Energy Independence and Security Act of 2007
Title I—Energy Security through Improved Vehicle Fuel Economy
Subtitle A—Increased Corporate Average Fuel Economy Standards

Policy Description

Subtitle A of Title I of the Energy Independence and Security Act of 2007 (EISA) includes new corporate average fuel economy (CAFE) standards, beginning with the 2011 model year vehicles. The average combined fuel economy of automobiles will be at least 35 miles per gallon (mpg) by 2020, with separate standards applying to passenger and non-passenger automobiles. The standards will be phased in, starting with the 2011 model year, so that the CAFE increases each year until the average fuel economy of 35 mpg is reached by 2020. From 2021 through 2030, the maximum feasible average fuel economy standard will apply for each fleet and model year. Additionally, fuel economy standards are required to be developed for commercial medium and heavy-duty highway vehicle and work trucks. Credits for the manufacture of flexible-fueled vehicles will be phased out by 2020.

Policy Design

Goals: The overall goal of the new CAFE standards is to increase CAFE to 35 mpg by 2020.

- **Timing:** The requirements begin with the 2011 model year, with phase-in through 2020, and additional maximum fuel economy requirements for 2021 through 2030 model year vehicles.
- **Parties Involved:** Specific fuel economy standards are to be prescribed by the US Secretary of Transportation, in consultation with the US Secretary of Energy and the Administrator of the US Environmental Protection Agency.

Implementation Mechanisms

Federal law and accompanying DOT regulations.

Related Policies/Programs in Place

CAFE standards were originally established in 1975 in response to the Arab oil embargo. The original goal was to double fuel economy to 27.5 mpg by 1985. The CAFE standard for passenger cars has remained at 27.5 mpg since the 1990 model year. The most recent light truck CAFE standards have been set at 21.0 mpg for the 2005 model year, 21.6 mpg for the 2006 model year, and 22.2 mpg for the 2007 model year.

Types(s) of GHG Reductions

Net reduction in CO_2 emissions resulting from reduced fuel consumption.

Estimated GHG Reductions and Costs (or Cost Savings)

Data Sources:

National Highway Traffic Safety Administration, US Department of Transportation, "Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011-2015," Notice of Proposed Rulemaking, Docket No. NHTSA-2008-0089, April 22, 2008. http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.43ac99aefa80569eea57529cdba046a0/

Energy Information Administration, US Department of Energy, *Annual Energy Outlook 2008 (Early Release),* Report # DOE/EIA-0383(2008), release date December 2007, http://www.eia.doe.gov/oiaf/archive/earlyrelease08/index.html.

Energy Information Administration, US Department of Energy, *Annual Energy Outlook 2008 (Revised Early Release,)* Report # DOE/EIA-0383(2008), release date March 2008 (revised), http://www.eia.doe.gov/oiaf/aeo/index.html.

Environmental Protection Agency, Office of Transportation and Air Quality, MOBILE6 Vehicle Emission Modeling Software and "User's Guide to MOBILE6.1 and MOBILE6.2 Mobile Source Emission Factor Model," EPA420-R-03-010, August 2003, http://www.epa.gov/otaq/m6.htm.

Quantification Methods:

A brief overview of the inputs and process used for estimating CO_2 reductions due to the new CAFE standards is listed below:

Data inputs:

- Fuel economy by model year for the baseline and with new CAFE standards for light-duty vehicles, light-duty trucks, and commercial light trucks;
- Vehicle registration data and mileage accumulation rates by model year;
- VMT forecast by vehicle type; and
- Baseline transportation inventory and forecast.

Procedure:

- Allocate VMT by model year and vehicle type.
- Divide VMT by corresponding baseline fuel economy (mpg). This gives gallons of fuel consumed by model year. Repeat using new CAFE fuel economy values by model year to get fuel consumed by model year with new CAFE standards.
- Total the difference in fuel consumed under the baseline case and new CAFE case.
- Multiply the percentage reduction in fuel consumption from the new CAFE standards out of the total onroad fuel consumption by total onroad CO_2 emissions. This gives the CO_2 reduction from CAFÉ.

Fuel economy data by model year were obtained from the 2008 versions of the Annual Energy Outlook (AEO2008 and AEO2008Revised) and from the National Highway Traffic Safety Administration (NHTSA) proposed CAFE standards. Baseline fuel economy data were taken from AEO2008. The new fuel economy standards for passenger cars and light trucks were taken from the NHTSA proposed CAFE standards. The NHTSA set specific fuel economy standards for the model years 2011-2015, and made reference to constant fuel efficiency growth rates for model years 2016-2020. To reach the fuel economy standards set by the EISA for the year 2020, this analysis used linear growth rates for fuel efficiency in the years 2016-2020. Since the NHTSA proposed CAFE standards did not address light commercial trucks, AEO2008Revised was used to provide data for this category (vehicles with a gross vehicle weight rating [GVWR] of 8,501 lbs to 10,000 lbs). No fuel efficiency improvements were assumed for the new CAFE case for the years 2020-2025.

The fuel economy data were then adjusted to account for on-road performance (as opposed to the tested fuel economy values). The adjustment factors were obtained from AEO2008Revised. The adjustment factors for the light-duty trucks were also applied to the commercial light trucks. Tables 1, 2, and 3 display the tested and adjusted on-road fuel economies by model year for the baseline and the new CAFE case for passenger cars, light trucks, and light commercial trucks, respectively.

Table 1. New Passenger Car Fuel Economy Values by Model Year

Model	Tested (mpg)		Adjustment	On-Road (mpg)	
Year	Baseline	New CAFE	Factor	Baseline	New CAFE
2009	30.1	30.1	0.845	25.4	25.4
2010	30.4	30.4	0.846	25.7	25.7
2011	30.8	31.2	0.842	25.9	26.3
2012	30.9	32.8	0.806	24.9	26.5
2013	31.0	34.0	0.782	24.2	26.6
2014	31.1	34.8	0.795	24.7	27.7
2015	31.3	35.7	0.805	25.2	28.7
2016	31.5	36.9	0.816	25.7	30.1
2017	31.7	38.1	0.820	26.0	31.2
2018	32.0	39.4	0.829	26.5	32.6
2019	32.3	40.7	0.827	26.7	33.6
2020	32.5	42.0	0.827	26.9	34.7
2021	32.8	42.0	0.827	27.1	34.7
2022	33.0	42.0	0.827	27.3	34.7
2023	33.4	42.0	0.827	27.6	34.7
2024	33.7	42.0	0.827	27.9	34.7
2025	34.0	42.0	0.827	28.1	34.7

Table 2. New Light Truck Fuel Economy Values by Model Year

Model	Tested (mpg)		Adjustment	On-Road (mpg)	
Year	Baseline	New CAFE	Factor	Baseline	New CAFE
2009	23.0	23.0	0.823	19.0	19.0
2010	23.4	23.4	0.819	19.2	19.2
2011	23.9	25.0	0.792	18.9	19.8
2012	24.0	26.4	0.776	18.6	20.5
2013	24.1	27.8	0.760	18.3	21.1
2014	24.2	28.2	0.769	18.6	21.7
2015	24.4	28.6	0.788	19.2	22.5
2016	24.5	29.1	0.788	19.3	23.0
2017	24.7	29.7	0.797	19.7	23.6
2018	24.9	30.2	0.805	20.1	24.3
2019	25.1	30.8	0.806	20.2	24.8
2020	25.3	31.4	0.818	20.7	25.7
2021	25.4	31.4	0.818	20.8	25.7
2022	25.6	31.4	0.818	20.9	25.7
2023	25.8	31.4	0.818	21.1	25.7
2024	26.0	31.4	0.818	21.3	25.7
2025	26.3	31.4	0.818	21.5	25.7

Table 3. New Commercial Light Truck Fuel Economy Values by Model Year

Model	Tested (mpg)		Adjustment	On-Road (mpg)	
Year	Baseline	New CAFE	Factor	Baseline	New CAFE
2009	15.3	15.6	0.823	12.6	12.8
2010	15.5	15.7	0.819	12.7	12.9
2011	15.9	16.2	0.792	12.6	12.8
2012	15.9	16.6	0.776	12.3	12.9
2013	16.0	17.1	0.760	12.1	13.0
2014	16.0	17.5	0.769	12.3	13.4
2015	16.1	18.1	0.788	12.7	14.2
2016	16.2	18.3	0.788	12.8	14.4
2017	16.3	18.7	0.797	13.0	14.9
2018	16.4	19.1	0.805	13.2	15.4
2019	16.5	19.3	0.806	13.3	15.6
2020	16.6	19.8	0.818	13.6	16.2
2021	16.7	19.8	0.818	13.7	16.2
2022	16.8	19.8	0.818	13.7	16.2
2023	16.9	19.8	0.818	13.8	16.2
2024	17.1	19.8	0.818	14.0	16.2
2025	17.2	19.8	0.818	14.1	16.2

Using the fuel economy values in the tables above, the general methodology applied to estimate the benefits of the new CAFE standards involved first allocating the Michigan VMT projections used in developing the Michigan reference case GHG transportation emission inventory by model year. The VMT data by model year were then divided by

the corresponding fuel economy values (mpg) to obtain gallons of fuel consumed. The percentage change in the fuel consumption in the baseline scenario and new CAFE scenario by calendar year (aggregating the fuel consumption from all model years being used in a given calendar year) was then applied to the reference case CO_2 emissions from the onroad gasoline and diesel vehicles. Note that these reductions were not applied to the CH_4 or N_2O emissions as these are calculated as a function of vehicle miles traveled, while CO_2 is calculated as a function of fuel consumed.

Data from Michigan Department of Environmental Quality and EPA's MOBILE6 onroad emission factor model were used to allocate Michigan's projected VMT by model year. Michigan statewide vehicle registration data for 2004 were used for passenger cars and light trucks. MOBILE6 data was used for the vehicle age distributions of heavy vehicles. The vehicle registration distribution fractions used in this analysis are shown in Table 4. The data in this table represent the fraction of all vehicles of a particular type registered in a given calendar year that are of the age listed, as of July 1 of that year. The default MOBILE6 mileage accumulation rates by vehicle type and age are shown in Table 5. The data in this table represent the mileage that would be accumulated by a typical vehicle of a given age over the course of a year. Using the data from Tables 4 and 5, default normalized VMT distributions by model year and vehicle type were calculated. The total VMT by vehicle type in a given calendar year was then multiplied by the normalized VMT distribution by model year for that vehicle type to estimate the VMT in a given calendar year contributed by each model year operating during the calendar year. These VMT values by model year were then divided by the corresponding fuel economy values to obtain the gallons of fuel consumed.

Results:

Results from this analysis are shown in Tables 6, 7, and 8. Table 6 shows the baseline Michigan transportation emission inventory. Note that onroad gas and diesel have been combined here, as the proposed fuel economy standards are independent of fuel type. Table 7 shows the Michigan transportation GHG emission inventory when the new CAFE standards are accounted for. Finally, Table 8 shows the percentage reduction in the onroad emissions and in the total transportation emissions as a result of the new CAFE standards.

Key Assumptions:

Key assumptions in this analysis include those built into the modeling performed for the AEO2008 analyses determining the fuel economy values that were used in this analysis. The AEO2008 modeling includes assumptions about consumer choice of vehicles and technologies that affect the resulting fuel economy values.

Key Uncertainties

One of the primary uncertainties in this analysis is the first model year in which fuel economy improvements will be seen as a result of the new CAFE standards. The recent proposed rulemaking from the NHTSA on April 22, 2008 indicated that fuel economy would increase by 4.5% for model years 2011 through 2015, and then continue to increase at a slower pace through 2020 when a fleetwide CAFE of 35 mpg must be reached. This path was used for our estimates and thus, 2011 was the first model year

Table 4. Michigan Statewide Vehicle Registration Distribution Fractions by Vehicle Age

Vehicle Age	Light-Duty Vehicles (Passenger Cars)	Light-Duty Trucks 1&2 (6,000 lb GVWR and under)	Light-Duty Trucks 3&4 (6,001-8,500 lb GVWR)	Heavy-Duty Vehicles Class 2B (8,501-10,000 lb GVWR) (Commercial Light Trucks)
0	0.0770	0.1216	0.1095	0.0503
1	0.1027	0.1621	0.1460	0.0916
2	0.0997	0.1574	0.1418	0.0833
3	0.0813	0.0894	0.0961	0.0758
4	0.0516	0.0579	0.0557	0.0690
5	0.0496	0.0497	0.0711	0.0627
6	0.0401	0.0447	0.0398	0.0571
7	0.0385	0.0339	0.0354	0.0519
8	0.0371	0.0285	0.0308	0.0472
9	0.0449	0.0289	0.0356	0.0430
10	0.0430	0.0315	0.0346	0.0391
11	0.0439	0.0285	0.0236	0.0356
12	0.0426	0.0238	0.0222	0.0324
13	0.0412	0.0248	0.0150	0.0294
14	0.0388	0.0195	0.0187	0.0268
15	0.0383	0.0213	0.0196	0.0244
16	0.0317	0.0203	0.0169	0.0222
17	0.0228	0.0141	0.0136	0.0202
18	0.0200	0.0127	0.0150	0.0184
19	0.0153	0.0097	0.0118	0.0167
20	0.0110	0.0068	0.0082	0.0152
21	0.0057	0.0035	0.0048	0.0138
22	0.0033	0.0021	0.0026	0.0126
23	0.0030	0.0018	0.0015	0.0114
24+	0.0171	0.0056	0.0302	0.0499
Total	**1.0000**	**1.0000**	**1.0000**	**1.0000**

Table 5. Default MOBILE6 Mileage Accumulation Rates (miles per year)

Vehicle Age	Light-Duty Vehicles	Light-Duty Gas Trucks 1&2	Light-Duty Gas Trucks 3&4	Light-Duty Diesel Trucks 1&2	Light-Duty Diesel Trucks 3&4	Heavy-Duty Gas Vehicles Class 2B	Heavy-Duty Diesel Vehicles Class 2B
0	14,910	19,496	21,331	27,059	26,040	19,977	27,137
1	14,174	18,384	19,865	24,384	24,018	18,779	24,831
2	13,475	17,308	18,500	21,973	22,154	17,654	22,721
3	12,810	16,267	17,228	19,801	20,434	16,596	20,791
4	12,178	15,260	16,044	17,843	18,848	15,601	19,024
5	11,577	14,289	14,942	16,079	17,385	14,666	17,407
6	11,006	13,352	13,915	14,490	16,036	13,787	15,928
7	10,463	12,451	12,959	13,057	14,791	12,961	14,575
8	9,947	11,584	12,068	11,766	13,643	12,184	13,336
9	9,456	10,752	11,239	10,603	12,584	11,454	12,203
10	8,989	9,955	10,466	9,555	11,607	10,768	11,166
11	8,546	9,194	9,747	8,610	10,706	10,122	10,217
12	8,124	8,467	9,077	7,759	9,875	9,516	9,349
13	7,723	7,775	8,453	6,992	9,109	8,946	8,555
14	7,342	7,118	7,872	6,301	8,402	8,409	7,828
15	6,980	6,496	7,331	5,678	7,749	7,905	7,163
16	6,636	5,909	6,827	5,116	7,148	7,432	6,554
17	6,308	5,356	6,358	4,610	6,593	6,986	5,997
18	5,997	4,839	5,921	4,155	6,081	6,568	5,488
19	5,701	4,357	5,514	3,744	5,609	6,174	5,021
20	5,420	3,909	5,135	3,374	5,174	5,804	4,595
21	5,152	3,497	4,782	3,040	4,772	5,456	4,204
22	4,898	3,120	4,454	2,740	4,402	5,129	3,847
23	4,656	2,777	4,148	2,469	4,060	4,822	3,520
24+	4,427	2,470	3,862	2,225	3,745	4,533	3,221

Table 6. Baseline Michigan Transportation Inventory

Emission Totals ($MMTCO_2e$)	1990	1995	2000	2005	2010	2015	2020	2025
Onroad Gas and Diesel	42.60	48.48	52.62	53.50	57.15	60.26	63.94	68.08
Jet Fuel/Av. Gas	4.15	3.66	3.00	1.52	1.45	1.48	1.50	1.51
Marine	1.87	2.41	2.61	2.25	2.18	2.35	2.52	2.70
Rail	0.41	0.64	0.45	0.25	0.25	0.25	0.25	0.25
Other	0.69	0.65	0.71	0.66	0.69	0.70	0.70	0.70
Total	**49.72**	**55.85**	**59.39**	**58.17**	**61.71**	**65.03**	**68.91**	**73.25**

Table 7. Michigan Transportation Inventory with New CAFE Standards

Emission Totals ($MMTCO_2e$)	1990	1995	2000	2005	2010	2015	2020	2025
Onroad Gas and Diesel	42.60	48.48	52.62	53.50	56.97	56.58	57.21	60.25
Jet Fuel/Av. Gas	4.15	3.66	3.00	1.52	1.45	1.48	1.50	1.51
Marine	1.87	2.41	2.61	2.25	2.18	2.35	2.52	2.70
Rail	0.41	0.64	0.45	0.25	0.25	0.25	0.25	0.25
Other	0.69	0.65	0.71	0.66	0.69	0.70	0.70	0.70
Total	**49.72**	**55.85**	**59.39**	**58.17**	**61.53**	**61.35**	**62.18**	**65.41**

Table 8. Percentage Reductions in Emissions due to New CAFE Standards

Percentage Reductions in $MMtCO_2e$	1990	1995	2000	2005	2010	2015	2020	2025
Onroad Gas and Diesel	0.0%	0.0%	0.0%	0.0%	0.3%	6.1%	10.5%	11.5%
Total Transportation Inventory	0.0%	0.0%	0.0%	0.0%	0.3%	5.7%	9.8%	10.7%

affected by the new CAFE standards. Vehicles meeting the new CAFE standards are already available and demand for these vehicles may increase relative to the baseline case prior to the 2011 model year. This rulemaking does not yet indicate what fuel economy standards would be applied post 2020, so this analysis assumes that the fuel economy values from 2020 remain the same from 2021 to 2025. The EISA states that from 2021 to 2030, the maximum feasible fuel economy standard should be applied. Thus, these fuel economy values are likely to increase beyond the assumptions used in this analysis for the post-2021 model years.

Other factors will affect the actual fuel economy of vehicles on the road that have not been accounted for here. For example, EISA provides credit for flexible-fleet vehicles FFVs). If manufacturers sell a large number of FFVs to comply with the CAFE standard requirements under EISA, the fuel economy may be lower than accounted for in this analysis. Additionally, the adjustment factors used to convert tested fuel economy to on-road fuel economy significantly impact this analysis. There is some uncertainty surrounding these numbers, particularly at the higher fuel economy values.