Consumer Federation of America

An Analysis of Consumer Savings and Automaker Progress On the Road to 2025 CAFE Standards

Increasing Fuel Economy Saves Consumers Money, Sells Vehicles, Keeps American Companies Competitive and, Most Importantly, is Achievable

Jack Gillis

Richard Eckman

Consumer Federation of America

July 24, 2017

INTRODUCTION

This report evaluates the direct consumer savings, and automaker progress, associated with the 2025 CAFE standards. It is in response to current efforts by certain members of Congress and the current Administration to roll back those standards. The rationale for the rollback is that it costs too much to comply with the standards and, as a result, vehicle prices will increase, thus dissuading consumers from buying new cars. The fact is, rolling back the standards would not only cause great harm to consumer pocketbooks, but, because of consumer demand for fuel efficiency, would also harm sales.

Public opinion surveys, including one recently conducted by the Consumer Federation of America, demonstrate unquestionably that consumers want more fuel efficient vehicles and that they strongly support standards requiring them. Consumers understand that gasoline costs are a major household expenditure and improvements in vehicle fuel economy puts money directly back into their pocketbooks. Furthermore, while gas prices are currently low, they understand the cyclical nature and volatility of those prices.

Our analysis shows that Congress and the Administration would be making a serious mistake in rolling back the standards. Not only would the impact be immediately felt by already financially strapped Americans, but it would put the U.S. car companies at a distinct disadvantage, both nationally and globally, in competing with the Asian manufacturers, who are quite capable of complying with the standards. As this report will demonstrate, not only do fuel economy standards pay off in lower ownership and operating costs, but the carmakers are fully capable of meeting the standards at a reasonable cost, and improving fuel economy improves sales.

We examined the current progress in meeting fuel economy standards by analyzing the performance of 2017 and 2016 vehicles from a variety of perspectives. On

July 24, 2017, CFA released its most recent survey of consumer attitudes towards fuel economy in link.

NEARLY HALF OF "ALL-NEW" 2017 VEHICLES COST LESS TO BUY AND FUEL THAN THEIR 2011 COUNTERPARTS

25% of the 2017 All-New Vehicles Cost Less Than Their 2011 Counterparts AND Got Better Fuel Economy

Manufacturers have the greatest opportunity to improve vehicle fuel economy when they introduce a truly new vehicle.[1] For this analysis, we compared the cost and fuel economy of 19 of the 27 "all-new" 2017 models which had a 2011 version, the year before the current standard was put in place.[2] These 19 models included 79 different EPA designated engine/drive train/transmission/MPG configurations (or what are called "trims"). When we compared the cost difference between the "all-new" 2017 models and their 2011 version, after factoring in inflation, 21 or 27% actually went down in price, yet every one of these vehicles saw a 1 to 10 MPG increase. Vehicles that improved their fuel economy while going down in price ranged from the Subaru Impreza and GMC Acadia to the Mercedes E Series, clearly demonstrating that improvements in fuel economy do not have to generate higher prices.

FUEL SAVINGS EXCEEDED FUEL ECONOMY TECHNOLOGY COSTS FOR 94% OF ALL-NEW 2017 MODELS

Annual vehicle price increases (less inflation) cover many different improvements such as new safety technology, convenience items, design changes, as well as upgraded fuel economy technology. By separating out the cost of fuel economy improvements from these other costs, we were able to get a more accurate look at the impact of the

[1]Each year only about 10 percent of the fleet is made up of truly "all-new" vehicles. Typically, when a new model is introduced, that vehicle essentially stays the same for 5-6 years. This is called a "model series" and while there may be some style and feature changes during a model's series, the mechanics of the vehicle generally stay the same

[2] There were 27 all new vehicles introduced in 2017, 19 of them had a previous version available in 2011. These 19 vehicles were the ones we included in this analysis.

standards on consumer pocketbooks. Overall, for 74 of the 79 vehicles (94%), the added cost of new fuel efficient technology was far exceeded by the resulting fuel cost savings over the first 5 years of ownership.

EVEN IF THE PRICE OF THE VEHICLE GOES UP, FUEL ECONOMY SAVINGS CAN OFFSET THE INCREASE

For 12 of the 58 vehicles whose cost went up, the savings in fuel costs exceeded the entire price increase for that vehicle, even though only part of that increase can be attributed to fuel efficiency.

Each mile per gallon of improvement is estimated to cost about $100 in improved fuel economy technology.[3] For 41 of the 58 vehicles whose cost went up, the savings in fuel costs outweighed the cost of the fuel economy technology. Finally, for the few vehicles whose fuel economy stayed the same or actually decreased, all experienced an increase in price.

Figure 1: 2011 vs. 2017 "All-New" Price Comparison (Accounting for Inflation)

	"All-New" Trims[123]	Percent of "All-New Trims"
Total "All-New" Vehicles with 2011 Counterpart	79	100%
2011 Vehicles Which Were LESS Expensive in 2017 Dollars and Had Higher MPG	21	27%
2011 Vehicles Which Were MORE Expensive in 2017, Who's Fuel[4] Savings Offset the Entire Price Increase	12	15%
2011 Vehicles Which Were MORE Expensive in 2017, Whose Fuel[4] Savings Offset the $100/MPG Cost of Fuel Economy Technology[5]	41	52%
2011 Vehicles Which Were MORE Expensive in 2017, Who's Fuel Economy Stayed the Same or Decreased	5	6%

[1]Inflation was calculated using BLS average inflation numbers from 2011-2016.

[2]Average "All-New" Vehicle Price from the New Car Cost Guide.

[3] CFA bases its estimate of the cost of fuel economy on a review of the literature including historical, market-based and engineering studies, as described in Appendix B.

[3]Fuel Economy of "All-New" Vehicles based on EPA combined estimates.
[4] Gas costs from AAA $2.27 (7/19/17) and driving an average of 14,000 miles per year.
[5] CFA bases its estimate of the cost of fuel economy on a review of the literature including historical, market-based and engineering studies, as described in Appendix B.

OVERALL, FUEL ECONOMY IMPROVEMENTS FAR EXCEED THEIR COST, AND PARTIALLY OFFSET THE COST OF OTHER IMPROVEMENTS

The average "all-new" vehicle increased in price from $37,808[4] in 2011 to $39,723 in 2017, (4.8%). Their increase in fuel economy went from an average of 21.0 to 24.2 MPG, (13.2%). Considering that every mile per gallon of improvement costs about $100, the average cost of these improvements was $320. However, this fuel economy increase saved owners of these "all-new" vehicles an average of $946 in gas costs over 5 years. The difference between the cost of these improvements and their benefit provided consumers with an average savings of $626 over 5 years in gasoline costs. These savings go directly into consumer pocketbooks and back into the economy or offset about 40% of the non-fuel efficiency technology component of the average price increase of "all-new" cars from 2011-2017.

[4] 2017 Dollars

Figure 2: 2011 & 2017 Average "All-New" Vehicle Price and Fuel Economy (Accounting for Inflation)			
Year	**Ave. "All-New" Vehicle Price[1][2]**	**Ave. Fuel Economy of "All-New" Vehicles[3]**	**Gas Cost for 5 Years[4]**
2011 Price in 2017 Dollars	$37,808	21.0	$7,567
2017 Price	$39,723	24.2	$6,621
Change in Price	$1,915	3.2	-$946
% Change	4.8%	13.2%	-14.3%
COST: $100 per MPG Increase for Fuel Economy Technology[5]	-$320		
BENEFIT: Gas Savings Due to Fuel Efficient Technology	$946		
SAVINGS: Average Savings for "All-New" Car Buyers	$626		

[1]Inflation was calculated using BLS average inflation numbers from 2011-2016 averaging 1.4% per year.

[2]Average "All-New" Vehicle Price is from the New Car Cost Guide for the 79 vehicles.

[3]Average Fuel Economy of 79 "All-New" Vehicles is based on EPA combined mileage estimates.

[4]Gas costs from AAA $2.27 (7/19/17) and driving an average of 14,000 miles per year.

[5] CFA bases its estimate of the cost of fuel economy on a review of the literature including historical, market-based and engineering studies, as described in Appendix B.

CAFE COMPLIANCE AMONG "ALL-NEW" VEHICLES SHOW MANUFACTURERS ARE ON THEIR WAY TO 2025 COMPLIANCE

The introduction of "all-new" vehicles is the best barometer of a manufacturer's ability to comply with CAFE standards. Changing the fuel economy of existing vehicles is difficult, as the vehicle is already designed and is being manufactured to its original specifications. With "all-new" vehicles, manufacturers can incorporate their latest fuel-saving technologies.

In comparing the CAFE compliance of "all-new" models introduced in 2015, 2016 and 2017, there was a significantly higher percentage of CAFE-compliant vehicles in 2017. In fact, 70 percent of the "all-new" 2017 vehicles had a CAFE-compliant trim, compared to 41 percent of the "all-new" 2015 vehicles (Figure 3). Particularly noteworthy was the fact that 78% of the "all-new" light duty trucks had a CAFE

compliant trim for 2017. Interestingly, percentage-wise, trucks beat cars for CAFE compliance in 2017.

Figure 3: Percentage of CAFE Compliant Vehicles Among "All-New" Models 2015-2017			
	2015	**2016**	**2017**
Total "All-New" Vehicles	34	32	27
Total CAFE Compliant	14 (41%)	19 (60%)	19 (70%)
Percentage of CAFE Compliant Vehicles Among "All-New" Model Cars 2015-2017			
	2015	**2016**	**2017**
Total "All-New" Cars	19	19	18
Total CAFE Compliant	8 (42%)	15 (80%)	12 (67%)
Percentage of CAFE Compliant Vehicles Among "All-New" Model Trucks 2015-2017			
	2015	**2016**	**2017**
Total "All-New" Trucks	15	13	9
Total CAFE Compliant	6 (40%)	5 (40%)	7 (78%)

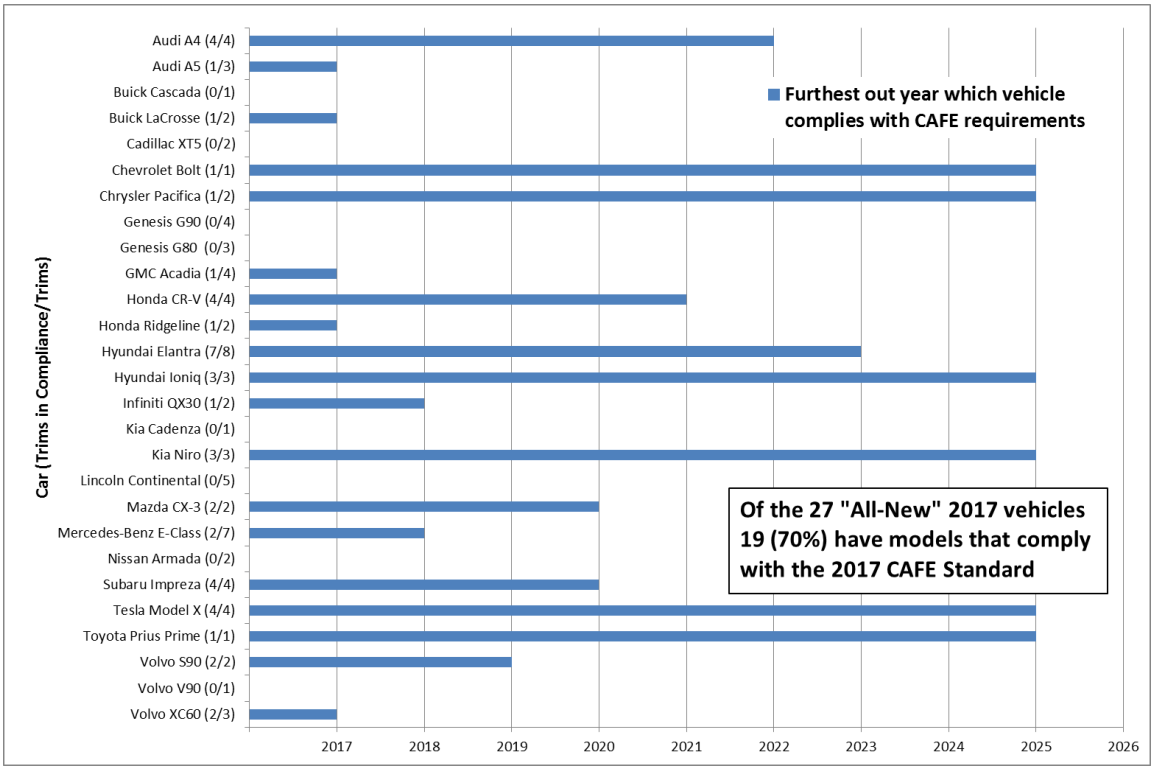
MANY MODELS EXCEED CURRENT YEAR CAFE REQUIREMENTS – SOME COMPLYING TO 2025

In reviewing the "all-new" vehicles, we also determined how many years into the future each model would comply with the *gradual increase* in CAFE requirements. Current vehicles that meet CAFE requirements for future years indicate that manufacturers are actually "ahead of the game" in terms of compliance.

70% (19) of the 27 "all-new" vehicles for 2017 had models which met, at the minimum, the 2017 CAFE standard. In fact, from 2015-2017, the majority of these compliant cars actually exceeded the minimums required for that year. Figure 4a shows that 6 of the 2017 vehicles are already CAFE compliant with the 2025 standard—a record number.

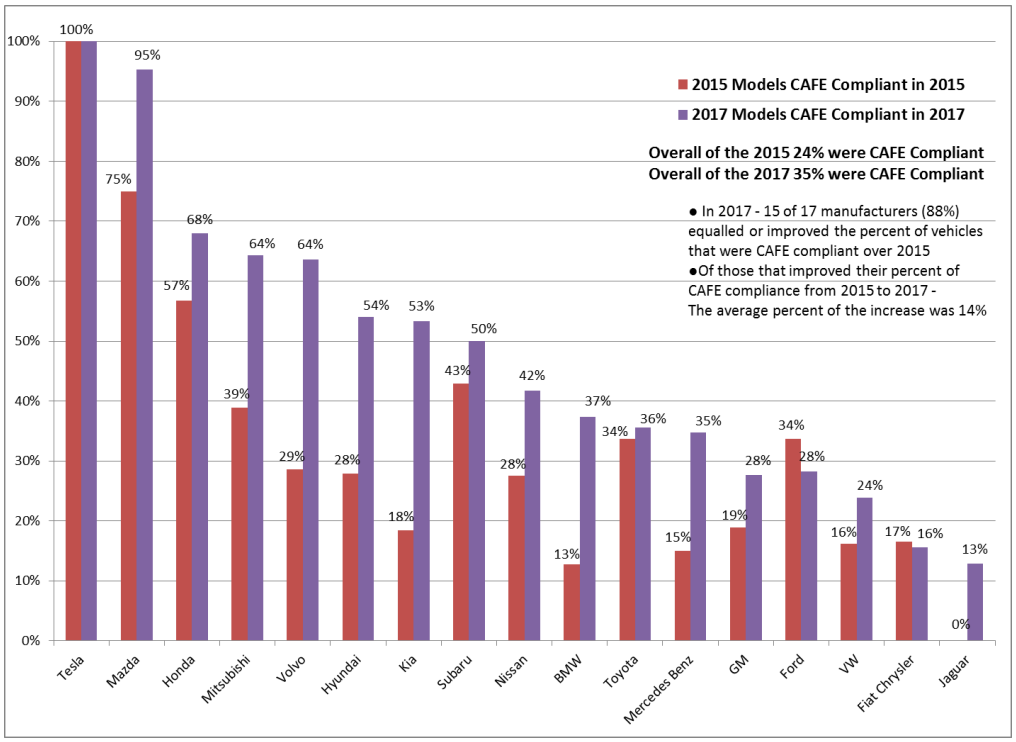
Figure 4a: Among the "All-New" Vehicles – How Many Will Continue Their CAFE Compliance Until:											
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
2015	14	10 (71%)	8 (57%)	6 (43%)	5 (36%)	3 (21%)	3 (21%)	2 (14%)	0	0	0
2016	-	19	18 (95%)	18 (95%)	15 (79%)	14 (74%)	11 (58%)	7 (37%)	6 (32%)	4 (21%)	2 (11%)
2017	-	-	19	14 (74%)	11 (58%)	10 (53%)	8 (42%)	8 (42%)	7 (37%)	6 (32%)	6 (32%)

Figure 4b. 2017 "All-New" Vehicles and Their CAFE Compliance



What is particularly remarkable is the improvements in CAFE compliance by each of the manufacturers. 14 of the 17 major manufacturers improved the percent of their vehicles that were CAFE compliant from 2015 to 2017. (Tesla at 100% compliance matched its 2015 compliance.) While Ford and Fiat Chrysler lost ground, many of the other manufacturers actually doubled the percent of CAFE compliant vehicles. (Figure 4c)

Figure 4c. Percent of 2015 and 2017 Vehicle Trims that were CAFE Compliant by Manufacturer



GAS GUZZLERS DECLINE SIGNIFICANTLY IN 2017 - VEHICLES GETTING OVER 30 MPG STAYS STEADY

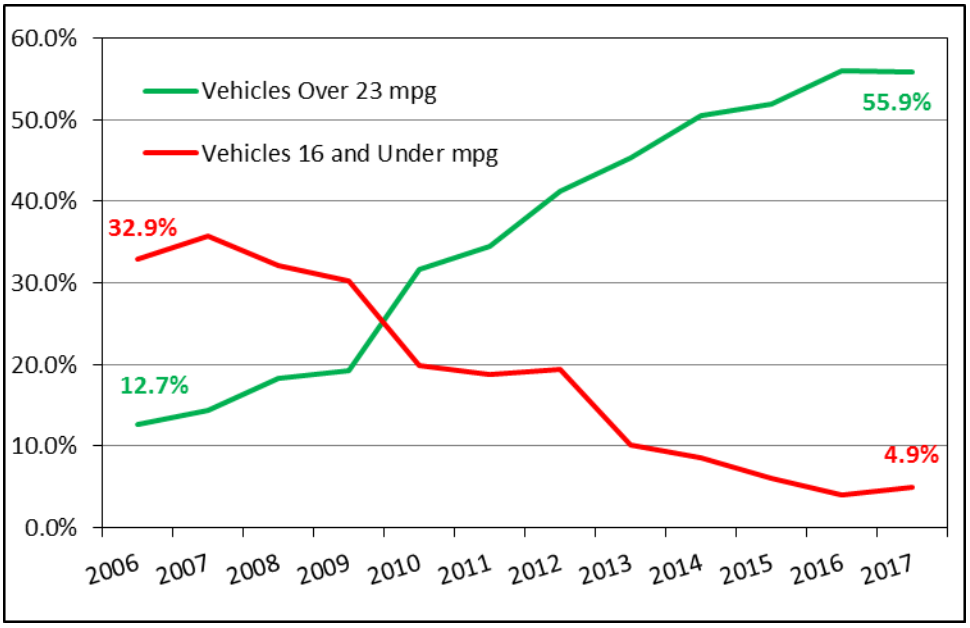
Fuel economy progress is going well. In looking at all of the 2017 models, "gas guzzlers" getting below 14 MPG are a miniscule 0.4% in 2017, down from 8.5% in 2011. At the other end, there was a small increase in vehicles getting over 38 MPG, going from 4% last year to 4.3% in 2017. (Figure 5a)

Figure 5a: On the Road to 40 mpg by 2025: Carmakers Demonstrate Significant Progress

EPA Grade	MPG	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
10	38+	0.4%	0.2%	0.2%	0.2%	0.6%	1.0%	1.1%	2.9%	3.1%	3.0%	4.0%	4.3%
9	31-37	0.7%	0.4%	0.8%	1.1%	2.1%	3.2%	4.7%	6.4%	8.5%	8.7%	9.3%	8.8%
Over 30MPG		**1.1%**	**0.6%**	**1.0%**	**1.3%**	**2.7%**	**4.2%**	**5.8%**	**9.3%**	**11.6%**	**11.7%**	**13.4%**	**13.0%**
8	27-30	2.4%	3.0%	3.5%	4.4%	7.3%	7.8%	9.2%	12.0%	14.8%	16.5%	17.3%	15.8%
7	23-26	10.3%	10.2%	12.8%	12.4%	18.9%	18.3%	20.4%	25.0%	24.1%	23.8%	25.4%	27.1%
Acceptable		**12.7%**	**14.4%**	**18.3%**	**19.3%**	**31.6%**	**34.5%**	**41.2%**	**45.3%**	**50.5%**	**52.0%**	**56.1%**	**55.9%**
6	22	10.4%	10.4%	7.2%	11.7%	8.4%	8.0%	7.0%	7.7%	6.1%	8.0%	7.5%	7.7%
5	19-21	28.2%	26.5%	28.5%	27.6%	29.2%	30.4%	26.9%	26.5%	24.3%	22.2%	21.8%	21.1%
4	17-18	14.7%	13.7%	14.9%	12.5%	13.8%	12.5%	11.3%	9.4%	10.6%	11.7%	10.7%	10.5%
3	15-16	24.4%	24.6%	16.6%	15.6%	11.4%	10.3%	9.8%	6.7%	6.1%	4.7%	3.7%	4.5%
2	13-14	5.0%	5.9%	9.9%	8.2%	6.7%	6.8%	7.8%	3.0%	2.4%	1.4%	0.3%	0.4%
1	0-12	3.5%	5.2%	5.7%	6.4%	1.7%	1.7%	1.8%	0.4%	0.0%	0.0%	0.0%	0.0%
Poor		**86.2%**	**86.3%**	**82.8%**	**82.0%**	**71.2%**	**69.7%**	**64.6%**	**53.7%**	**49.5%**	**48.0%**	**43.9%**	**44.1%**
# of Trims[1]		**1076**	**1184**	**1198**	**1182**	**1101**	**1053**	**901**	**1057**	**1091**	**1194**	**1094**	**1097**

[1]We did not include large passenger vans or exotic vehicles.

Figure 5b. Percent of Gas Guzzlers and Misers



SUVS, CROSSOVERS AND PICKUPS WITH HIGHER MPG INCREASES SELL BETTER

A key concern among U.S. automakers is the impact of fuel economy standards on sales. Rolling back the standards, they say, is necessary to maintain sales. Our analysis specifically demonstrates just the opposite.

SUVs, pickups and crossovers, whose MPGs (miles per gallon) increased by over 10% between 2011 to 2016, had a 59% increase in sales. On the other hand, those same vehicles with less than a 10% increase in MPGs from 2011 to 2016 experienced only a 41% increase in sales, almost 20% less. (Figure 6) This analysis completely debunks automaker claims that consumers don't value good gas mileage. Clearly, the more improvement in MPG, the better the sales. NOTE: 2011 was the year prior to when the current CAFE requirements went into effect.

Figure 6: SUVs, Crossovers, Light Trucks - 2011-2016

Percent Increase in MPG 2011 - 2016	Number of Vehicles	2011 Average Sales Per Model	2016 Average Sales Per Model	Average Change in Sales (Units)	2011 - 2016 Average % Change in Sales
10% or More	29	95,143	150,828	55,685	59%
Under 10%	37	63,423	89,696	26,273	41%
Mileage figures from EPA and Sales from Auto News					

The Toyota RAV4, which increased by 10 MPG from 2011 to 2016 and saw a sales increase of almost 220,000 or a 166% increase in annual vehicle sales. Meanwhile, the GMC Terrain which had a 1 MPG decrease saw only a 6% increase in sales from 2011 to 2016. And even though consumers are increasingly choosing crossover models over sedans, the typical crossover now gets 10% better gas mileage than in 2011, thanks to fuel economy standards which are currently under threat of a rollback.

CONCLUSION: ROLLING BACK FUEL ECONOMY STANDARDS WILL HURT BOTH THE U.S. CAR COMPANIES AND THE AMERICAN CONSUMER—THERE'S NO NEED FOR A ROLL BACK

Not only do consumers want more fuel efficiency, but this data and analysis make it abundantly clear that manufacturers are fully capable of meeting the current standard and that fuel economy helps sales. This should be no surprise, because the standard was specifically designed to help manufacturers meet the challenges they face with improving fuel efficiency. The current standards are not "one-size fits all" and were specifically crafted to respect the differing vehicle mixes among manufacturers as well as consumer choice. Acknowledging the fuel economy challenges inherent in larger vehicles, the standard incorporates two separate calculations, one for cars and one for light trucks, SUVs, and most crossovers. Furthermore, within those calculations, a sliding scale further reduces the requirements on larger vehicles. Finally, automakers meet requirements on an average basis across their entire fleet, which means that not all of the manufacturer's models have to meet a given year's target. This enables automakers to produce a mix of vehicles in response to consumer demand. The result: the standards have helped create a much more efficient U.S. auto fleet while preserving both manufacturer and consumer choice on size, weight and performance.

It is also evident that increased fuel economy plays an important role in vehicle sales. That was made clear in the mid 2000's when auto dealer lots were filled with gas guzzlers they simply couldn't sell, resulting in government bailouts for the industry. Rolling back the standards today would not only hurt U.S. automakers as the Asian companies roar ahead with vehicles in compliance, but would be a big blow to American pocketbooks, especially as gas prices rise in the future.

In spite of their current compliance with the standards and the positive impact on sales, the auto manufacturers want to roll-back the requirements. They've lobbied the President to reopen the final determination on fuel economy standards for 2025, inviting a rollback from the Environmental Protection Agency. In addition, Congress is now working on bills (S.1273 and an anticipated House Bill) that will lower mileage requirements for these larger vehicles. While the automakers may try to "lay the blame" on their customers for "needing" to roll back the standards, consumers are voting for the higher mileage vehicles with their dollars. This shortsighted thinking by certain members

of Congress, the Administration and the auto companies ignores consumer demand for more fuel efficiency. As gas prices creep back up, car companies will be in the same spot they were back in 2009 when they had to be bailed out by the government, with lots filled with larger, fuel inefficient vehicles they can't sell.

APPENDIX A: VEHICLE AND PRICE CHANGES AMONG "ALL-NEW" MODELS 2011 TO 2017

The following information was used to analyze the performance of "all-new" vehicles in the 2017 fleet with their 2011 counterparts. 2011 was the year before the current standard was implemented. The 2011 vehicle pricing was adjusted for inflation in order to fairly compare price changes with the 2017 models. There were 27 "all new" models in 2017. For 19 of those models, there was a corresponding vehicle available in 2011. Those are the vehicles we were able to compare. Among the 19 models, there were 79 different trim configurations each having a separate cost and MPG rating. Using current gas prices and assuming 14,000 miles driven in a typical year, the savings from increased fuel economy was determined for all 79 different trim configurations.

Vehicle Price Change From 2011 to 2017 Compared to Gas Savings Due to Increased Fuel Efficiency										
Division	Model	Trim	2011 Price in 2017 Dollars[12]	2017 Price	Change in Price	Change in MPG[3]	Cost of FE Tech ($100/ MPG)[4]	Change in 5 Yr. Gas Costs[5]	Price Difference Plus Gas Savings	FE Tech Cost Plus Gas Savings
GMC	Acadia FWD	2011 - SL [3.6, V6, A(A6)] 2017 - SL [2.5, I4, A(A6)]	$34,005	$29,070	-$4,935	4	$400	-$1,474	-$6,409	-$1,074
GMC	Acadia FWD	2011 - SLE [3.6, V6, A(A6)] 2017 - SLE-1 [2.5, I4, A(A6)]	$36,809	$32,450	-$4,359	4	$400	-$1,474	-$5,832	-$1,074
GMC	Acadia AWD	2011 - SLE [3.6, V6, A(A6)] 2017 - SLE-1 [3.6, V6, A(A6)]	$38,945	$34,450	-$4,495	1	$100	-$424	-$4,918	-$324
Honda	Ridgeline 4WD	2011 - RTS [3.5, V6, A(A5)] 2017 - RTS [3.5, V6, A(A6)]	$33,754	$31,515	-$2,239	5	$500	-$2,152	-$4,392	-$1,652
GMC	Acadia FWD	2011 - SLT [3.6, V6, A(A6)] 2017 - SLT-1 [2.5, I4, A(A6)]	$40,782	$38,350	-$2,432	4	$400	-$1,474	-$3,905	-$1,074
Honda	Ridgeline 4WD	2011 - RT [3.5, V6, A(A5)] 2017 - RT [3.5, V6, A(A6)]	$30,865	$29,475	-$1,390	5	$500	-$2,152	-$3,543	-$1,652
Honda	Ridgeline 4WD	2011 - RTL [3.5, V6, A(A5)] 2017 - RTL [3.5, V6, A(A6)]	$36,825	$35,580	-$1,245	4	$400	-$1,804	-$3,049	-$1,404
Subaru	Impreza Wagon	2011 - 2.5i Premium [2.5, I4, A(S4)] 2017 - Premium [2.0, I4, A(AV-S7)]	$20,287	$19,895	-$392	10	$1,000	-$2,287	-$2,679	-$1,287
Subaru	Impreza AWD	2011 - 2.5i [2.5, I4, A(S4)] 2017 - Base [2.0, I4, A(AV-S7)]	$19,753	$19,395	-$358	10	$1,000	-$2,287	-$2,645	-$1,287
Mercedes	E-Series	2011 - E 350 4MATIC [3.5, V6, A(A5)] 2017 - 300 4MATIC [2.0, I4, A(A9)]	$55,429	$54,650	-$779	5	$500	-$1,765	-$2,545	-$1,265
Cadillac	SRX/XT5 AWD	2011 - Luxury [3.0, V6, A(S6)] 2017 - Luxury [3.6, V6, A(S8)]	$49,229	$47,390	-$1,839	2	$200	-$807	-$2,646	-$607
Hyundai	Elantra	2011 - 2017 - Eco [1.4, I4, A(AM7)]	$21,675	$20,650	-$1,025	9	$900	-$1,592	-$2,617	-$692
Chrysler	T&C/Pacifica	2011 - Touring [3.6, V6, A(A6)] 2017 - Touring [3.6, V6, A(A9)]	$32,211	$30,495	-$1,716	2	$200	-$732	-$2,448	-$532
GMC	Acadia AWD	2011 - SLT [3.6, V6, A(A6)] 2017 - SLT-1 [3.6, V6, A(A6)]	$42,918	$41,450	-$1,468	1	$100	-$424	-$1,891	-$324
GMC	Acadia AWD	2011 - Denali [3.6, V6, A(A6)] 2017 - Denali [3.6, V6, A(A6)]	$48,295	$46,920	-$1,375	1	$100	-$424	-$1,799	-$324
Hyundai	Elantra	2011 - Touring SE [2.0, I4, M(M5)] 2017 - Value Edition [2.0, I4, A(S6)]	$20,821	$20,250	-$571	6	$600	-$1,161	-$1,732	-$561
GMC	Acadia FWD	2011 - Denali [3.6, V6, A(A6)] 2017 - Denali [3.6, V6, A(A6)]	$46,159	$44,920	-$1,239	1	$100	-$424	-$1,663	-$324
Mercedes	E-Series	2011 - E 350 Coupe [3.5, V6, A(A5)] 2017 - 300 [2.0, I4, A(A9)]	$52,172	$52,150	-$22	5	$500	-$1,610	-$1,632	-$1,110
Mercedes	E-Series	2011 - E 550 [5.5, V8, A(A7)] 2017 - 550 (coupe) [4.7, V8, A(A7)]	$60,983	$60,650	-$333	3	$300	-$1,278	-$1,611	-$978
Mercedes	E-Series	2011 - E 550 (CONVERTIBLE) [5.5, V8, A(A7)] 2017 - 550 (convertible) [4.7, V8, A(A7)]	$69,206	$69,100	-$106	3	$300	-$1,421	-$1,527	-$1,121
Hyundai	Elantra	2011 - GLS [1.8, I4, A(A6)] 2017 - SE [2.0, I4, A(S6)]	$18,241	$18,150	-$91	1	$100	-$152	-$244	-$52
Subaru	Impreza Wagon	2011 - 2.5i Premium [2.5, I4, A(S4)] 2017 - Premium [2.0, I4, A(AV-S7)]	$21,355	$21,695	$340	10	$1,000	-$2,287	-$1,947	-$1,287
Subaru	Impreza AWD	2011 - 2.5i [2.5, I4, A(S4)] 2017 - Base [2.0, I4, A(AV-S7)]	$20,821	$21,195	$374	10	$1,000	-$2,287	-$1,913	-$1,287
Mazda	CX-9 2WD	2011 - Sport [3.7, V6, A(S6)] 2017 - Sport [2.5, I4, A(S6)]	$31,116	$31,520	$404	5	$500	-$1,765	-$1,362	-$1,265

Division	Model	Trim	2011 Price in 2017 Dollars[12]	2017 Price	Change in Price	Change in MPG[3]	Cost of FE Tech ($100/ MPG)[4]	Change in 5 Yr. Gas Costs[5]	Price Difference Plus Gas Savings	FE Tech Cost Plus Gas Savings
Volvo	XC60 FWD	2011 - 3.2 R [3.2, V6, A(S6)] 2017 - T5 Inscription [2.0, I4, A(S8)]	$40,637	$40,950	$313	5	$500	-$1,474	-$1,162	-$974
Volvo	XC60 AWD	2011 - 3.2 R [3.2, V6, A(S6)] 2017 - T5 Inscription [2.0, I4, A(S8)]	$42,773	$42,950	$177	3	$300	-$1,050	-$873	-$750
Mazda	CX-9 4WD	2011 - Sport [3.7, V6, A(S6)] 2017 - Sport [2.5, I4, A(S6)]	$32,601	$33,320	$719	4	$400	-$1,474	-$754	-$1,074
Honda	CR-V 4WD	2011 - EX-L [2.4, I4, A(A5)] 2017 - EX-L [1.5, I4, A(AV)]	$29,792	$30,495	$703	6	$600	-$1,448	-$745	-$848
Honda	CR-V 2WD	2011 - EX [2.4, I4, A(A5)] 2017 - EX [1.5, I4, A(AV)]	$28,457	$29,195	$738	6	$600	-$1,342	-$604	-$742
Chrysler	T&C/Pacifica	2011 - Touring L [3.6, V6, A(A6)] 2017 - Touring L [3.6, V6, A(A9)]	$34,347	$34,495	$148	2	$200	-$732	-$584	-$532
Honda	CR-V 4WD	2011 - EX [2.4, I4, A(A5)] 2017 - EX-L [1.5, I4, A(AV)]	$26,962	$27,995	$1,033	6	$600	-$1,448	-$415	-$848
Honda	CR-V 2WD	2011 - EX-L [2.4, I4, A(A5)] 2017 - EX [1.5, I4, A(AV)]	$25,627	$26,695	$1,068	6	$600	-$1,342	-$273	-$742
Honda	CR-V 2WD	2011 - LX [2.4, I4, A(A5)] 2017 - LX [2.4, I4, A(AV)]	$23,170	$24,045	$875	4	$400	-$958	-$84	-$558
Mazda	CX-9 2WD	2011 - Touring [3.7, V6, A(S6)] 2017 - Touring [2.5, I4, A(S6)]	$33,167	$35,970	$2,803	5	$500	-$1,765	$1,038	-$1,265
Mazda	CX-9 2WD	2011 - Grand Touring [3.7, V6, A(S6)] 2017 - Grand Touring [2.5, I4, A(S6)]	$35,399	$40,470	$5,071	5	$500	-$1,765	$3,306	-$1,265
Buick	Lacrosse	2011 - CXS [3.6, V6, A(A6)] 2017 - Premium [3.6, V6, A(S8)]	$36,061	$41,065	$5,004	5	$500	-$1,610	$3,394	-$1,110
Buick	Lacrosse	2011 - CXL [3.6, V6, A(A6)] 2017 - Essence [3.6, V6, A(S8)]	$31,565	$38,665	$7,100	5	$500	-$1,610	$5,490	-$1,110
Mazda	CX-9 4WD	2011 - Touring [3.7, V6, A(S6)] 2017 - Touring [2.5, I4, A(S6)]	$34,651	$37,770	$3,119	4	$400	-$1,474	$1,645	-$1,074
Mazda	CX-9 4WD	2011 - Grand Touring [2.5, I4, A(S6)] 2017 - Grand Touring [3.7, V6, A(S6)]	$36,883	$42,270	$5,387	4	$400	-$1,474	$3,913	-$1,074
Volvo	XC60 FWD	2011 - 3.2 [3.2, V6, A(S6)] 2017 - T5 Dynamic [2.0, I4, A(S8)]	$34,603	$40,950	$6,347	5	$500	-$1,474	$4,872	-$974
Volvo	XC60 AWD	2011 - T6 [3.0, V6, A(S6)] 2017 - T6 Inscription [2.0, I4, A(S8)]	$41,011	$46,350	$5,339	3	$300	-$1,156	$4,183	-$856
Volvo	XC60 AWD	2011 - T6 R [3.0, V6, A(S6)] 2017 - T6 R-Design [2.0, I4, A(S8)]	$44,375	$51,000	$6,625	3	$300	-$1,156	$5,469	-$856
Volvo	S80/S90 FWD	2011 - 3.2 [3.2, V6, A(S6)] 2017 - T5 Momentum [2.0, I4, A(S8)]	$39,463	$46,950	$7,487	5	$500	-$1,355	$6,132	-$855
Volvo	S80/S90 AWD	2011 - T6 [3.0, V6, A(S6)] 2017 - T6 Momentum [2.0, I4, A(S8)]	$43,468	$52,950	$9,482	4	$400	-$1,227	$8,256	-$827
Volvo	XC60 AWD	2011 - 3.2 [3.2, V6, A(S6)] 2017 - T5 Dynamic [2.0, I4, A(S8)]	$36,739	$42,950	$6,211	3	$300	-$1,050	$5,161	-$750
Hyundai	Equus/G90	2011 - Signature [4.6, V8, A(A6)] 2017 - Premium [3.3, V6, A(S8)]	$61,944	$68,100	$6,156	2	$200	-$894	$5,262	-$694
Nissan	Armada AWD	2011 - SV [5.6, V8, A(A5)] 2017 - SV [5.6, V8, A(S7)]	$46,469	$47,800	$1,331	1	$100	-$767	$565	-$667
Nissan	Armada AWD	2011 - SL [5.6, V8, A(A5)] 2017 - SL [5.6, V8, A(S7)]	$48,744	$52,550	$3,806	1	$100	-$767	$3,040	-$667

Division	Model	Trim	2011 Price in 2017 Dollars[12]	2017 Price	Change in Price	Change in MPG[3]	Cost of FE Tech ($100/ MPG)[4]	Change in 5 Yr. Gas Costs[5]	Price Difference Plus Gas Savings	FE Tech Cost Plus Gas Savings
Nissan	Armada AWD	2011 - Platinum [5.6, V8, A(A5)] 2017 - Platinum [5.6, V8, A(S7)]	$56,487	$60,490	$4,003	1	$100	-$767	$3,237	-$667
Honda	CR-V 4WD	2011 - LX [2.4, I4, A(A5)] 2017 - LX [2.4, I4, A(AV)]	$23,170	$25,345	$2,175	4	$400	-$1,037	$1,138	-$637
Cadillac	SRX/XT5 AWD	2011 - Premium [3.0, V6, A(S6)] 2017 - Premium Luxury [3.6, V6, A(S8)]	$51,841	$54,390	$2,549	2	$200	-$807	$1,742	-$607
Nissan	Armada 2WD	2011 - SL [5.6, V8, A(A5)] 2017 - SL [5.6, V8, A(S7)]	$45,753	$49,650	$3,897	1	$100	-$671	$3,226	-$571
Nissan	Armada 2WD	2011 - Platinum [5.6, V8, A(A5)] 2017 - Platinum [5.6, V8, A(S7)]	$53,496	$57,590	$4,094	1	$100	-$671	$3,423	-$571
Nissan	Armada 2WD	2011 - SV [5.6, V8, A(A5)] 2017 - SV [5.6, V8, A(S7)]	$40,488	$44,900	$4,412	1	$100	-$671	$3,741	-$571
Cadillac	SRX/XT5 FWD	2011 - Performance [3.0, V6, A(S6)] 2017 - Premium Luxury [3.6, V6, A(S8)]	$45,337	$51,895	$6,558	2	$200	-$732	$5,827	-$532
Cadillac	SRX/XT5 FWD	2011 - Base [3.0, V6, A(S6)] 2017 - Base [3.6, V6, A(S8)]	$36,130	$38,995	$2,865	2	$200	-$732	$2,133	-$532
Cadillac	SRX/XT5 FWD	2011 - Luxury [3.0, V6, A(S6)] 2017 - Luxury [3.6, V6, A(S8)]	$40,862	$44,895	$4,033	2	$200	-$732	$3,302	-$532
Chrysler	T&C/Pacifica	2011 - Limited [3.6, V6, A(A6)] 2017 - Limited [3.6, V6, A(A9)]	$41,289	$42,495	$1,206	2	$200	-$732	$474	-$532
Audi	A4 Quattro	2011 - Prestige [2.0, I4, A(S8)] 2017 - Prestige [2.0, I4, A(AM-S7)]	$45,646	$48,000	$2,354	3	$300	-$745	$1,608	-$445
Audi	A4 Quattro	2011 - Premium [2.0, I4, A(S8)] 2017 - Premium [2.0, I4, A(AM-S7)]	$36,462	$39,400	$2,938	3	$300	-$745	$2,193	-$445
Audi	A4 Quattro	2011 - Premium Plus [2.0, I4, A(AM-S7)] 2017 - Premium Plus [2.0, I4, A(S8)]	$40,093	$43,200	$3,107	3	$300	-$745	$2,362	-$445
Audi	A4	2011 - Premium [2.0, I4, A(AV)] 2017 - Premium [2.0, I4, A(AM-S7)]	$34,123	$34,900	$777	3	$300	-$690	$87	-$390
Audi	A4	2011 - Premium Plus [2.0, I4, A(AV)] 2017 - Premium Plus [2.0, I4, A(AM-S7)]	$37,807	$41,100	$3,293	3	$300	-$690	$2,603	-$390
Hyundai	Equus/G90	2011 - Ultimate [4.6, V8, A(A6)] 2017 - Ultimate [5.0, V8, A(S8)]	$68,886	$69,700	$814	1	$100	-$471	$343	-$371
Buick	Lacrosse	2011 - CX [2.4, I4, A(S6)] 2017 - Preferred [3.6, V6, A(S8)]	$28,831	$36,065	$7,234	2	$200	-$560	$6,674	-$360
Lincoln	MKS/Continental FWD	2011 - FWD [3.7, V6, A(S6)] 2017 - Premiere [3.7, V6, A(S6)]	$44,076	$44,560	$484	1	$100	-$424	$60	-$324
Audi	A4 Quattro	2011 - Prestige [2.0, I4, M(M6)] 2017 - Prestige [2.0, I4, M(M6)]	$44,269	$48,000	$3,731	2	$200	-$477	$3,254	-$277
Audi	A4 Quattro	2011 - Premium [2.0, I4, M(M6)] 2017 - Premium[2.0, I4, M(M6)]	$35,084	$39,400	$4,316	2	$200	-$477	$3,839	-$277
Audi	A4 Quattro	2011 - Premium Plus [2.0, I4, M(M6)] 2017 - Premium Plus[2.0, I4, M(M6)]	$38,715	$43,200	$4,485	2	$200	-$477	$4,008	-$277
Hyundai	Genesis/G80	2011 - V6 [3.8, V6, A(A6)] 2017 - 3.8L V6 [3.8, V6, A(S8)]	$35,244	$41,400	$6,156	1	$100	-$348	$5,808	-$248
Audi	A5 Quattro	2011 - Premium [2.0, I4, A(S8)] 2017 - Sport [2.0, I4, A(S8)]	$40,360	$42,200	$1,840	1	$100	-$268	$1,572	-$168
Audi	A5 Quattro	2011 - Premium [2.0, I4, M(M6)] 2017 - Sport [2.0, I4, M(M6)]	$38,982	$41,200	$2,218	1	$100	-$248	$1,970	-$148

Division	Model	Trim	2011 Price in 2017 Dollars[1][2]	2017 Price	Change in Price	Change in MPG[3]	Cost of FE Tech ($100/ MPG)[4]	Change in 5 Yr. Gas Costs[5]	Price Difference Plus Gas Savings	FE Tech Cost Plus Gas Savings
Hyundai	Elantra	2011 - Touring GLS [2.0, I4, A(A4)] 2017 - GT [2.0, I4, A(S6)]	$18,364	$19,800	$1,436	1	$100	-$229	$1,206	-$129
Hyundai	Elantra	2011 - Touring GLS [2.0, I4, M(M5)] 2017 - GT [2.0, I4, M(M6)]	$17,083	$18,800	$1,717	1	$100	-$229	$1,488	-$129
Audi	A5 Cabriolet Quattro	2011 - Premium [2.0, I4, A(S8)] 2017 - Sport [2.0, I4, A(AM-S7)]	$47,195	$48,600	$1,405	0	$0	$0	$1,405	$0
Hyundai	Elantra	2011 - Limited [1.8, I4, A(A6)] 2017 - Limited [2.0, I4, A(S6)]	$21,339	$22,350	$1,011	0	$0	$0	$1,011	$0
Lincoln	MKS/Continental AWD	2011 - AWD [3.7, V6, A(S6)] 2017 - Premiere [3.7, V6, A(S6)]	$46,095	$46,560	$465	0	$0	$0	$465	$0
Hyundai	Elantra	2011 - GLS [1.8, I4, M(M6)] 2017 - SE [2.0, I4, M(M6)]	$15,838	$17,150	$1,312	-3	$0	$520	$1,832	$520
Hyundai	Genesis/G80	2011 - V8 [4.6, V8, A(A6)] 2017 - 5.0L V8 [5.0, V8, A(S8)]	$45,924	$54,550	$8,626	-2	$0	$894	$9,520	$894

[1]Inflation was calculated using BLS average inflation numbers from 2011-2016.

[2]Vehicle Price is from the New Car Cost Guide.

[3]Fuel Economy of Vehicles is from the EPA.

[4]CFA bases its estimate of the cost of fuel economy on a review of the literature including historical, market-based and engineering studies, as described in Appendix B.

[5]Gas costs based on driving the vehicle 14,000 miles per year for 5 years and using gas prices from AAA (7/10/17).

2011 Vehicles Which Were Less Expensive in 2017 Dollars and Had Higher MPG

2011 Vehicles Which Were More Expensive in 2017, but Who's Fuel Savings Offset the Entire Price Increase

2011 Vehicles Which Were More Expensive in 2017, but Who's Fuel[4] Savings Offset the $100 per MPG Cost of Fuel Efficient Technology

2011 Vehicles Which Were More Expensive in 2017 and Whose Fuel Economy Stayed the Same or Decreased

Appendix B: The Cost of Increasing Fuel Economy: Support for Identifying an Average of $100 as the Cost Per Mile of Fuel Economy Improvement

Estimating the cost of increasing fuel economy has been a matter of great debate for decades. Empirical analyses that look at actual costs show that regulators overestimate the cost by a factor of two and automakers overestimate it by much more.

David Greene, one of the leading experts on fuel economy, recently conducted a review of the literature in which he concluded that an estimate of 27% of the increase in vehicle cost, or about $150 for every mile per gallon improvement, was too high. He gave two reasons for this.

First, backward looking analysis of cost increases that included used vehicles (as his analysis did), were double counting the cost of increasing fuel economy because the sellers of vehicles were capturing a significant part of the capitalized value of better fuel economy equal to about 20% of the estimated cost of efficiency, in their sales price. This factor alone would lower the estimate to 21.6% of the increase in price or about $120 for each 1 mile improvement in the MPG.

Second, real world experience showed that there was a learning process in which costs fell as automakers gained more experience with increasing fuel economy. He suggested that 2% per year was a reasonable estimate. Over the redesign cycle of vehicles (e.g. five years) this learning rate would lower the cost by about 10%. Thus, one might argue that the appropriate numbers would be about 20% per year and $108 dollars per MPG, as shown in Table 1.

There is a third factor that is implicit in Greene's analysis. The distribution of the cost of vehicles is skewed. The much more expensive vehicles purchased by upper income households are likely to include a larger amount of costs incurred to upscale the vehicles, rather than for fuel economy.

In a subsequent analysis Greene estimated the cost of improving fuel economy directly with an econometric model that corroborated the above concerns, as shown in Table 1. The simple adjustment to a constant 20% of total cost moves the estimate much closer to

the empirical evidence offered by Greene suggesting costs that are about two thirds of the literature review—about 18% or $99/MPG.

EPA's analysis of the cost of the National Program currently yields an estimated cost for fuel savings that is similar, $97/MPG. This estimate reflects considerable technological progress over the early years of the National Program, which is consistent with the historical pattern. A recent study by the ICCT offers an estimate of going forward costs of improvement close to the rate of the national program (national program = 3.3%, ICCT = 4% per year). The ICCT study also includes continuing technological progress.

Moreover, our data on new models since the National Program reducing emissions/fuel economy, supports the key problem with using a simple percentage of the total cost of the vehicle to approximate the cost of improving fuel economy, as shown in the charts below. There is a strong, negative correlation (r = -.7) between the cost of a vehicle and the mileage and a moderate, negative correlation (r= -.4) between the cost of the vehicle and the change in mileage. A fixed percentage makes no sense.

In light of this analysis, we believe a cautious estimate of the cost of fuel economy improvements is $100/MPG improvement.

TABLE 1: HISTORICAL AND ENGINEERING ESTIMATES OF THE COST OF INCREASING MILEAGE

	Greene Literature Review	Simple Adjustment Approach	Greene Direct	EPA Final 2017-2025	ICCT Estimate for 2025-2030 4.5%/year
Annual Cost	$213	na	$141	$97	$110
% of Total Cost Increase	27%	20%	18%	na	na
$/MPG	$150	$108	$99	$97	$86

Sources: Greene 1,2, EPA Determination, ICT

VEHICLE COST AND MILEAGE