65. Fuel Efficiency of Class 8 Trucks by Vehicle Weight Range on Flat Terrain

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 Effects 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.

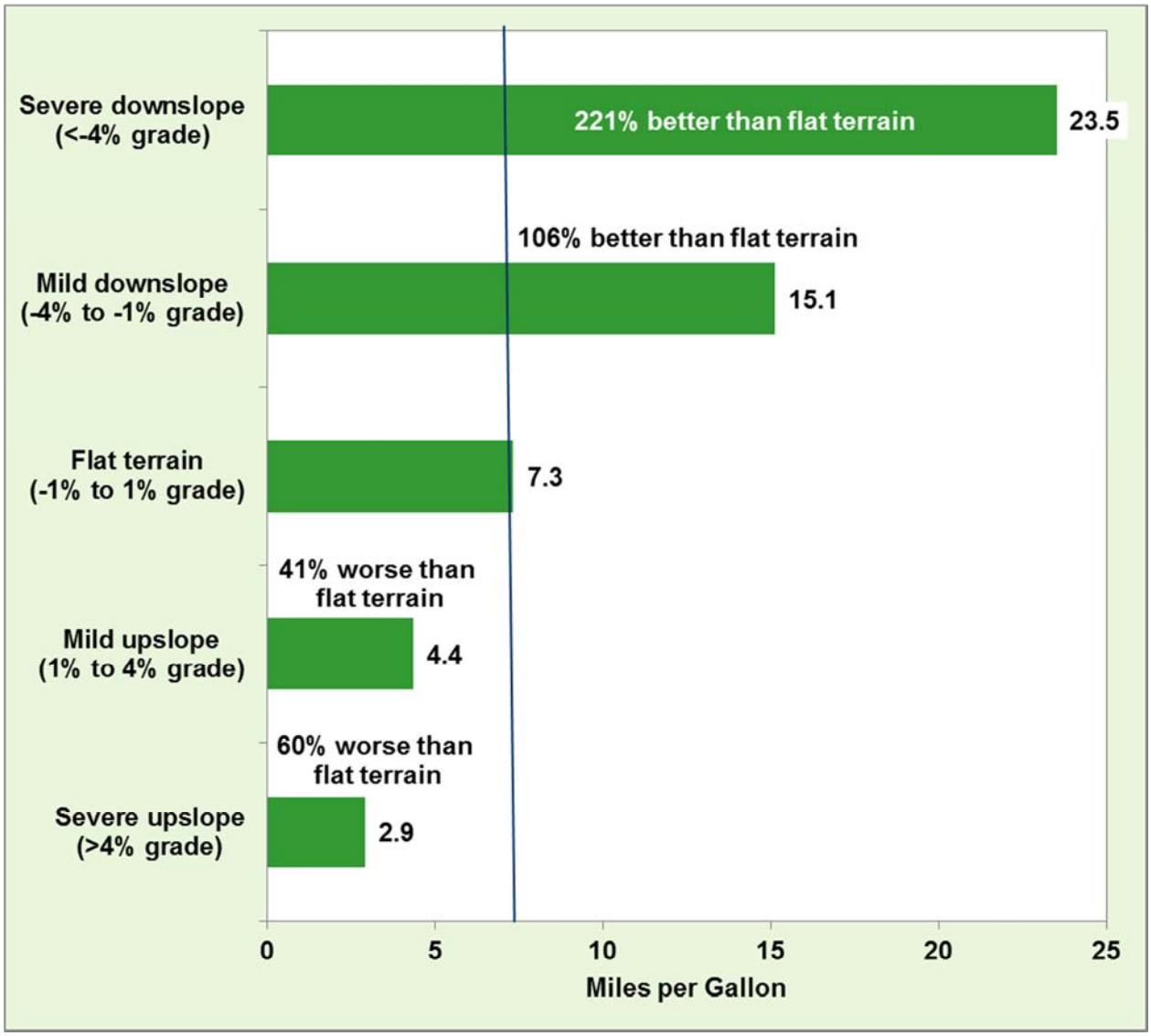

FIGURE 66. Fuel Efficiency of Class 8 Trucks by Roadway Grade

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.

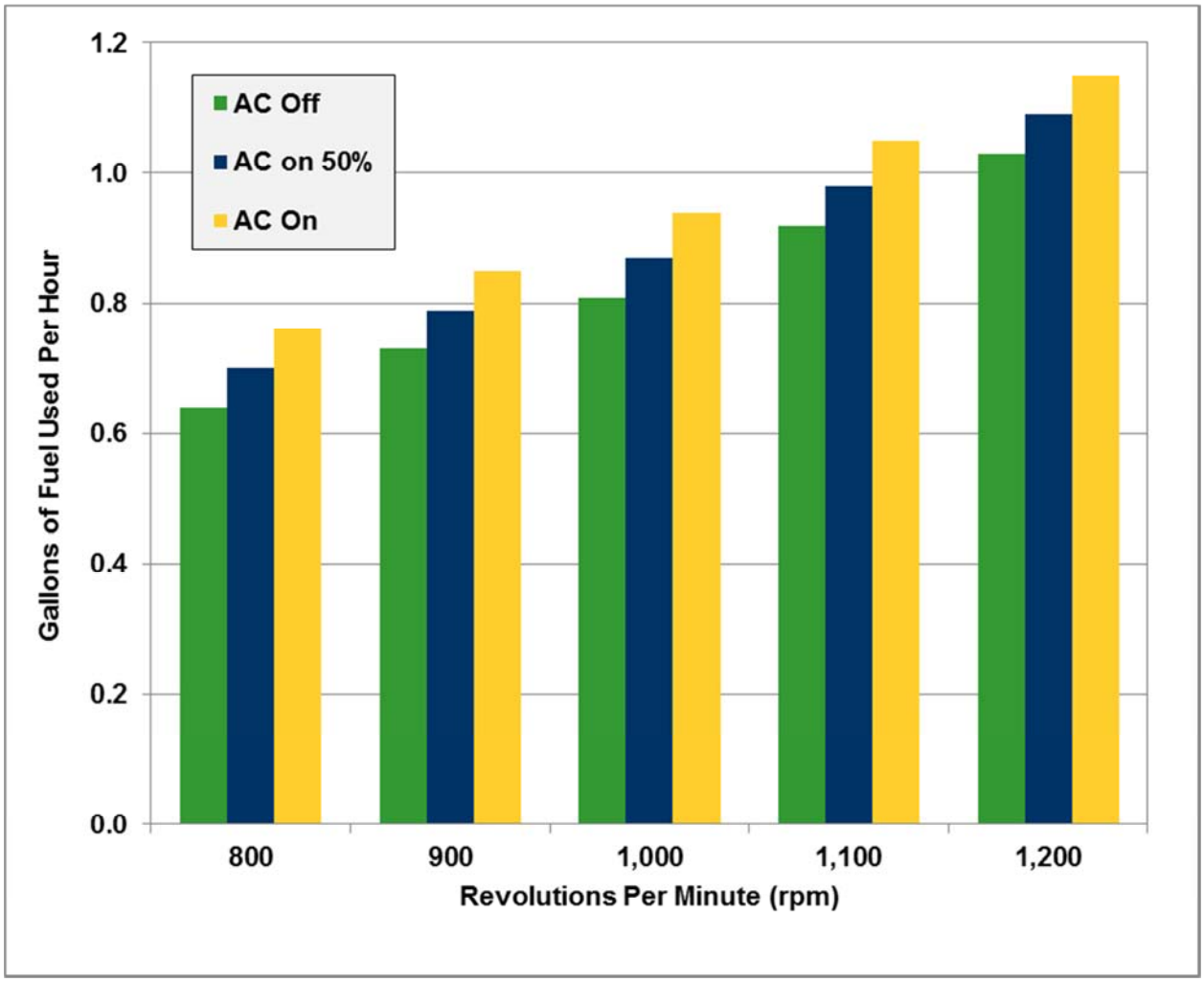

FIGURE 67. Average Amount of Fuel Used for Idling a Truck-Tractor

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

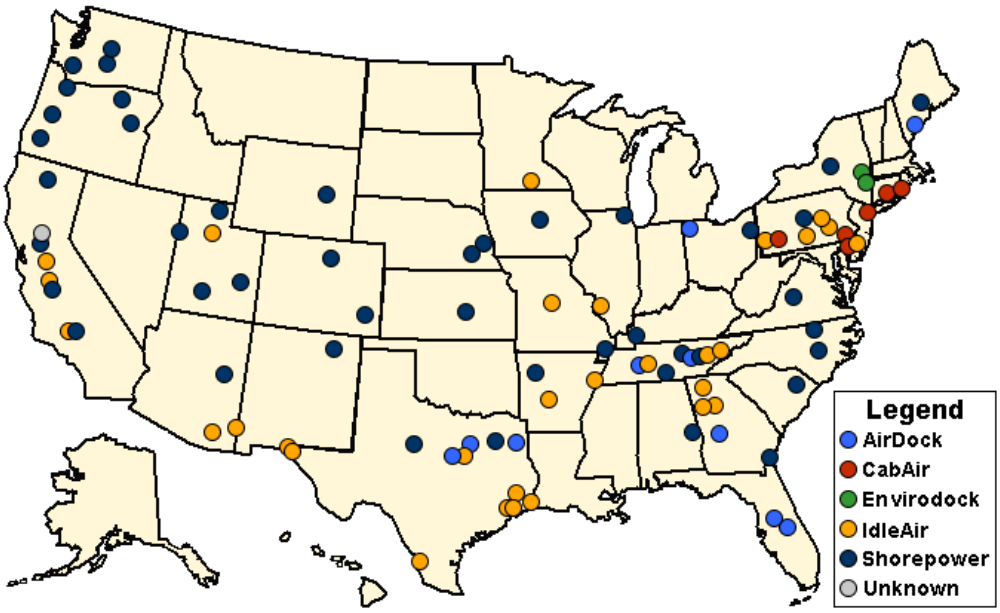

FIGURE 68. Map of Truck Stop Electrification Sites, 2012

TABLE 11. Number of Truck Stop Electrification Sites by State, 2012

State	Number of Sites	State	Number of Sites
Alabama	1	Nebraska	2
Arizona	3	New Jersey	2
Arkansas	3	New Mexico	1
California	8	New York	3
Colorado	2	North Carolina	2
Connecticut	2	Ohio	2
Delaware	2	Oregon	5
Florida	2	Pennsylvania	6
Georgia	5	South Carolina	1
Illinois	2	Tennessee	8
Iowa	1	Texas	13
Kentucky	1	Utah	5
Kansas	1	Virginia	1
Maine	2	Washington	3
Minnesota	1	Wyoming	1
Missouri	2		
Total	**93**		

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 93 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. Accessed January 8, 2013.
http://www.afdc.energy.gov/afdc/locator/tse/state