CALIFORNIA AIR RESOURCES BOARD
ADDENDUM TO FEBRUARY 25 TECHNICAL ASSESSMENT
May 8, 2008

COMPARISON OF GREENHOUSE GAS REDUCTIONS FOR THE UNITED STATES AND CANADA UNDER ARB GHG REGULATIONS AND PROPOSED FEDERAL 2011-2015 MODEL YEAR FUEL ECONOMY STANDARDS

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EXECUTIVE SUMMARY

This document is an addendum to a report issued by the California Air Resources Board (ARB) on February 25, 2008. It compares the greenhouse gas (GHG) emission reduction benefits expected from California's Pavley rules with the recently proposed federal fuel economy standards for 2011 through 2015 model year (MY) passenger cars and light trucks.

The previous ARB study, published before the schedule for achieving the CAFE (Corporate Average Fuel Economy) standards had been released by the National Highway and Transportation Safety Administration (NHTSA) on April 22, 2008 assumed that attaining the CAFE standard of 35 mpg by 2020 would be on a regular year-by-year incremental basis. The schedule for implementing the CAFE standards proposed by NHTSA, by contrast, is 'front-loaded' -- requiring the bulk of the increases in fuel economy to come into effect earlier during the 2011-2015 time period. This addendum takes that new schedule into consideration, and also considers revisions to the federal fleet mix assumptions used by NHTSA. (The fleet mix refers to the ratio of cars and light trucks to heavier trucks and larger SUVs.) In all other regards, this analysis uses the same methodology as the previous ARB report.

This analysis concludes that although the proposed 2011-2015 model year federal fuel economy standards result in larger reductions than our previous analysis assumed the federal program still falls far short of the GHG emission reductions that would result if the California Pavley rules are implemented in the United States, and Canada. Between 2009 and 2016, the California standards would prevent emissions of 411 million metric tons (MMT) of GHG in the United States. This is 36% more than the 303 MMT of GHG prevented if the proposed federal fuel economy rules are implemented. By 2020, the Pavley standards would reduce a cumulative total of 1283 MMT of GHG in the United States compared to 912 MMT of GHG achieved by the proposed federal standards -- a difference of 41% -- assuming the federal standards are strengthened in the 2016 to 2020 period to meet the full requirements of the 2007 Energy Bill. Similar benefits will accrue to Canada, with a cumulative total of 87 MMT of GHG reductions by calendar year 2020 with the Pavley rules, compared to 58 MMT of GHG reductions achieved by the proposed federal standards.

In short, the benefits of the Pavley rules, whether implemented in California, the United States, or Canada, are clearly greater than those provided by the proposed federal fuel economy rules, both in terms of GHG emissions reductions and fuel savings.

MAJOR FINDINGS

- *California's Rules Are More Stringent Earlier.* In calendar year 2016, our state standards (referred to as the California standards or the Pavley rules) will reduce California's GHG emissions by 16.4 million metric tons (MMT) of carbon dioxide equivalents (CO_2E). This is almost 50% more than the 11.1 MMT reduction produced by the proposed federal rules (see Table 2).

- *California's Rules Are More Stringent Later.* By 2020, California is committed to implement revised, more stringent GHG emission limits (the Pavley Phase 2 rules). California's requirements would reduce California GHG emissions by 31.7 $MMTCO_2E$ in calendar year 2020, 45 percent more than the 21.9 MMTs reductions under the proposed federal rules in that year (see Table 2).

- *There Are Greater Fuel Savings Under California Rules.* Our analysis estimates the effects of the federal CAFE standards on GHG emission rates. This also allows a comparison of the impact of the two programs on vehicle efficiency. Since the California rules are significantly more effective at reducing GHGs than the federal CAFE program, they also result in better fuel efficiency – roughly 43 miles per gallon (mpg) in 2020 for the California vehicle fleet as compared to the new CAFE standard of 35 mpg.

- *The Cumulative Greenhouse Gas Benefit Is Greater under California Rules.* The cumulative GHG emission reductions of our standards have also been estimated (see Tables 1 and 3). Between 2009 and 2016, the California standards will prevent emissions of 55 $MMTCO_2E$ in California. This is 53 percent more than the 36 MMTs prevented if only the proposed federal fuel economy standards were implemented. By calendar year 2020, the California rules would prevent 158 $MMTCO_2E$ emissions, 49 percent more than the 106 MMTs reductions of CO_2E expected if only the proposed federal standards were implemented in California.

- *Other States Magnify the Superiority of California Rules.* There are also significant benefits for other states that adopt the California standards. Fourteen states including California have done so to date. By calendar year 2020, California's more stringent limits will reduce cumulative GHG emissions in California and those 13 states by 450 $MMTCO_2E$, a 43 percent improvement over the proposed federal standards (see Table 1).

- *California's Rules Would Be a Better "National Solution."* If the Pavley rules are implemented in all 50 states, by calendar year 2016 a cumulative total of 411 $MMTCO_2E$ will have been prevented from being emitted into the air as compared to 303 $MMTCO_2E$ if only the proposed federal fuel economy standards were implemented. By calendar year 2020, the combination of the Pavley 1 and 2 rules will have prevented 1,283 $MMTCO_2E$ from being emitted as compared to 912 $MMTCO_2E$ if only the proposed federal fuel economy standards were implemented (see Tables 1 and 3).

- *There Are Additional Benefits if Canada Adopts California Standards.* If the Pavley rules are implemented in Canada, by calendar year 2020, a cumulative total of 87 $MMTCO_2E$ will have been prevented from being emitted as compared to 58 $MMTCO_2E$ if only the proposed federal fuel economy standards were implemented.

- *The Bottom Line: California's Rules Provide Superior Greenhouse Gas Benefits.* If the Pavley rules were implemented in the United States and Canada, by 2016 a cumulative total of 440 $MMTCO_2E$ will have been reduced as compared to 321 $MMTCO_2E$ if only the proposed federal fuel economy standards were implemented. By 2020, the Pavley rules will have prevented 1,370 $MMTCO_2E$ from being emitted as compared to 970 $MMTCO_2E$ if only the proposed federal fuel economy standards were implemented.

BACKGROUND

On February 25, 2008 ARB released a comprehensive report[1] comparing the greenhouse gas (GHG) emission reduction benefits of California's adopted Pavley standards with the new CAFE fuel economy standards established under the 2007 Energy Bill. The February 25 assessment compared the annual and cumulative CO_2E emissions benefits in calendar years 2016 and 2020 expected from the proposed new CAFE standards with the benefits expected if California's GHG rules were implemented in the United States and Canada.

In April the federal NHTSA proposed specific fuel economy standards for model years 2011-2015 which are more stringent than had been assumed in our February report. This addendum re-estimates the GHG benefits expected from the recently proposed federal fuel economy standards. If NHTSA implements the new standards as proposed they would begin with model year 2011 vehicles and require an average improvement in fuel economy of 4.5 percent each year through the 2015 model year. By model year 2015, new passenger cars and light trucks will need to meet average fuel economies of 35.7 miles per gallon (mpg) and 28.6 mpg, respectively, achieving a new vehicle fleet average fuel economy of 31.6 mpg or better.

The phase-in schedule for the proposed 2011-2015 model year federal fuel economy rule is as follows:

- 2011: cars 31.2 mpg, trucks 25.0 mpg, combined 27.8 mpg;
- 2012: cars 32.8 mpg, trucks 26.4 mpg, combined 29.2 mpg;
- 2013: cars 34.0 mpg, trucks 27.8 mpg, combined 30.5 mpg;
- 2014: cars 34.8 mpg, trucks 28.2 mpg, combined 31.0 mpg; and
- 2015: cars 35.7 mpg, trucks 28.6 mpg, combined 31.6 mpg.

The proposed rule accelerates the introduction of more fuel-efficient vehicles in the 2011-2015 timeframe more quickly than our previous analysis assumed. It should be noted that the 35 mpg fuel economy standard mandated by the 2007 Energy Bill for 2020 model year passenger cars and light trucks remains the same.

METHODOLOGY

As noted above, the methodology and assumptions used in calculating the benefits of the proposed 2011-2015 model year standards are the same as those in the February 25 ARB report with these two significant revisions:

- It is assumed for this analysis that approximately 50% of new vehicle sales nationwide are passenger cars as compared to the 39% assumed in the February 25 assessment. To corroborate these changes to the fleet mix, ARB staff reviewed national passenger car and light truck sales data[2] indicating that 48% of new vehicles sold in April 2008 were passenger cars with the remaining 52% being light trucks.

- Fuel economy assumptions for 2011 through 2015 model year vehicles have been updated to reflect the proposed new federal fuel economy standards for those model years.

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[1] The full report is available at http://www.arb.ca.gov/cc/ccms/reports/pavleycafe_reportfeb25_08.pdf
[2] See Edmunds AutoObserver, *April Car Sales: U.S. Consumers Flock to Cars, Gouging Detroit Three* (May 2, 2008) http://www.autoobserver.com/2008/05/april-car-sales.html

RESULTS

Table 1 compares the cumulative GHG benefits of California's Pavley rules to the 2007 Energy Bill (as reported in the February 25 report)[3] and the proposed 2011-2015 federal fuel economy standards. For all regions analyzed, California's standards provide significantly more GHG reductions than the federal fuel economy standards, even when the more stringent 2011-2015 MY standards are taken into consideration. In calendar year 2016, our state standards will reduce California's GHG emissions by 55 MMTCO$_2$E, as compared to 36 MMTCO$_2$E under the proposed federal standards. By 2020, the Pavley rules are expected to achieve 158 MMTCO$_2$E reductions, 49 percent more than if the 2011-2015 MY fuel economy standards were implemented in California. If implemented in the other 49 states or Canada, the Pavley rules would provide similar additional GHG emission reductions relative to the 2011-2015 federal fuel economy standards.

Table 1. Summary of Cumulative Benefits of the California Program for California, Other States, and Canada.

Region	Year	Energy Act of 2007				Proposed 2011 - 2015 MY Standard			
		Cumulative GHGs Reduced (MMT[a])			% Benefit	Cumulative GHGs Reduced (MMT[a])			% Benefit
		Fed. Std[b]	CA Std	CA over Fed Std	CA over Fed Std	Fed. Std[b]	CA Std	CA over Fed Std	CA over Fed Std
California	2016	22	55	33	150%	36	55	20	54%
	2020[c]	79	158	79	100%	106	158	52	49%
California and 13 Other States[d]	2016	70	154	83	119%	105	148	43	41%
	2020[c]	244	461	217	89%	316	450	135	43%
All 50 States	2016	207	434	226	109%	303	411	109	36%
	2020[c]	716	1323	608	85%	912	1283	371	41%
Canada	2016	12	29	17	139%	18	29	10	55%
	2020[c]	44	87	43	99%	58	87	29	51%
United States and Canada	2016	219	462	243	111%	321	440	119	37%
	2020[c]	759	1411	651	86%	970	1370	400	41%

[a] Million metric tons.
[b] Based on CAFE standard and proposed 2011-2015 MY standard.
[c] Based on current and planned standards.
[d] Includes states that have adopted California's standards (Arizona, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington).

Figure 1 compares the cumulative CO$_2$E benefits of the Pavley regulations to the proposed MY 2011-2015 fuel economy standards if California's program is implemented in all fifty states. By 2016, the Pavley rules would prevent a cumulative total of 411 MMTCO$_2$E from being emitted into the air as compared to 303 MMTCO$_2$ if only the proposed Federal fuel economy standards were implemented. By 2020, Pavley standards would prevent 1,283 MMTCO$_2$E from being emitted as compared to 912 MMTCO$_2$E if only the Federal fuel economy standards were implemented.

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[3] Since publication of the February 25 report, Arizona has adopted the Pavley standards, increasing the number of other states hoping to implement the California standards from 12 to 13.

Figure 1. Comparison of Cumulative CO_2-Equivalent Benefits of Pavley Regulations and Proposed Federal Fuel Economy Standard if Implemented in all Fifty States
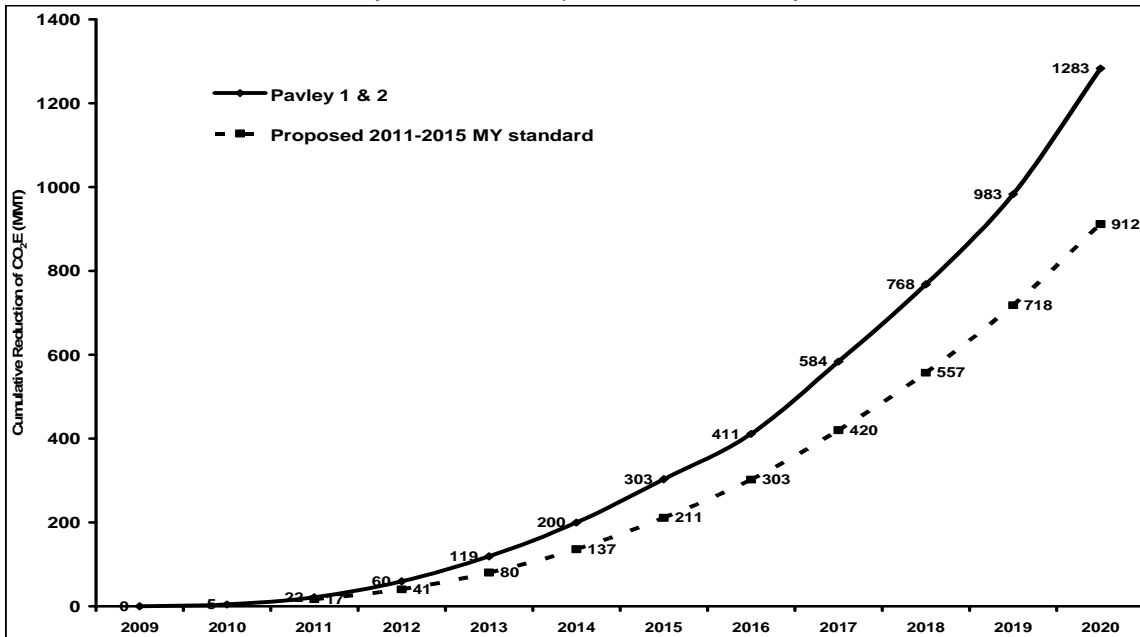
Staff also calculated the nationwide cumulative CO_2E benefits achieved by California's rules and the proposed MY 2011-2014 fuel economy standards through 2020, assuming a variety of different implementation scenarios. Figure 2 compares the four scenarios that were developed. Each bar shows the cumulative CO_2E emission reductions for those states adopting California standards, and the remainder that only benefit from the federal fuel economy standards. At the top of each bar, the percentage increase in CO_2E emission benefit is also shown.

Figure 2. Comparison of Nationwide Cumulative CO_2E Benefits Achieved by Pavley Regulation and Proposed Federal Fuel Economy Standard by 2020 under Different Scenarios
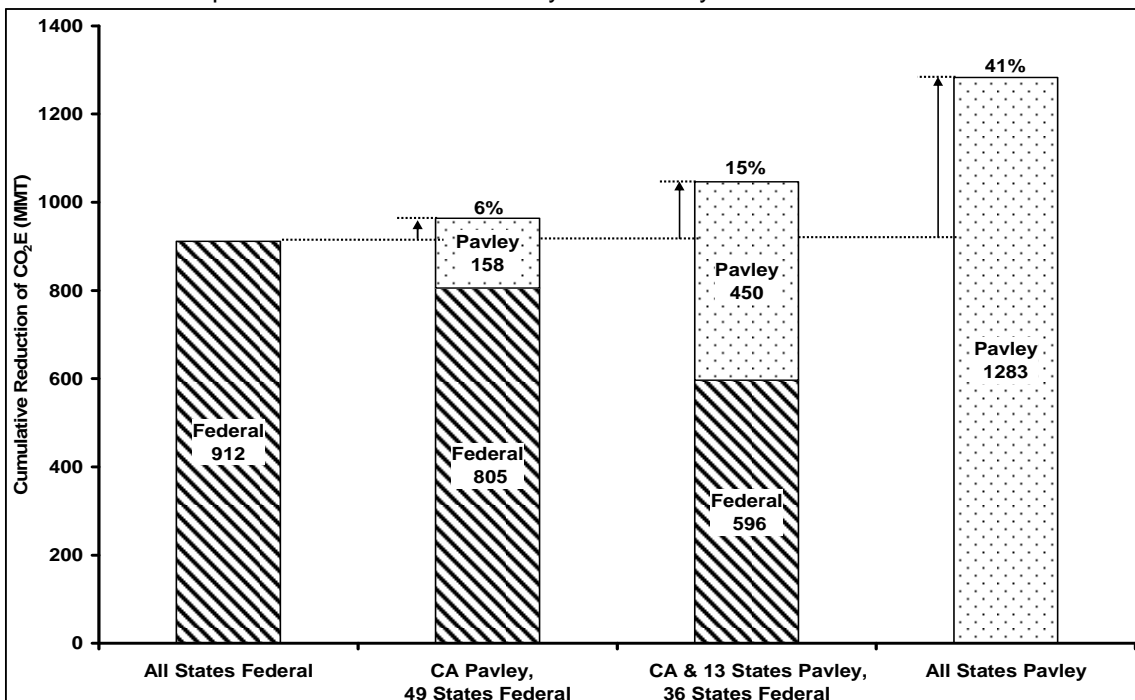
ARB staff calculated the annual and cumulative CO_2E reductions achieved for each of the 50 states if standards were in place that were as stringent as California's vehicle greenhouse gas emission standards. Tables 2 lists for each state the annual CO_2E benefits achieved by calendar year 2016 and 2020 and compares the benefits of both California's standards and the proposed 2011-2015 MY federal fuel economy standards. Table 3 compares the cumulative CO_2E benefits of the California standards and the proposed federal standards.

Table 2. Comparison of State-Specific Annual CO_2E Benefits Achieved by Pavley Regulation and Proposed Federal Fuel Economy Standards by 2016 and 2020

State	Motor Vehicle Gasoline Consumption[a] (1000 Barrels)	Gasoline Use Ratio to California	GHG Benefit from CA Stds in 2016[b] (MMTs)	GHG Benefit from Fed Stds in 2016[b] (MMTs)	GHG Benefit of CA Stds Over Fed Stds in 2016[b] (MMTs)	GHG Benefit from CA Stds in 2020[b] (MMTs)	GHG Benefit from Fed Stds in 2020[b] (MMTs)	GHG Benefit of CA Stds Over Fed Stds in 2020[b] (MMTs)
Alabama	61,615	0.16	2.2	1.8	0.5	4.8	3.5	1.3
Alaska	6,583	0.02	0.2	0.2	0.1	0.5	0.4	0.1
Arizona	66,394	0.18	2.4	1.9	0.5	5.2	3.8	1.4
Arkansas	33,139	0.09	1.2	0.9	0.3	2.6	1.9	0.7
California[b]	375,652	1.00	16.4	11.1	5.3	31.7	21.9	9.8
Colorado	49,893	0.13	1.8	1.4	0.4	3.9	2.9	1.0
Connecticut	37,850	0.10	1.4	1.1	0.3	2.9	2.2	0.8
Delaware	10,418	0.03	0.4	0.3	0.1	0.8	0.6	0.2
District of Columbia	3,007	0.01	0.1	0.1	0.0	0.2	0.2	0.1
Florida	204,304	0.54	7.4	5.8	1.6	15.9	11.7	4.2
Georgia	119,515	0.32	4.3	3.4	1.0	9.3	6.9	2.5
Hawaii	10,833	0.03	0.4	0.3	0.1	0.8	0.6	0.2
Idaho	14,116	0.04	0.5	0.4	0.1	1.1	0.8	0.3
Illinois	121,758	0.32	4.4	3.5	1.0	9.5	7.0	2.5
Indiana	75,375	0.20	2.7	2.1	0.6	5.9	4.3	1.5
Iowa	36,906	0.10	1.3	1.0	0.3	2.9	2.1	0.8
Kansas	26,893	0.07	1.0	0.8	0.2	2.1	1.5	0.6
Kentucky	51,716	0.14	1.9	1.5	0.4	4.0	3.0	1.1
Louisiana	54,379	0.14	2.0	1.5	0.4	4.2	3.1	1.1
Maine	17,040	0.05	0.6	0.5	0.1	1.3	1.0	0.4
Maryland	63,544	0.17	2.3	1.8	0.5	5.0	3.6	1.3
Massachusetts	67,081	0.18	2.4	1.9	0.5	5.2	3.8	1.4
Michigan	117,139	0.31	4.3	3.3	0.9	9.1	6.7	2.4
Minnesota	63,344	0.17	2.3	1.8	0.5	4.94	3.63	1.3
Mississippi	38,188	0.10	1.4	1.1	0.3	3.0	2.2	0.8
Missouri	74,563	0.20	2.7	2.1	0.6	5.8	4.3	1.5
Montana	11,117	0.03	0.4	0.3	0.1	0.9	0.6	0.2
Nebraska	18,872	0.05	0.7	0.5	0.2	1.5	1.1	0.4
Nevada	26,507	0.07	1.0	0.8	0.2	2.1	1.5	0.5
New Hampshire	16,542	0.04	0.6	0.5	0.1	1.3	0.9	0.3
New Jersey	102,025	0.27	3.7	2.9	0.8	7.9	5.9	2.1
New Mexico	22,262	0.06	0.8	0.6	0.2	1.7	1.3	0.5
New York	134,906	0.36	4.9	3.8	1.1	10.5	7.7	2.8
North Carolina	102,026	0.27	3.7	2.9	0.8	7.9	5.9	2.1
North Dakota	8,080	0.02	0.3	0.2	0.1	0.6	0.5	0.2
Ohio	122,074	0.32	4.4	3.5	1.0	9.5	7.0	2.5
Oklahoma	43,421	0.12	1.6	1.2	0.3	3.4	2.5	0.9
Oregon	36,488	0.10	1.3	1.0	0.3	2.8	2.1	0.8
Pennsylvania	121,878	0.32	4.4	3.5	1.0	9.5	7.0	2.5
Rhode Island	9,100	0.02	0.3	0.3	0.1	0.7	0.5	0.2
South Carolina	58,235	0.16	2.1	1.7	0.5	4.5	3.3	1.2
South Dakota	9,470	0.03	0.3	0.3	0.1	0.7	0.5	0.2
Tennessee	73,105	0.19	2.7	2.1	0.6	5.7	4.2	1.5
Texas	272,404	0.73	9.9	7.7	2.2	21.2	15.6	5.6
Utah	24,067	0.06	0.9	0.7	0.2	1.9	1.4	0.5
Vermont	8,166	0.02	0.3	0.2	0.1	0.6	0.5	0.2
Virginia	93,557	0.25	3.4	2.7	0.7	7.3	5.4	1.9
Washington	63,818	0.17	2.3	1.8	0.5	5.0	3.7	1.3
West Virginia	19,783	0.05	0.7	0.6	0.2	1.5	1.1	0.4
Wisconsin	59,571	0.16	2.2	1.7	0.5	4.6	3.4	1.2
Wyoming	7,389	0.02	0.3	0.2	0.1	0.6	0.4	0.2
Total	3,266,108	8.7	121.6	93.2	28.4	256.9	187.7	69.3

[a] Energy Information Administration / Department of Energy, data for 2005 (http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_mg.html)

[b] California fleet mix (70 percent PC/LDT1 & 30 percent LDT2) used for CA; all other states are represented by federal fleet mix (approximately 55 percent PC/LDT1 & 45 percent LDT2). This results in other states having less benefit on a percentage basis than CA.

Table 3. Comparison of State-Specific Cumulative CO_2E Benefits Achieved by Pavley Regulation and Proposed Federal Fuel Economy Standards by 2016 and 2020

State	Motor Vehicle Gasoline Consumption[a] (1000 Barrels)	Gasoline Use Ratio to California	Cum. Benefit from CA Stds by 2016[b] (MMTs)	Cum. Benefit from Fed Stds by 2016[b] (MMTs)	Cum. Benefit of CA Stds Over Fed Stds by 2016[b] (MMTs)	Cum. Benefit from CA Stds by 2020[b] (MMTs)	Cum. Benefit from Fed Stds by 2020[b] (MMTs)	Cum. Benefit of CA Stds Over Fed Stds by 2020[b] (MMTs)
Alabama	61,615	0.16	7.6	5.7	1.9	24.0	17.2	6.8
Alaska	6,583	0.02	0.8	0.6	0.2	2.6	1.8	0.7
Arizona	66,394	0.18	8.2	6.1	2.1	25.8	18.5	7.3
Arkansas	33,139	0.09	4.1	3.1	1.0	12.9	9.2	3.7
California[b]	375,652	1.00	55.5	35.9	19.5	158.4	106.5	52.0
Colorado	49,893	0.13	6.1	4.6	1.5	19.4	13.9	5.5
Connecticut	37,850	0.10	4.7	3.5	1.2	14.7	10.5	4.2
Delaware	10,418	0.03	1.3	1.0	0.3	4.1	2.9	1.1
District of Columbia	3,007	0.01	0.4	0.3	0.1	1.2	0.8	0.3
Florida	204,304	0.54	25.2	18.8	6.3	79.5	56.9	22.5
Georgia	119,515	0.32	14.7	11.0	3.7	46.5	33.3	13.2
Hawaii	10,833	0.03	1.3	1.0	0.3	4.2	3.0	1.2
Idaho	14,116	0.04	1.7	1.3	0.4	5.5	3.9	1.6
Illinois	121,758	0.32	15.0	11.2	3.8	47.4	33.9	13.4
Indiana	75,375	0.20	9.3	7.0	2.3	29.3	21.0	8.3
Iowa	36,906	0.10	4.5	3.4	1.1	14.4	10.3	4.1
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Minnesota	63,344	0.17	7.8	5.8	2.0	24.6	17.7	7.0
Mississippi	38,188	0.10	4.7	3.5	1.2	14.9	10.6	4.2
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Nevada	26,507	0.07	3.3	2.4	0.8	10.3	7.4	2.9
New Hampshire	16,542	0.04	2.0	1.5	0.5	6.4	4.6	1.8
New Jersey	102,025	0.27	12.6	9.4	3.2	39.7	28.4	11.3
New Mexico	22,262	0.06	2.7	2.1	0.7	8.7	6.2	2.5
New York	134,906	0.36	16.6	12.4	4.2	52.5	37.6	14.9
North Carolina	102,026	0.27	12.6	9.4	3.2	39.7	28.4	11.3
North Dakota	8,080	0.02	1.0	0.7	0.2	3.1	2.3	0.9
Ohio	122,074	0.32	15.0	11.3	3.8	47.5	34.0	13.5
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Rhode Island	9,100	0.02	1.1	0.8	0.3	3.5	2.5	1.0
South Carolina	58,235	0.16	7.2	5.4	1.8	22.7	16.2	6.4
South Dakota	9,470	0.03	1.2	0.9	0.3	3.7	2.6	1.0
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Texas	272,404	0.73	33.6	25.1	8.4	106.0	75.9	30.0
Utah	24,067	0.06	3.0	2.2	0.7	9.4	6.7	2.7
Vermont	8,166	0.02	1.0	0.8	0.3	3.2	2.3	0.9
Virginia	93,557	0.25	11.5	8.6	2.9	36.4	26.1	10.3
Washington	63,818	0.17	7.9	5.9	2.0	24.8	17.8	7.0
West Virginia	19,783	0.05	2.4	1.8	0.6	7.7	5.5	2.2
Wisconsin	59,571	0.16	7.3	5.5	1.8	23.2	16.6	6.6
Wyoming	7,389	0.02	0.9	0.7	0.2	2.9	2.1	0.8
Total	**3,266,108**	**8.7**	**411.5**	**302.5**	**109.0**	**1282.7**	**911.9**	**370.7**

[a] Energy Information Administration / Department of Energy, data for 2005 (http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_mg.html)

[b] California fleet mix (70 percent PC/LDT1 & 30 percent LDT2) used for CA; all other states are represented by federal fleet mix (approximately 55 percent PC/LDT1 & 45 percent LDT2). This results in other states having less benefit on a percentage basis than CA.