

The CAFE Way: Future Trucks and Fuel Economy

What 'The New Standard' Means for Trucks, and How Automakers will Meet them

By Gary Witzenburg | February 16, 2012 | In [Motor Trend Magazine](#) [29](#)

Fuel efficiency has been a priority for a long time, as you can see in this 1952 ad. If you're above a certain age, you have vivid memories of the 1973 oil embargo and the resulting fuel shortages. Many people were inconvenienced, frustrated, and angered by empty gas pumps and long lines. And perhaps for the first time, many people thought seriously about fuel consumption as both a budgetary and a freedom of movement concern. Lacking safe, efficient, convenient, flexible public transportation outside of major cities, we were hopelessly dependent on private cars and trucks. Without gas, we couldn't get where we wanted and needed to go. The gas crisis temporarily caused vehicle preferences to change. Small, [fuel-efficient cars](#) sold out, and almost no one wanted big cars and trucks. Then fuel became plentiful again, gas prices dropped, and some people who had downsized to smaller vehicles wished they hadn't.

One of the ways truckmakers plan to [improve fuel economy](#) is to reduce weight. This cutaway at left shows several components that could be made from high-strength steel.

CAFE

That cycle repeated itself in 1979-1980 and again in 2008-2009, but the lasting legacy of that 1973 fuel shortage is the federal government's response: Corporate Average [Fuel Economy](#) laws. The first required automakers' 1978-model "sales-weighted fleet averages" to be no lower than 18 mpg -- no challenge for imports, which produced a lot of small cars, but a tall order for domestics. It meant makers had to balance sales of profitable larger vehicles with sales of smaller ones (usually at a loss), whether or not anyone wanted to buy them. Light-truck standards followed for 1979, beginning at 17.2 mpg for 2WD models and 15.8 for those with 4WD. When it comes to CAFE, critics contend it's a sorry substitute for reducing fuel usage through higher fuel taxes, as other countries have done, because it puts the onus on automakers, regardless of market demand, and drives up [vehicle prices](#). Nevertheless, these laws were toughened each year through the early 1980s, softened slightly in the mid-'80s, then leveled at 27.5 mpg for cars from 1990 to 2010. The truck number accelerated slowly to 20.7 mpg (combined for 2WD and 4WD) for 1996, stayed there through 2004, then climbed again to 23.5 mpg for 2010.

NEW CAFE

Then, on May 19, 2009, President Obama announced a new "national fuel economy program" mandating a fleet average of 35.5 mpg for by 2016, a daunting 29-percent increase that moved the requirements of an existing 2007 law forward by four full years. Since 2012 models were essentially done, automakers would have just four model years to achieve it. A year later, he ordered the U.S. National Highway Traffic Safety Administration, which (for some reason) manages CAFE, and the Environmental Protection Agency to jointly mandate much tougher standards for 2017-2025. They laid out four scenarios of 3-, 4-, 5-, and 6-percent annual

increases over that 35.5-mpg 2016 level. The 6-percent-per-year schedule would have resulted in a CAFE of 62 mpg by 2025, but they later settled on a somewhat more reasonable 54.5 mpg.

Using prices for an array of fuel-efficiency technologies projected by a 2010 National Research Council study commissioned by NHTSA, the Center for Automotive Research predicted a retail cost of meeting a (then-proposed) 56-mpg CAFE at \$6714, which (when added to an estimated \$1500 increase for future safety requirements) would result in 2025-model vehicle stickers \$8214 higher on average than 2016 prices.

FOOTPRINT-BASED

The only good news for automakers in these new requirements (which were not fully formulated for 2017-2025 as this was written) is that they move from a straight fleet average to a much more complex but more rational footprint-based formula, which comprehends the basic law of physics that larger vehicles will consume more energy than smaller ones. (A vehicle's footprint is its wheelbase times its average tread width.) It's important to note that CAFE-compliance fuel-economy numbers, derived from EPA emissions-tests, are higher than those you see in ads and articles and on window stickers because the feds mathematically adjust the test results downward to obtain the published numbers that are better predictors of real-world efficiency. Thus a 2012 subcompact Honda Fit with a 40-square-foot footprint must achieve an EPA test fuel economy of 36 mpg, equivalent to a published 27 mpg, while a Ford F-150 with a 65-75-square-foot footprint must test at 22 mpg for a published 17 mpg.

Automakers apply technology and vehicle design to make trucks more fuel-efficient. All of the changes, improvements, and theories are put to the test at each vehicle's research and development facilities.

TRUCKMAKERS' CHALLENGE

We asked experts from Ford, Chrysler, and Toyota (GM declined an interview) what this means to full-size truckmakers. "There is no fixed number that we will have to hit," says Jeff Lewis, head of Ford's Vehicle Energy Management Engineering group. "[Compliance] will be tied to the footprints and the overall mix of our products." He added that the light-truck target will be significantly lower than the 54.5 mpg required of the entire U.S. fleet. "The input we have been providing [internally] is, 'Here is what our cycle plan looks like, here are the footprints of those vehicles, and here is the predicted sales mix of those vehicles.' Our CAFE planning team comes back and says, 'Then here is what each of our vehicles needs to deliver for us to be compliant.' The footprints and mix will determine what our corporate number needs to be, then we will know where each of our products needs to be."

"A given vehicle is assigned a target," explains Gary Oshnock, Chrysler's manager of Fuel Economy-CHG Programs and Regulatory Affairs. "What a manufacturer does to reach compliance is sales weight. Each model will have X, Y, or Z number of sales to come up with an average footprint for its fleet. And for a given model year, that average footprint determines the fleet average fuel economy requirement. "We use an SAE procedure to determine the wheelbases and track widths," Oshnock says. "But when we get into heavy-duty trucks, it will be a completely different system. A regulation just came out for 2014-2018 model years for over-8500-pound-GVW trucks -- wreckers, ambulances, potato-chip trucks, up to Class 8 line-haul trucks. "Instead of a footprint, Class 2B and 3 full-size pickups and vans will use a 'work factor' attribute: 0.75 times payload capacity (GVW minus curb weight), plus 500 pounds if it's

equipped with 4WD, plus 0.25 times tow capacity (GCW minus GVW). But Chrysler supports this methodology because it recognizes the underlying physics of a truck's capability."

Michael Cairns, Chrysler's vehicle line executive for Ram Trucks and Regulatory Affairs, points out that truck makers will have to meet four separate requirements, two for light-duty and two for heavy-duty, because EPA's "greenhouse gas" mandates (as of now) are different from NHTSA's CAFE requirements. On top of that is another set of CO2 requirements for California and 13 other states that have adopted California's standards. "The government has tried, with industry help, to tie those together," Cairns says, "to provide some rationality among them." He points out that light-truck fuel-economy standards apply to a lot more vehicles than just pickups, including minivans, Jeep Wranglers, and even Patriots, since NHTSA and EPA categorize trucks based on attributes such as cargo-carrying and off-road capabilities. Oshnock continues that, while two government agencies and California are involved, "the programs are fairly well aligned -- though it does add complexity. Trying to get to a single national program? We generally support this effort."

GM has a 33,000-square-foot Global Battery Systems Lab, the largest in the U.S., where it tests batteries for present and future vehicles.

CAN IT BE DONE?

"Previously, when a manufacturer had a single number target, you had two choices of how to improve fuel economy to hit that target," says Michael Love, Toyota USA's national manager of Regulatory Affairs and Powertrain Planning. "You could apply technology to a given size truck to make it more efficient, or you could build smaller trucks. Under this new footprint-based program -- depending on whether the curves set by the government are truly size neutral -- there is little or no benefit to building smaller trucks. Your only options are to apply technology and make the vehicles lighter through vehicle design and materials technology, while keeping the same size."

Ram initiated a three-year plan to test its plug-in hybrid electric Ram 1500s.

He adds that the 2012-2016 rules require a very aggressive 4.0-4.5-percent annual increase.

"With a five-year product cycle between major changes, every time you have a major change, you will need more than a 20-percent increase in fuel economy. What technologies will get you a 20-percent increase? And what will you need for your next 20 percent?" The rules for 2017-2025, to which the manufacturers have nominally agreed, also require about a 4-percent annual increase for cars. Full-size trucks get no increase through 2020, after which their annual rate of increase will also be about 4 percent for 2021-2025. "That was negotiated with the government to benefit full-size pickups," Love explains, "and there are some yet-to-be-defined bonus credits for full-size hybrid pickups."

Do truckmakers believe they can meet these incredibly aggressive requirements without losing important capabilities and/or driving costs (and therefore retail prices) through the roof? They all say they can and will, but with reservations.

"Arguably, there is a lot of available technology," Love responds, "but the biggest question is the cost. All the cheap technology has already been adopted. We're moving into much more expensive technology, and there's always a debate about what those costs will be -- there are huge differences of opinion between costs as estimated by the government and as estimated by the manufacturers -- and therefore a big question about whether the public is willing to pay for it." "It is a great challenge for engineers," says Cairns. "Do we know how to do it today? Not really. There is technology that can get us there, but not in a cost-effective manner. If we would

just apply known technologies now, we would price ourselves out of the market. So the answers that exist today are not going to be the right answers as we move forward. We have to invent things, come up with new creative ideas, as well as improvements and cost reductions to known technologies, plus the weight reductions and aerodynamic improvements we have been doing over the years. No doubt it's a big challenge, but Ram trucks will find a way because we want to provide what our customers want."

"In one sense, it's a very simple formula to improve fuel economy," Ford's Lewis asserts. "Get weight out, improve rolling resistance, get better aerodynamics, get rid of parasitic losses in the systems and squeeze as much efficiency as possible out of your powertrains. "We can figure out how to do it, but it will be costly. Technology needs to be developed. We're capable of developing it, but how much investment and variable cost can we put into it? Our business is hugely competitive from a cost and investment perspective, so the bigger challenge is figuring out how to stay in business while implementing it."

"Everyone is faced with the same challenges," he concludes. "We all focus on and will implement fundamentally the same technologies, and we can't lose capabilities. Customers buy trucks for capabilities. So whoever figures it out, executes best, and implements most efficiently with the best business plan will win. We're hopeful that will be us." And if it turns out that it simply can't be done? We love former GM product guru Bob Lutz's take on CAFE a few years ago, when he still worked for GM: "If something is impossible," he said, "nobody will do it. And when they get to the point where the legislation is tantamount to saying that cars may no longer touch the road surface because we don't want to deteriorate the infrastructure, so we're mandating that by 2015, all cars have to hover off the highway by 2 inches, I think, well, that's nice. So [if CAFE gets to that point], I won't worry about it. I'll just know it's that it's physically impossible, so something is going to give before we get there."

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