Fueling Savings: Higher Fuel Economy Standards Result In Big Savings for Consumers

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1. INTRODUCTION

This report provides updated estimates of net savings under the latest CAFE (corporate average fuel economy) standards for a typical car or light truck owner. Synapse Energy Economics (Synapse) evaluated the costs and fuel savings associated with compliance with the 2025 standard—the latest model year (MY) proposed—relative to the existing standards for MY 2016. The costs of compliance are based on assumed incremental technology costs when purchasing a vehicle, as well as associated annual insurance and maintenance costs. Fuel savings are based on forecasts of future gasoline prices and miles driven.

As shown in Table 1, we found that the lifetime net savings (i.e. savings minus costs) for compliance with the MY 2025 standard are $3,200 per car and $4,800 per light truck, under base case assumptions for gasoline prices and technology costs. Under a higher gas price regime, compliance becomes even more attractive, with a typical car saving $5,700 and a truck saving $8,200. In all cases, the net savings estimates are higher or on par with results from our earlier May 2016 study.[1]

Table 1: Lifetime Net Savings for MY 2025 Compliance

Gas Prices	Car	Truck
Base Case	$3,200	$4,800
High Case	$5,700	$8,200

Note: Net Present Value (at 3% discount rate) of additional costs and savings of a vehicle complying with MY 2025 standard, relative to MY 2016 standard; includes changes in purchase cost, insurance, maintenance, and fuel spending.

Our previous study, released on May 3, 2016, relied on technical documentation produced by the U.S. Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) in 2012.[2] It also relied on Energy Information Administration (EIA) forecasts of gasoline prices available at the time.[3] Since then new documentation has been released by EPA and NHTSA (along with the California Air Resources Board) in the form of the Draft Technical Assessment Report (Draft TAR) in July

[1] The previous results for the base case were: $3,100 for cars and $4,300 for trucks. The results under the high case were: $5,800 for cars and $8,200 for trucks. Estimates adjusted from 2013 to 2015 dollars. See: Synapse Energy Economics. May 2016. *Consumer Savings from 2025 Corporate Average Fuel Economy Standards (CAFE)*. Prepared for Consumers Union. Available at: http://consumersunion.org/wp-content/uploads/2016/05/Consumer-Savings-From-CAFE-2025.pdf, Table 1.

[2] U.S. EPA and U.S. DOT (Final Rule). *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*. Available at: https://www.gpo.gov/fdsys/pkg/FR-2012-10-15/pdf/2012-21972.pdf.

U.S. EPA and U.S. DOT (TSD). *Joint Technical Support Document: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*. Available at: https://www3.epa.gov/otaq/climate/documents/420r12901.pdf

[3] Energy Information Administration (EIA) Annual Energy Outlook (AEO) 2015. Available at: http://www.eia.gov/forecasts/aeo/data/browser/

2016.[4] The Draft TAR provides updated assumptions and analyses performed separately by EPA and NHTSA. Both agencies' analyses also focus on compliance with the 2025 standards relative to compliance in 2021—instead of comparing to a 2016 compliance baseline, as they did previously. In this report, we have used new information from the Draft TAR where appropriate and the latest EIA gasoline price forecasts which were released after the Draft TAR.[5] Unlike the Draft TAR, however, our analysis maintains the comparison of 2025 compliance to a 2016 compliance baseline. Because we are comparing 2025 compliance to a 2016 baseline, our estimated savings are higher than those found in the Draft TAR which assumes a more efficient 2021 standard as a baseline.

Changes in savings estimates are due to changes in several key assumptions that occurred after the May 2016 study, including: lower technology costs, lower lifetime miles driven, lower fuel efficiency performance for trucks, and higher fuel efficiency performance for cars.[6] While some of these factors increased savings while others decreased savings—the net effect was an increase in savings for both cars and trucks. Gasoline prices are also a key assumption for calculating savings; however, the EIA 2016 forecasts used in this study are similar to, but slightly lower than the 2015 forecasts used in the May 2016 study.

The updated savings estimates are presented in further detail below. A description of the underlying assumptions is in the subsequent section.

2. NET SAVINGS FROM 2025 CAFE STANDARDS

Owners of new cars and trucks will save significantly when purchasing a vehicle that complies with the 2025 CAFE standards, relative to current standards. The 2025 CAFE standards for cars and trucks are 55.2 mpg (miles per gallon) for cars and 39.9 mpg for light trucks.[7] This represents a 52 percent increase in car fuel economy and a 45 percent increase for light trucks, compared to the 2016 standards.[8]

Under base case assumptions for gasoline prices and compliance technology costs, we estimate that 2025 compliance will save $3,200 per car and $4,800 per truck—see **Error! Reference source not found.**

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4 U.S. EPA, NHTSA, and CARB. 2016. Draft Technical Assessment Report: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025. Available at: https://www3.epa.gov/otaq/climate/documents/mte/420d16900.pdf.

5 Energy Information Administration (EIA). 2016. Annual Energy Outlook 2016. Available at: http://www.eia.gov/forecasts/aeo/data/browser/.

6 Despite a decrease in gasoline price expectations since 2012, the Draft TAR assumes a lower lifetime vehicle miles traveled (VMT) based on updated survey information and assumptions developed by EPA.

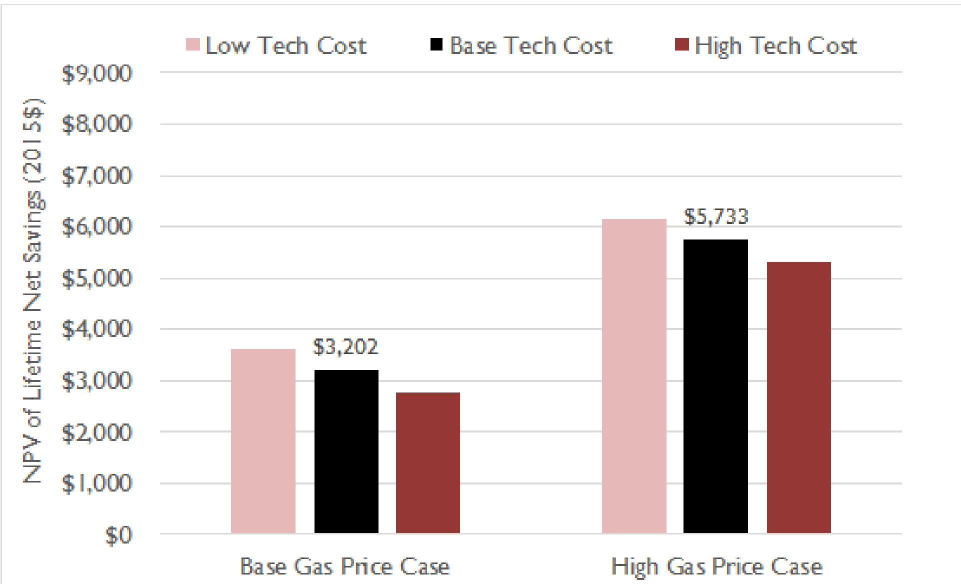
7 Draft TAR, Tables 10-1 and 10-2. These levels represent what EPA refers to as "effective mpg," which is adjusted to account for credits given to air conditioning systems increasing efficiency or reducing refrigerant leakage. They do not account for on-road fuel economy performance.

8 2016 CAFE standards are 36.2 mpg for cars and 27.5 for trucks. Available at: http://www.nhtsa.gov/Laws+&+Regulations/CAFE+-+Fuel+Economy/Model+Years+2012-2016:+Final+Rule.

and Figure 2 below.[9] These net savings estimates account for both the costs of compliance with the standard and the resulting fuel savings—both of which are incremental to existing 2016 CAFE standards.

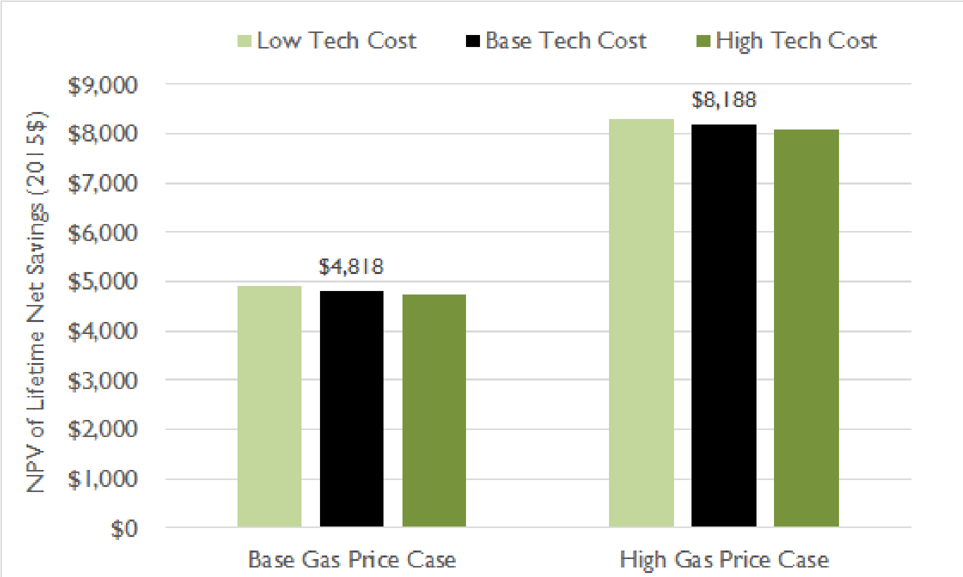
CAFE savings estimates fluctuate—while remaining positive—with variations in compliance costs and the gasoline price assumptions that we discuss in the next section. Higher gas prices lead to net savings of $5,700 per car (a 79 percent savings increase above the base case) and $8,200 per truck (a 70 percent savings increase above the base case). Under the most favorable assumptions considered—high gas prices and low technology costs—net savings are $6,200 per car and $8,300 per truck.

Figure 1: Lifetime Savings for MY 2025 Car (relative to MY 2016)



9 Savings estimates were developed by Synapse using methodology that is consistent with previous EPA and NHTSA estimates. All dollar figures in this report are expressed in 2015 dollars.

Figure 2: Lifetime Savings for MY 2025 Light Truck (relative to MY 2016)



Our study focuses on the costs and savings for a typical car or light-duty truck. However, EPA and NHTSA also show compliance costs and savings estimates in terms of a vehicle that represents the mix of cars and light-duty trucks on the road. This indicates the average costs and benefits per vehicle across the entire light-duty fleet. Table 2 shows how these average costs and benefits per vehicle would change with various fleet mixes. Not surprisingly, given the results shown above, a high mix of trucks would lead to a higher fleet-wide net benefit. Despite the fact that more cars on the road improves the fleet-wide fuel economy, truck owners save more gallons in absolute terms from efficiency gains and drive more miles than car owners (see Table 4) and, therefore, save more money on fuel.

Table 2: Lifetime Savings for MY 2025 Representative Light-duty Vehicle (Net Present Value at 3%)

Fleet Mix in 2025	Fuel savings	Compliance Costs	Net Benefits	On-road fuel economy (mpg)
40% Cars/60% Trucks	$6,160	$1,989	$4,171	36
50% Cars/50% Trucks	$5,981	$1,971	$4,010	37
60% Cars/40% Trucks	$5,802	$1,953	$3,848	38

Most car and truck owners will save money immediately because they purchase cars and trucks using financing rather than cash upfront. When the compliance costs for CAFE are spread over the term of a typical loan—between five and six years—the annual fuel savings outweigh the annual costs in all years. The bars on Error! Reference source not found. **and**

Figure 4 (below) show the annual compliance costs and fuel savings for a car and truck, respectively, under base case assumptions. Costs through Year 6 are mostly from car loan payments. After Year 6, low incremental insurance and maintenance costs persist in each year. For both cars and trucks, half of the lifetime savings (shown above in **Error! Reference source not found.** and Figure 2) is realized by the ninth year of operation.

Figure 3: Annual Car Compliance Costs and Fuel Savings (relative to MY 2016, assuming financing)

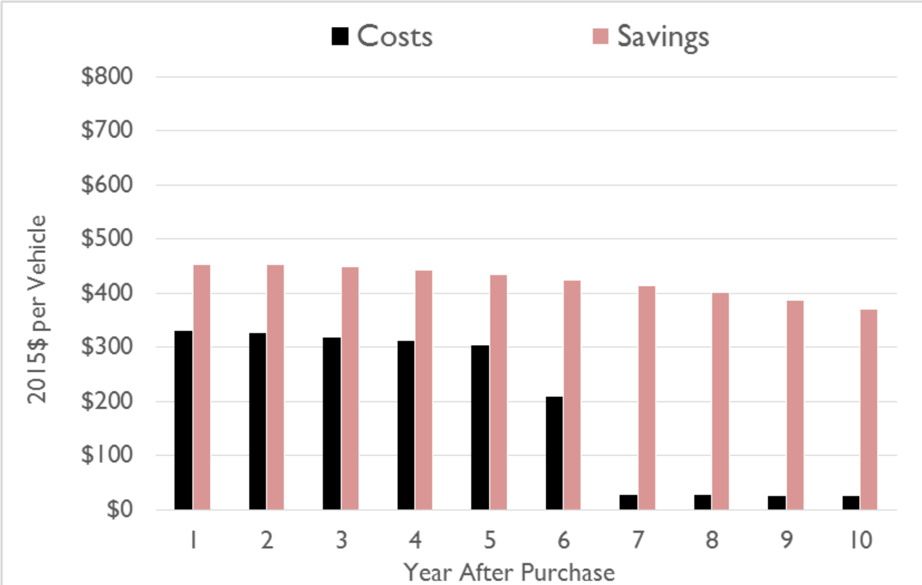


Figure 4: Annual Light Truck Compliance Costs and Fuel Savings (relative to MY 2016, assuming financing)

In the less frequent scenario that the vehicles are paid for in cash, consumers will save slightly more over the lifetime of the vehicle than with financing. However, unlike with financing, owners paying cash will not experience savings immediately. This is merely because the fuel savings in the first year do not outweigh the additional compliance costs when paid in one lump sum. Under the base case assumptions, a car owner paying cash will see net savings starting in the fourth year of ownership while a truck owner will in the third year. Under a high gas price regime, both would see net savings one year earlier—three years for car owners or two years for truck owners.

3. METHODOLOGY FOR ESTIMATING NET SAVINGS

Compliance costs for the 2025 standard were based on estimates from EPA and NHTSA. The "high" cost case takes the higher cost estimate of the two agencies. Similarly, the "low" cost case takes the lower of the two. The average of the high and low estimates for each vehicle type results in a base technology cost of $1,397 per car and $1,529 per truck. These costs have decreased since the May 2016 study. This is mainly due to EPA's cost estimates decreasing significantly for both cars and trucks in its latest 2016 analysis that updates prior assumptions about technology made back in 2012. There is significantly more variation in the compliance cost estimates for cars than there is for trucks. This effect is seen when comparing the lifetime savings results between technology cost cases for cars (shown in **Error! Reference source not found.**) compared to trucks (shown in Figure 2). Under financing, we assumed that the compliance cost was spread over an average car loan term and was subject to the average interest rate on new car loans.[10]

Table 3: MY 2025 Compliance Cost Estimates (incremental to MY 2016)

Technology cost per vehicle	Car	Truck
NHTSA[11]	$1,710	$1,458
EPA[12]	$1,085	$1,600
Base technology cost (average)	$1,397	$1,529

The gasoline price is a critical determinant of net savings. In this study, we relied on EIA's Annual Energy Outlook (AEO) developed in 2016 (the latest version available). Figure 5 shows three AEO 2016 gasoline prices that we reviewed for this study. The EIA reference case (our base case) starts at around $3.00 per gallon in 2025. The "high" case starts at about $5.00 per gallon while the "low" case starts at about $2.00 per gallon.[13] Our May 2016 study used the 2015 AEO forecasts, which were close to those produced in 2016. A 2013 Synapse study used the AEO 2012 gasoline price forecast which was

[10] Experian, State of the Automotive Finance Market First Quarter 2016. Available at: http://www.experian.com/assets/automotive/quarterly-webinars/2016-q1-safm.pdf. We assumed the reported average loan term of 68 months and average interest rate of 4.79%.

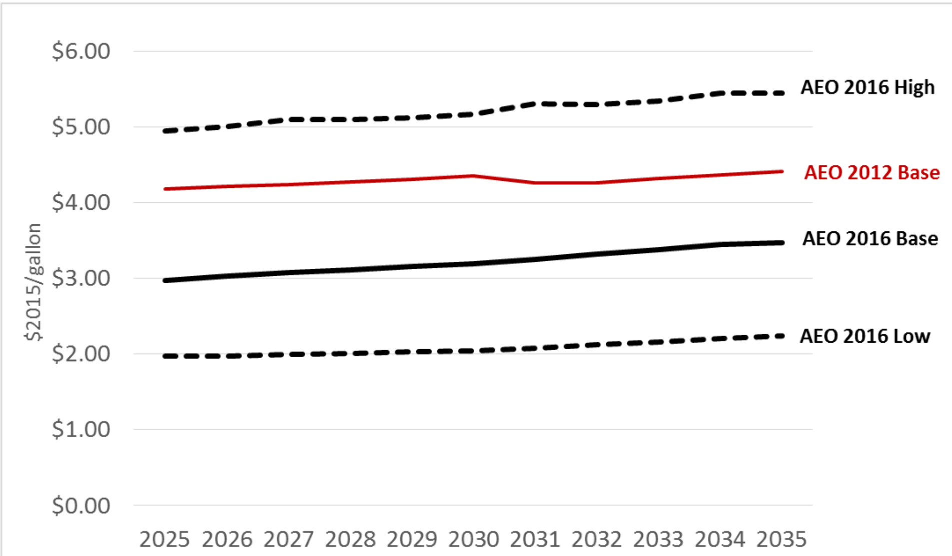
[11] Draft TAR. NHTSA values were provided in Table 13.23 for a combined car/truck cost per vehicle. This was used to derive costs per car and truck by using the fleet mix of 52% cars and 48% trucks implied in Tables 13.16, 13.17, and 13.18.

[12] Draft TAR. EPA values were derived by adding the incremental costs of compliance between MY 2016 and MY 2021 to the incremental costs of compliance between MY 2021 and MY 2025—as reported in Draft TAR Tables 12.44, 12.96, and 12.97 and adjusting from 2013 to 2015 dollars using the Producer Price Index for cars (Available at: https://research.stlouisfed.org/fred2/series/GDPCTPI).

[13] The "high" case is based on AEO's High Oil Price scenario. The "low" case is based on AEO's Low Oil Price scenario. All AEO forecasts are available at: http://www.eia.gov/oiaf/aeo/tablebrowser/. Estimates in the previous study were for a combined car/truck compliance vehicle. Therefore, they are not directly comparable to the separate car and truck estimates provided in this current study.

significantly higher than the AEO 2015 or 2016 base cases.[14] Thus the base case results presented in this current study reflect decreased gas price expectations in recent years.[15]

Figure 5: Gasoline Price Forecasts



The CAFE fuel economy values were developed under test conditions and have historically been higher than actual vehicle economy.[16] Thus, in estimating fuel savings, the miles per gallon targets previously mentioned were reduced to reflect what is referred to as the "fuel economy gap." This adjustment attempts to capture actual performance on the road. As shown below in

Table 4, this gap leads to adjusted values of 42.7 mpg for cars and 30.8 mpg for trucks. This gap has increased for both cars and trucks since the previous analysis. EPA and NHTSA report that this is mainly due to an increase in assumed ethanol content.[17]

Fuel savings is also determined by vehicle miles traveled (VMT). We relied on updated assumptions for lifetime VMT, including the annual survival rate of cars and trucks over time.[18] The "typical" car or truck evaluated in this study is an average of the entire fleet, including the effects of retirements. For example, if 20 percent of the car fleet is off the road by Year 11, then the VMT for our typical car in that

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[14] Consumers Union. 2013. *A Review of Consumer Benefits from Corporate Average Fuel Economy (CAFE) Standards*. Available at: http://consumersunion.org/wp-content/uploads/2013/06/FuelEconomyStandards.p

[15] Assuming these gas prices and base case compliance costs, estimated savings were $1,500 per car and $2,600 per truck. We do not focus on these results because the EIA forecasts incorporate the already low gas prices we see today, and it seems unlikely that gasoline will remain around $2.00 for in the coming decades.

[16] Draft TAR, p.10-2.

[17] Draft TAR, p.10-1.

[18] Draft TAR, Tables 10.5 and 10.6. The survival-weighted VMT in our study is based in part on the proportion of cars and trucks that are expected to remain on the road in each year through their respective lifetimes. These assumed survival rates are based on historical vehicle registration data.

year is adjusted downward to 80 percent of the estimated VMT for the remaining vehicles. Therefore, the fuel usage for a typical vehicle—and related savings—decays in each year as cars or trucks are taken off the road. The lifetime VMT decreased for cars and trucks compared to the previous assumptions used by NHTSA in 2012. This was due to updated assumptions on vehicle usage from EPA.[19] All else equal, this decrease would lead to lower net savings.[20] However, this effect is outweighed by other effects which lead to increased savings, mainly lower compliance costs.

Although the baseline level VMT in the Draft TAR was much lower, adjustments to VMT were applied in a similar manner to past evaluations. Most importantly, previous evaluations of the rule considered the "rebound effect" whereby people drive slightly more (or less) when fuel costs are lower (or higher). To be consistent with these methods, we allowed the VMT to vary with fuel costs per mile (from both gasoline price and fuel economy). Consistent with EPA's methodology, we assumed an elasticity of -0.10 for VMT with respect to fuel costs, i.e. a 10 percent decrease in fuel costs would lead to a 1 percent increase in VMT. Thus, vehicles were assumed to travel more miles under base gas prices case than under high gas prices. Likewise, vehicles were assumed to travel more under the 2025 standards than under the 2016 standards (all else equal). Even after adjusting for increased driving due to lower gas prices, the resulting VMT was still lower than what was assumed in our previous study because it started from a much lower baseline.

Table 4: Miles per Gallon and Lifetime Vehicle Miles Traveled (VMT) Assumptions

Fuel economy and usage per vehicle	Car	Truck
Initial MY 2025 mpg[21]	55.2	39.9
Fuel economy gap[22]	22.7%	22.7%
Adjusted MY 2025 mpg	42.7	30.8
Lifetime survival-weighted VMT, 2025 vehicle (base)	175,718	203,993

4. Conclusion

This study shows that increased fuel economy with the more stringent 2025 CAFE standards will lead to substantial net savings for both car and truck owners. Under mid-range assumptions, we estimate that the new standard will save $3,200 per car and $4,800 per truck. Assuming the vehicle is purchased using a loan, decreased fuel spending immediately outweighs the compliance costs. If the buyer pays cash for the new vehicle, payback occurs in 3 to 4 years.

[19] Draft TAR, p.10-6.

[20] Draft TAR, p.13-11. The updated odometer readings were conducted by IHS/Polk. The lifetime VMT used previously by NHTSA was based on the 2009 National Household Travel Survey.

[21] Draft TAR, p.10-3.

[22] Final Rule, Table IV-10.

These results are based on a gasoline price forecast of $3.00–$3.50 per gallon for the decade beginning in 2025. Under a high gas price ($5.00–$5.50) regime, the net savings increase by nearly 80 percent for cars and 70 percent for trucks. In the unlikely case that gas prices decrease from today's prices—and remain low—the net savings would remain positive but decrease by about half the levels under base case gas prices.