MORE JOBS PER GALLON:

How Strong Fuel Economy/GHG Standards Will Fuel American Jobs

A Ceres Report
July 2011

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Table of Contents

Foreword

What kind of mileage and emission standards make sense for Americans and our economy? That's the question being decided in Washington D.C. right now. As we release this report, the Obama Administration is drawing up new fuel efficiency and greenhouse gas (GHG) emissions standards for passenger vehicles in model years 2017-2025.

Ceres, a national coalition of investors and public interest organizations, brings a unique perspective to the debate: we're focused on the economic impacts of strong standards. Over time, it has become increasingly clear that it is in the interest of consumers, workers, investors, automakers and the broader economy to adopt strong fuel economy/GHG standards.

Here are some of the reasons why:

- **Stronger standards are good for the auto industry, especially U.S. automakers:** A report by Citi Investment Research, working with the University of Michigan Transportation Research Institute and Ceres, concluded that higher fuel economy/GHG standards would increase variable profits of the auto industry, ***with most of the added profits going to the Detroit Three***.
- **Voters want better mileage and GHG standards:** When we polled voters in the historic heart of the auto industry, 78 percent of likely Michigan voters—including Republicans and Democrats, conservatives and liberals—supported a standard of 60 mpg by the year 2025, and 81% favor reducing vehicle GHG emissions.
- **Dramatically higher mileage is technologically feasible:** John DeCicco at the University of Michigan's Energy Institute found that even if car makers rely only on technologies that are already available and affordable, fleetwide average fuel efficiency could reach 74 mpg over the next 25 years.

For this report, Ceres asked the respected, independent economic research firm Management Information Services, Inc. to look at what higher fuel efficiency/GHG standards would mean for the U.S. economy. At a time when all policies are being measured against the yardstick of job growth, we asked how strengthening mileage/GHG standards would affect employment. And with so many states struggling, we asked what higher fuel efficiency/GHG standards would mean for state economies across the country.

The answers, as you will see in this report, provide still more evidence that getting better gas mileage is not just good for consumers' wallets—it's good for job creation and the broader economy as well.

Mindy S. Lubber
President of Ceres
Director of Investor Network on Climate Risk

EXECUTIVE SUMMARY AND KEY FINDINGS

This Ceres report focuses on the economic impacts of strengthening fuel economy and greenhouse gas (GHG) emission standards for passenger vehicles sold in the United States. The analysis finds that stronger standards—more miles and fewer emissions per gallon—would lead to greater economic and job growth, both within the auto industry and in the broader economy as a whole.

This report comes as the Obama Administration and the state of California are developing new fuel economy and GHG emission standards for passenger vehicles for model years 2017-2025. Since light-duty vehicles account for more than 40 percent of U.S. oil consumption, and nearly 60 percent of mobile source GHGs,[1] the upcoming rules have important implications for energy security, protection from oil price spikes, and reducing global warming pollution.

Historically, Corporate Average Fuel Economy (CAFE) standards have saved substantial amounts of petroleum and played an important role in controlling vehicle GHG emissions and reducing our growing dependence on foreign oil. However, opponents of strong standards have raised concerns about the economic impacts of higher standards on auto industry profitability[2] and job growth.

This report analyzes the impacts of different regulatory scenarios being considered, and concludes that positive economic and jobs impacts will result from higher standards, and be more pronounced as standards strengthen.

Report author Management Information Services, Inc. (MISI), an internationally recognized research firm, used the MISI model, database and information system, combined with economic data from the Bureau of Economic Analysis, Bureau of Labor Statistics and U.S. Treasury Department, to estimate economic and employment effects of enhanced CAFE/GHG standards in 2030.

The MISI model is based on a widely used economic modeling technique, the economic input-output (I-O) model. A simplified version of the MISI model as applied in this study is summarized in Figure III-1 on page 13.

The analysis finds that stronger standards—more miles and fewer emissions per gallon—would lead to greater economic and job growth, both within the auto industry and in the broader economy as a whole.

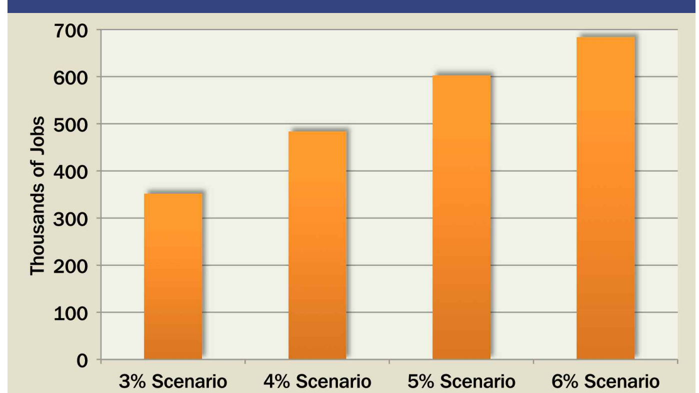
1 U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2007. 2009; U.S. EPA. Office of Transportation and Air Quality. Interim Joint Technical Assessment: Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025. 2010.

2 For an opposing view, see “Fuel Economy Focus, Perspectives on 2020 Industry Implications,” by Citi Investment Research, March 2011, which found that strong standards would benefit the auto industry, particularly the Detroit 3.

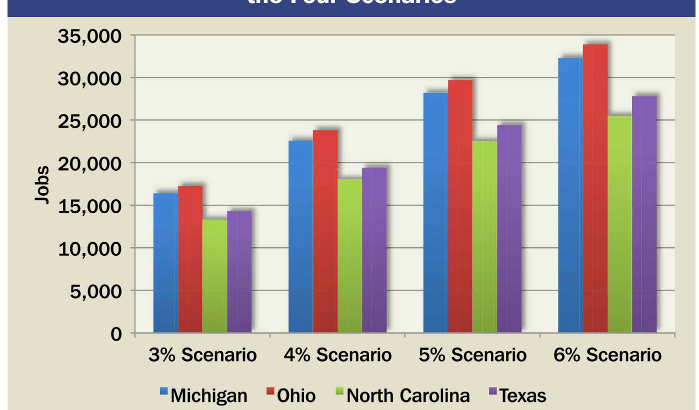
Key Report Findings:

- ***Each of the four scenarios*** covering the range of new standards currently under consideration for CAFE mileage and GHG emissions improvements—annual emissions reductions and fuel-economy improvements of three, four, five and six percent per year for the years 2017-25—***would bring substantial economic and job benefits for the U.S. economy in 2030. This includes net jobs gains in 49 states.***
- ***The greater the improvements in fuel economy and GHG emissions, the greater the economic benefits.*** For example, nearly 700,000 new jobs would be created under the six percent scenario, compared to only about 350,000 jobs under the three percent scenario.
- ***Domestic auto industry job creation would increase under all four scenarios, including 63,000 new, full-time domestic auto jobs in 2030 under the six percent scenario.***
- ***Stronger fuel economy and GHG standards would produce broad economic benefits.*** This includes significant consumer savings at the pump, which would shift significant consumer spending away from the oil industry and towards other parts of the economy, such as retail, food and health care.
- The six percent scenario would generate an estimated ***$152 billion in fuel savings in 2030*** compared to business as usual. Of the $152 billion saved at the pump, $59 billion would be expected to be spent in the auto industry, as drivers purchase cleaner, more efficient vehicles. The remaining $93 billion will be spent across the rest of the economy, from retail purchases, to more trips to restaurants to increased consumer spending on health care.
- ***All of the scenarios would deliver net job gains in 49 states, with the biggest winners on a percentage basis being Indiana, Michigan, Ohio, and New York.*** Other states that would see the most job growth on a percentage basis include Alabama, Kentucky, Tennessee, North Carolina, Vermont, New Hampshire, Oregon and Missouri. ***In terms of total number of new jobs, California and New York would see the biggest gains***, and other winners would include Florida, Ohio, Michigan Illinois, Pennsylvania, Texas, North Carolina, Indiana, Georgia and New Jersey. Wyoming is the only state that would lose jobs.
- ***Effects on national and state GDP would be overwhelmingly positive.*** States seeing the biggest percentage GDP gains under the strongest fuel efficiency standard have large auto industry sectors. The biggest gainers would be Michigan and Indiana, followed by Kentucky, South Carolina, Tennessee, Wisconsin, Iowa, Ohio, Alabama and Oregon. Some states would see net GDP decreases under this same scenario. These are primarily oil-producing states such as Alaska, Wyoming and Louisiana, followed by Oklahoma, Texas, New Mexico, Colorado and North Dakota. However, all these states, except Wyoming, would see net job gains as money is shifted away from the oil industry to sectors of the economy that deliver more jobs per dollar spent by consumers.

Growth in US Jobs in 2030



Job Growth in Selected States Across the Four Scenarios



Source: Management Information Services, Inc., 2011.

INTRODUCTION

The impacts of fuel consumption by light duty vehicles (LDVs) are significant, and the rapid rise in gasoline and diesel fuel prices in recent years, in conjunction with concerns over greenhouse gas (GHG) emissions from mobile sources, have made vehicle fuel economy an important policy issue. Corporate average fuel economy (CAFE) standards have saved substantial amounts of petroleum and have played an important role in reducing vehicle GHG emissions. However, until recently, revision of the CAFE standards has been blocked, in part due to auto industry concerns about alleged economic and job impacts of higher standards.

Several recent legislative, legal and regulatory initiatives have brought these issues to the forefront. The first major initiative was the mandate for increased CAFE standards under the Energy Independence and Security Act of 2007. This legislation requires the National Highway Traffic Safety Administration (NHTSA) to increase vehicle fuel economy standards, starting with model year 2011, until they achieve a combined average fuel economy of at least 35 miles per gallon (mpg) for model year 2020. The policy landscape has also been influenced by key legal rulings, including a U.S. Supreme Court decision[1] finding that greenhouse gases are pollutants under the Clean Air Act and subject to regulation by EPA; as well as district court cases upholding the right of California to adopt vehicle GHG standards, and that of states to adopt California's vehicle GHG standards in turn.[2]

The policy landscape has also been influenced by key legal rulings, including a U.S. Supreme Court decision[1] finding that greenhouse gases are pollutants under the Clean Air Act and subject to regulation by EPA.

In May 2009, President Obama announced the first national policy governing both fuel economy and GHG emissions standards for cars and light trucks for model years 2012-2016. This National Program grew out of an agreement between the automakers, California, and the Obama Administration. The Environmental Protection Agency (EPA) and NHTSA finalized the rule on April 1, 2010. The rule is estimated to increase new car and light truck averaged fuel economy to 34.1 mpg and to reduce averaged new vehicle emissions to 250 grams of CO_2–equivalent per mile by model year 2016.[3] In the fall of 2010, the California Air Resources Board (CARB) announced that compliance with EPA's GHG emissions standards would constitute compliance with California's standards through 2016. However, note that California retains its authority under the Clean Air Act to set its own standards, and that states are also empowered to adopt California's standards once California receives a waiver for its standards from EPA.

1 Massachusetts v. Environmental Protection Agency, 549 U.S. 497 (2007).

2 Central Valley Chrysler-Jeep, Inc. v. Goldstene, 529 F. Supp. 2d 1151 (E.D. Cal. 2007); Green Mountain Chrysler Plymouth Dodge Jeep v. Crombie, 508 F.Supp.2d 295 (D. Vt. 2007).

3 This represents an average increase of eight mpg per vehicle compared to estimated 2010 combined averaged new vehicle fuel economy. According to the Obama Administration, drivers will recoup the additional cost of a new, more fuel-efficient vehicle in three years and will, over the life of the vehicle, save $2,800, on average. It estimated that the new rule will save 1.8 billion barrels of oil over the next five years, and is the equivalent of taking 58 million vehicles off the road – see The White House, "Remarks by the President on National Fuel Efficiency Standards," May 19, 2009. Note that 34.1 mpg is the estimated CAFE standard assuming the market plays out as contemplated in the rule. The estimated GHG average is 250 grams per mile. This is actually the equivalent of 35.5 mpg if achieved entirely with mpg; however, some of this is expected to be met with air conditioning credits.

Introduction

On May 21, 2010, the President directed the agencies to take additional coordinated steps to bring about a new generation of clean vehicles.[4] Among other steps, the agencies were tasked with working with California to develop Phase II of the National Program involving standards for model year (MY) 2017 through 2025 that would be consistent with EPA's and NHTSA's respective statutory authorities, in order to continue to guide the automotive sector along the road to reducing its fuel consumption and GHG emissions.[5]

Credible analysis and data are required to assess the energy, economic, and job impacts of enhanced CAFE and GHG standards in order to inform the policy debate and assess the auto industry's contention that strong standards will hinder profits and cost jobs.[6] This report addresses these concerns by estimating the likely economic and job impacts of increasing the CAFE and GHG standards for new light duty vehicles sold between 2017 and 2025. In order to provide rigorous analysis of the job impacts of proposed enhanced CAFE and GHG standards, this report:

- **Provides needed data and analysis on the economic and job impacts of enhanced CAFE and GHG standards;**
- **Forecasts the macroeconomic and jobs impacts of higher CAFE/GHG standards on job creation in 2030 at both the national and state levels;**
- **Analyzes four scenarios:**

  1) the EPA/NHTSA/California Air Resources Board (CARB) six percent annual scenario—the highest standard under consideration by the agencies, which implies a 143 gram per mile CO_2-equivalent GHG standard and a CAFE standard of about 54-56 mpg[7] by 2025;
  2) a three percent annual scenario (the lowest under consideration) in 2025;
  3) a four percent annual scenario; and
  4) a five percent annual scenario.

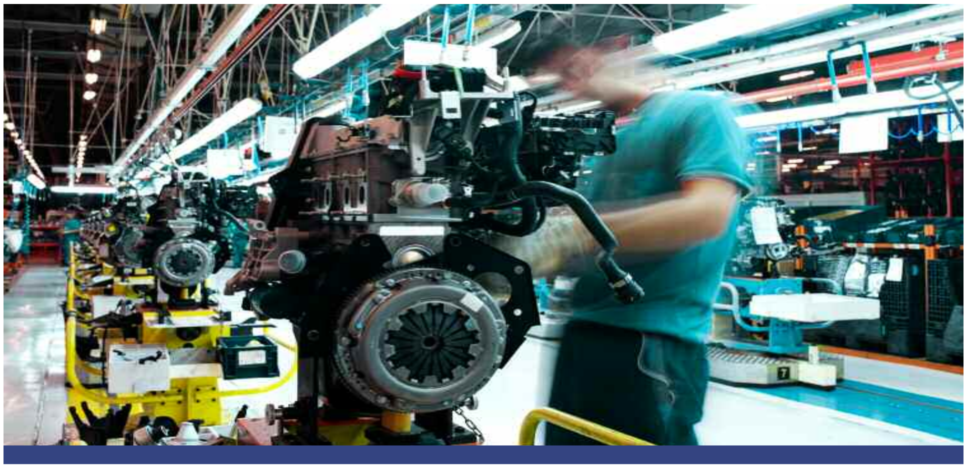
Credible analysis and data are required to assess the energy, economic, and job impacts of enhanced CAFE and GHG standards in order to inform the policy debate and assess the auto industry's contention that strong standards will hinder profits and cost jobs.[6]

4 Presidential Memorandum: "Improving Energy Security, American Competitiveness and Job Creation, and Environmental Protection Through a Transformation of Our Nation's Fleet of Cars And Trucks," Issued May 21, 2010, published at 75 Fed. Reg. 29399 (May 26, 2010).

5 See the discussion in Office of Transportation and Air Quality, U.S. Environmental Protection Agency, Office of International Policy, Fuel Economy, and Consumer Programs, National Highway Traffic Safety Administration, U.S. Department of Transportation, and California Air Resources Board, California Environmental Protection Agency, Interim Joint Technical Assessment Report: Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025, September 2010.

6 For example, the Auto Alliance, which includes GM, Chrysler, Ford, Toyota, Daimler, and other major vehicle manufacturers, contended that the 2011-2015 CAFE standards would cost consumers $29 billion, destroy 82,000 jobs, raise the cost of vehicles by $4,000 or more, and reduce annual production by up to 850,000 units industry-wide. See "CAFE to Cost 82,000 Jobs," Motor Trend, July 1, 2008. In contrast, a study for the UAW estimated that by 2020 supplying the U.S. automobile market with more efficient cars could provide a net gain of over 190,000 new jobs from improvements to fuel economy alone. See Alan Baum and Daniel Luria, Driving Growth: How Clean Cars and Climate Policy Can Create Jobs," report prepared for the Natural Resources Defense Council, United Auto Workers and Center for American Progress by The Planning Edge and the Michigan Manufacturing Technology Center, March 2010.

7 While the greenhouse gas standards could theoretically be met completely with fuel economy, automakers are expected to use credits of 15 to 21 grams per mile from improved air conditioning. The CAFE value here is consistent with use of air conditioning credits. Note that, while the regulatory test procedure value for CAFE of the 6% scenario would be 54-56 mpg, the real world fuel economy value would be approximately 40 to 45 mpg based on a real world shortfall of 20 to 25 percent.



TECHNOLOGIES AND COSTS FOR INCREASING VEHICLE FUEL EFFICIENCY

In 2009 and 2010, the U.S. National Academy of Sciences (NAS) finalized three studies indicating that a wide array of technologies and approaches exist for reducing fuel consumption, ranging from relatively minor changes with low costs and small fuel consumption benefits—such as use of new lubricants and tires—to large changes in propulsion systems and vehicle platforms that have high costs and large fuel consumption benefits. Two of the studies focused on 2020 and 2030 and concluded that automakers have the ability to produce much more efficient vehicles and that, although the efficiency of vehicle technology has improved steadily over the past 25 or so years, these improvements have been largely used to offset fuel consumption impacts of shifting to larger, heavier, and more powerful vehicles.[8] The third study also found significant opportunities for reductions in fuel consumption, but was only focused on technologies available over the next five years.[9]

To meet new federal standards, NAS determined that automakers will need to apply at least 75 percent of future efficiency improvements to direct reductions in fuel consumption. If they are able to maintain that rate of improvement past 2020, gasoline consumption is expected to level off and then decrease, despite a predicted increase in vehicle miles traveled. Through 2020, most of these improvements will be made by increasing the efficiency of existing gasoline, diesel, and hybrid-electric engines. As these are already on the market, incremental advances in them will have a larger immediate impact than the introduction of substantially new technologies that will have a small initial market share.

The most recent information on the cost and potential of vehicle efficiency and greenhouse gas reduction technology was released in October 2010 when EPA, NHTSA, and CARB published a joint Technical Assessment Report (TAR) to inform the rulemaking process for the second phase of the national program. This work reflects input from an array of stakeholders on relevant factors, including viable technologies, costs, benefits, lead time to develop and deploy new and emerging technologies, incentives and other flexibilities to encourage development and deployment of new and emerging

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8 These studies were conducted a part of the America's Energy Future project. See National Academy of Sciences, National Research Council, Real Prospects for Energy Efficiency in the United States, Washington, D.C.: National Academies Press, December 2009; and National Academy of Sciences, National Research Council, America's Energy Future: Technology and Transformation, Washington. D.C.: National Academies Press, 2009.

9 National Academy of Sciences, National Research Council, Committee on the Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy, Assessment of Technologies for Improving Light Duty Vehicle Fuel Economy, Washington, D.C., National Academies Press, 2011. Note that while this study was formally published in 2011, it was released in 2010.

technologies, impacts on jobs and the automotive manufacturing base in the U.S., and infrastructure for advanced vehicle technologies.[10] The report provided an overview of key stakeholder input and presented the agencies' initial assessment of a range of stringencies of future standards.

EPA/NHTSA/CARB found that the increased vehicle efficiency would result in substantial societal benefits in terms of GHG emission reductions and petroleum use reductions. In the scenarios analyzed for 2025 model year vehicles, lifetime GHG emissions would be reduced from 340 million metric tons (3 percent annual improvement scenario) to as much as 590 million metric tons for a 6 percent annual improvement scenario. For the same range of scenarios, lifetime fuel consumption for this single 2025 model year of vehicles would be reduced by 0.7 to 1.3 billion barrels.

EPA/NHTSA/CARB found that the increased vehicle efficiency would result in substantial societal benefits in terms of GHG emission reductions and petroleum use reductions.

The following two tables summarize the major EPA/NHTSA/CARB findings compared to a 2016 vehicle baseline. As shown in Table II-1 (see page 10), automotive technologies are available, or can be expected to be available, to support a reduction in GHGs, and commensurate increase in fuel economy, of up to six percent per year in the 2017-2025 timeframe. Greater reductions come at greater incremental vehicle costs. The per vehicle cost increase in 2025 ranges from slightly under $1,000 per new vehicle for a three percent annual GHG reduction, increasing to as much as $3,500 per new vehicle to achieve a six percent annual GHG reduction.[11] However, consumer savings would also increase with the lower GHG emissions and higher fuel economy. For the different scenarios analyzed, the net lifetime savings to the consumer due to increased vehicle efficiency range from $4,900 to $7,400 for an average new vehicle in 2025. The report found that the initial vehicle purchaser will find the higher vehicle price recovered in four years or less for every scenario analyzed.

EPA/NHTSA/CARB used distinct "technology pathways" to illustrate that there are multiple mixes of advanced technologies which can achieve the range of GHG targets analyzed.[12] Their approach of considering four technology pathways for this assessment was chosen for several reasons. First, in the stakeholder meetings with the auto manufacturers, the companies described a range of technical strategies they were pursuing for potential implementation in the 2017-2025 timeframe. Using multiple technology pathways allowed the agencies to evaluate how different technical approaches could be used to meet progressively more stringent scenarios. Second, this approach helps to generally capture the uncertainties that exist with forecasting the potential penetration of and costs of different advanced technologies into the light-duty vehicle fleet ten to fifteen years into the future at this time. There are four technology pathways:

- **Pathway A** is intended to portray a technology path focused on hybrid electric vehicles (HEVs), with less reliance on advanced gasoline vehicles and mass reduction, relative to Pathways B and C.
- **Pathway C** represents an approach where the industry focuses most on advanced gasoline vehicles and mass reduction, and to a lesser extent on HEVs.
- **Pathway B** represents an approach where advanced gasoline vehicles and mass reduction are utilized at a more moderate level, higher than in Pathway A but less than in Pathway C. Pathway B is the most balanced path, and we use Pathway B cost levels in our analysis.
- **Pathway D** represents an approach focused on the use of plug-in hybrid electric vehicles (PHEV), electric vehicles (EV) and HEV technology, with less reliance on advanced gasoline vehicles and mass reduction.

10 Interim Joint Technical Assessment Report: Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025.
11 Ibid. The TAR notes that the estimated average compliance cost in 2016 is about $907 above the price of a 2011 vehicle.
12 Ibid.

II. Technologies and Costs for Increasing Vehicle Fuel Efficiency

It is important to note that Pathway A assumed minimal mass reduction, Pathway C assumed maximum mass reduction, Pathway B assumed a balance between A and B, and Pathway D assumed minimal mass reduction, and forced penetration of hybrids, PHEVs, and EVs by restricting progress on conventional technical development.

Table II-1: Projections for MY 2025 Per-Vehicle Costs, Vehicle Owner Payback, and Net Owner Lifetime Savings[13, 14]

Scenario	New Fleet g/mile CO_2 Target (MPGe)	Technology Path	Per-Vehicle Cost increase ($)	Payback Period (years)	Net Lifetime Owner Savings ($)
3% per year	190 (47)	A	$930	1.6	$5,000
		B	$850	1.5	$5,100
		C	$770	1.4	$5,200
		D	$1,050	1.9	$4,900
4% per year	173 (51)	A	$1,700	2.5	$5,900
		B	$1,500	2.2	$6,000
		C	$1,400	1.9	$6,200
		D	$1,900	2.9	$5,300
5% per year	158 (56)	A	$2,500	3.1	$6,500
		B	$2,300	2.8	$6,700
		C	$2,100	2.5	$7,000
		D	$2,600	3.6	$5,500
6% per year	143 (62)	A	$3,500	4.1	$6,200
		B	$3,200	3.7	$6,600
		C	$2,800	3.1	$7,400
		D	$3,400	4.2	$5,700

Source: U.S. Environmental Protection Agency, U.S. National Highway Traffic Safety Administration, and California Air Resources Board, 2010.

For the different scenarios analyzed, the net lifetime savings to the consumer due to increased vehicle efficiency range from $4,900 to $7,400 for an average new vehicle in 2025.

Table II-2 (see page 11) illustrates the levels of technology required to achieve the different GHG and fuel economy levels that were analyzed in the EPA/NHTSA/CARB report. The types of vehicle technologies sold in 2025 to meet more stringent emission and fuel economy standards depend on the stringency of the adopted standards, the success in fully commercializing at a reasonable cost emerging advanced technologies, and consumer acceptance. The EPA/NHTSA/CARB analysis illustrated a wide range of possible outcomes, and these will likely vary by vehicle manufacturer. The potential fleet penetrations for gasoline and diesel vehicles, hybrids, plug-in electric vehicles, or electric vehicles may also vary greatly depending on assumptions about which technology pathways industry chooses.

As shown in Table II-2, at the three or four percent annual improvement scenarios, advanced gasoline and diesel powered vehicles that do not use electric drivetrains may be the most common vehicle types available in 2025. In the three percent to four percent annual improvement range, all pathways use advanced, lightweight materials and improved engine and transmission technologies. This table also shows that hybrid vehicle penetration under the three and four percent annual improvement scenarios vary widely due to the assumptions made for each technology pathway, ranging from roughly three to 40 percent of the market in 2025.

13 Per-vehicle costs represent the increase in costs to consumers from the MY 2016 standards. Payback period and lifetime owner savings use a 3% discount rate and AEO 2010 reference case energy prices. The gasoline price used for this estimate is $3.49/gallon in 2025 and increases over time to a maximum of $4.34/gallon in 2050. Per-vehicle costs represent the estimated cost to the consumer, including the direct manufacturing costs for the new technologies, indirect costs for the auto manufacturer (e.g., product development, warranty) as well as auto manufacturer profit, and indirect costs at the dealership.

14 The targets evaluated were CO_2 targets which could be meet through reductions in CO_2 as well as through air conditioning system hydroflurocarbon reductions converted to a CO_2 equivalent value. MPGe is the equivalent MPG value if all of the CO_2 reductions came from fuel economy improvement technologies. Real-world CO_2 is typically 25 to 33 percent higher and real-world fuel economy is typically 20 to 25 percent lower. Thus, the 3% to 6% range evaluated in the EPA/NHTSA/CARB assessment would span a range of real world fuel economy values of approximately 37 to 50 mpg if met exclusively with fuel economy, which correspond to the regulatory test procedure values of 47 and 62 mpg, respectively. Expected use of air conditioning credits of 15 to 21 grams per mile further lower expected real world fuel economy values to 32 to 45 mpg.

II. Technologies and Costs for Increasing Vehicle Fuel Efficiency

Under the 5 or 6 percent annual improvement scenarios hybrids could comprise from 40 percent to 68 percent of the market. In Paths A through C, PHEVs penetrate the market substantially in 2025 (four to nine percent) only at the six percent annual improvement scenario. In Path D, an unlikely scenario where a manufacturer makes no improvement in gasoline and diesel vehicle technologies beyond MY 2016, PHEVs and EVs begin to penetrate the market at the four percent annual improvement rate and may have as high as a 16 percent market penetration under the six percent annual improvement scenario.

Table II-2: Technology Penetration Estimates for MY 2025 Vehicle Fleet

		New Vehicle Fleet Technology Penetration				
Scenario	**Technology Path**	**Mass Reduction***	**Gasoline & Diesel Vehicles**	**HEVs**	**PHEVs****	**EVs**
3% per year	Path A	15%	89%	11%	0%	0%
	Path B	18%	97%	3%	0%	0%
	Path C	18%	97%	3%	0%	0%
	Path D	15%	75%	25%	0%	0%
4% per year	Path A	15%	65%	34%	0%	0%
	Path B	20%	82%	18%	0%	0%
	Path C	25%	97%	3%	0%	0%
	Path D	15%	55%	41%	0%	4%
5% per year	Path A	15%	35%	65%	0%	1%
	Path B	20%	56%	43%	0%	1%
	Path C	25%	74%	25%	0%	0%
	Path D	15%	41%	49%	0%	10%
6% per year	Path A	14%	23%	68%	2%	7%
	Path B	19%	48%	43%	2%	7%
	Path C	26%	53%	44%	0%	4%
	Path D	14%	29%	55%	2%	14%

** Mass reduction is the overall net mass reduction of the 2025 fleet compared to MY 2008 vehicles.*

*** This assessment considered both PHEVs and EVs. These results show a higher relative penetration of EVs compared to PHEVs. The agencies do believe PHEVs may be used more broadly by auto firms than indicated in this technical assessment.*

Source: U.S. Environmental Protection Agency, U.S. National Highway Traffic Safety Administration, and California Air Resources Board, 2010.

In Paths A through C, PHEVs penetrate the market substantially in 2025 (four to nine percent) only at the six percent annual improvement scenario.

METHODOLOGY

The economic and employment effects of enhanced CAFE/GHG standards were estimated using the MISI model, data base, and information system. A simplified version of the MISI model as it will be applied in this study is summarized in Figure III-1 (see page 13).

The first step in the MISI model involves translation of increased expenditures for reconfigured motor vehicles meeting the revised CAFE/GHG standards into per unit output requirements from every industry in the economy.[15] Second, the direct output requirements of every industry affected as a result of the revised CAFE/GHG standards will be estimated, and they reflect the production and technology requirements implied by the enhanced CAFE/GHG standards. These direct requirements show, proportionately, how much an industry must purchase from every other industry to produce one unit of output. Direct requirements, however, give rise to subsequent rounds of indirect requirements. The sum of the direct plus the indirect requirements represents the total output requirements from an industry necessary to produce one unit of output. Economic input output (I-O) techniques allow the computation of the direct as well as the indirect production requirements, and these total requirements are represented by the "inverse" equations in the model.

Thus, in the third step in the model the direct industry output requirements are converted into total output requirements from every industry by means of the I-O inverse equations. These equations show not only the direct requirements, but also the second, third, fourth, nth round indirect industry and service sector requirements resulting from revised CAFE/GHG standards.

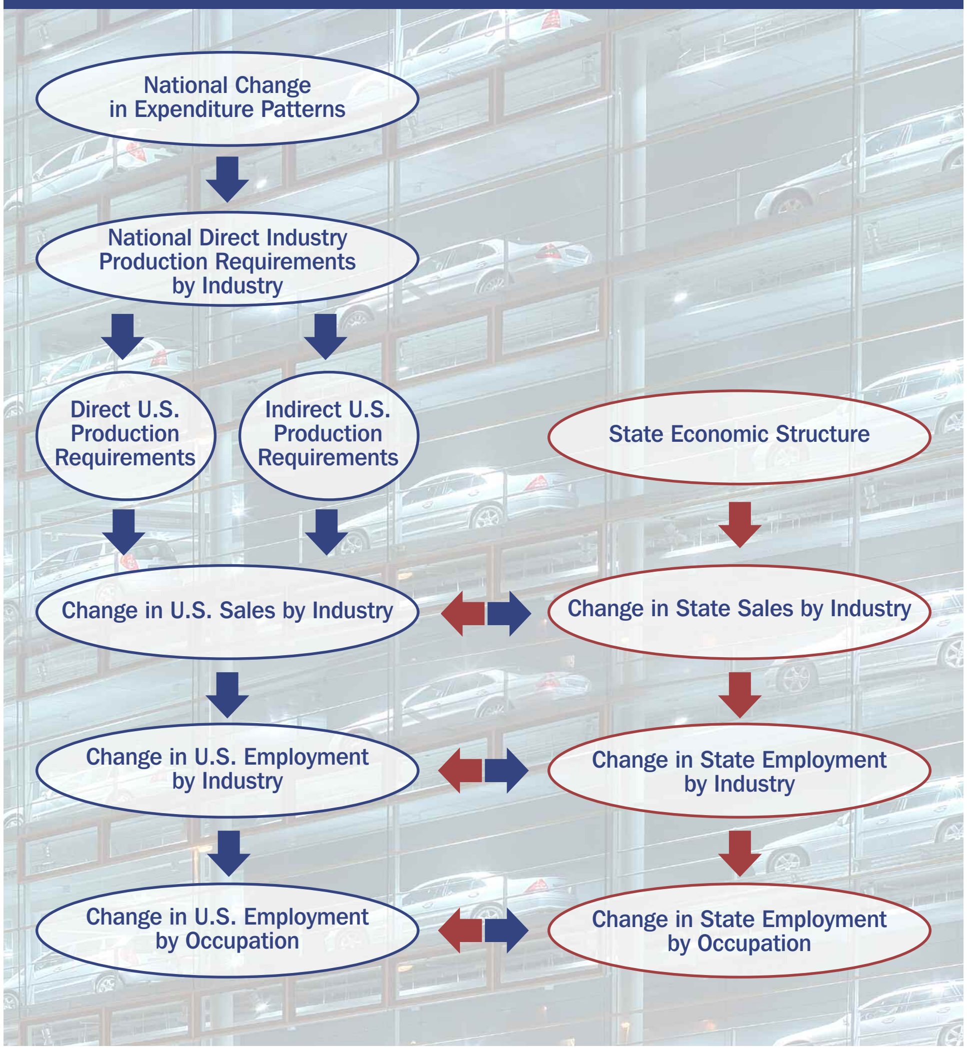
Next, the total output requirements from each industry are used to compute sales volumes, profits, and value added for each industry. Then, using data on manhours, labor requirements, and productivity, employment requirements within each industry are estimated. This allows computation of the total number of jobs created within each industry. Utilizing the modeling approach outlined above, the MISI model allows estimation of the effects on the economy and jobs.

15 While the MISI model contains 500 industries, in the work conducted here an 80-order industry scheme was used.

III. Methodology

The final step in the analysis entails assessing the economic and job impacts on individual states using the MISI regional model. This model recognizes that systematic analysis of economic impacts must also account for the inter-industry relationships between regions, since these relationships largely determine how regional economies will respond to project, program, and regulatory changes. The MISI I-O modeling system includes the databases and tools to project these interrelated impacts at the regional level. The model allows the flexibility of specifying multi-state, state, or county levels of regional detail. Regional I-O multipliers are calculated and forecasts made for the detailed impacts on industry economic output and jobs at the state level for 51 states (50 states and the District of Columbia). Because of the comprehensive nature of the modeling system, these state impacts are consistent with impacts at the national level, an important fact that adds to the credibility of the results since there is no "overstatement" of the impacts at the state level.

Figure III-1: Use of the MISI Model to Estimate the Economic and Jobs Impacts of Increased CAFE Standards



Source: Management Information Services, Inc., 2011.

This model recognizes that systematic analysis of economic impacts must also account for the inter-industry relationships between regions, since these relationships largely determine how regional economies will respond to project, program, and regulatory changes.

ESTIMATES OF NATIONAL IMPACTS

Deriving the Estimates

Estimating the costs in 2030 of implementing the enhanced CAFE/GHG Standards is fairly straightforward. Using data from the EPA/NHTSA/CARB Technical Assessment Report for vehicle cost and data provided by the Union of Concerned Scientists,[16] for sales of cars and light trucks, fuel use and fuel costs, provides estimates for the additional costs in the U.S. economy as a result of the new standards. As shown in Table IV-1, the additional per vehicle costs range from about $850 (2009 dollars) for light trucks and cars under the three percent scenario and increase to nearly $3,200 for cars and light trucks under the six percent scenario. The resulting additional costs to consumers range from $26.7 billion under the three percent scenario to $58.6 billion under the six percent scenario.

Table IV-1: LDV Market in 2030 under CAFE Scenarios

Case	LDV Sales (thousands)	Average Vehicle Cost ('09$)	Cost of CAFE per Vehicle ('09)	LDV Sales (billions – '09$)	Change in LDV Expenditures (billions – '09$)
Reference	17,957	27,960	-	502.1	-
3%	18,356	28,807	$847	528.8	26.7
4%	18,359	29,383	$1,423	539.4	37.4
5%	18,250	30,144	$2,184	550.1	48.1
6%	18,010	31,132	$3,172	560.7	58.6

Source: EPA/NHTSA/CARB Technical Assessment Report and the Union of Concerned Scientists, Reference Case and 3% through 6% Side Cases; and MISI; 2011.

The reference case is also based on the Union of Concerned Scientists' analysis and assumes that without the new standards, new LDV fuel economy reaches 34.1 mpg by 2016 per current CAFE requirements and 35 mpg by 2020 per requirements under the 2007 Energy Independence and Security Act. The reference case also assumes that all

16 2030 Impacts of Fuel Efficiency and Global Warming Pollution Standards, Union of Concerned Scientists, June 2011. Available at https://s3.amazonaws.com/ucs-documents/clean-vehicles/CeresData.pdf. This analysis includes sales rebound effects from consumer net savings over the first five years of vehicle ownership.

new vehicles receive 10.6 grams per mile of air conditioning credit from 2016 onward, per estimates from the EPA/NHTSA/CARB Technical Assessment Report. Despite the increased fuel economy in the baseline, vehicle travel and gasoline prices rise as the economy grows, and liquid fuel costs to the consumer will thus be higher than today. Comparing the three to six percent CAFE/GHG scenarios to the Reference Case results in estimated stock fuel savings in 2030, which range from 20 billion gallons under the three percent scenario, to 39 billion gallons under the six percent scenario—Table IV-2. In order to estimate a value of this savings to the U.S. economy, the AEO 2011 Reference Case price of $3.64 per gallon was used for the reference case, and adjusted based on the monopsony effect value of $10.57 to $12.31 per barrel of oil saved for the three through six percent cases.[17] This resulted in a range of estimates of fuel savings under the three percent and six percent scenarios of $78 billion to $152 billion in 2030 alone.

Table IV-2: LDV Fuel Expenditures in 2030 under CAFE Scenarios

Case	Fuel Consumed (billions gallons}	Average per Gallon ('09$)	Fuel Cost (billions – '09$)	Change in Fuel Expenditures (billions – '09$)
Reference	141	$3.64	513.1	-
3%	121	$3.60	435.5	-77.6
4%	113	$3.59	406.2	-106.9
5%	107	$3.56	379.8	-133.3
6%	102	$3.54	361.2	-151.9

Source: U.S. Energy Information Administration, Annual Energy Outlook 2011; EPA/NHTSA/CARB Technical Assessment Report and the Union of Concerned Scientists; Reference Case and 3% through 6% Side Cases; and MISI; 2011.

Estimated National Impacts in 2030

For the modeling effort, the CAFE/GHG scenarios and respective costs were matched against the Reference case costs (Table IV-1 and Table IV-2). Because in all CAFE/GHG scenario cases the additional costs in the U.S. economy of the vehicles are less than the additional costs of the fuel, residual consumer expenditures were allocated to the Final Demand category of Personal Consumption Expenditures. This methodology ensures that the application is a net analysis, comparing identical amounts spent by consumers in 2030, but with a vastly differing expenditure pattern. Under the CAFE/GHG scenarios, the consumer is purchasing more expensive LDV's outfitted with better technology; and under the Reference scenario, the consumer is purchasing more liquid fuel for the vehicle.

Across all economic categories, the impacts of the CAFE/GHG six percent, five percent, four percent, and three percent scenarios were more positive than the (BAU) case, as shown in Table IV-3 (see page 16). Based upon the increased costs of LDV's by $58.6 billion (see Table IV-1), the increased fuel savings of $151.9 billion (see Table IV-2), and the net consumer surplus expenditures, the net positive direct and indirect impacts of the six percent scenario on the U.S. economy are estimated to be as follows:

- **Gross economic output (sales)** is projected to be $31.2 billion higher
- **Net job gains:** 684,000
- **Personal income:** $20.5 billion higher
- **Local, State and Federal taxes:** $18.8 billion higher

Under the 6% scenario, net job gains are projected to by 684,000, and personal income is projected to be $20.5 billion higher, and revenue for cash-strapped federal, state and local governments is projected to be $18.8 billion higher.

17 Based on the fuel savings, the monopsony effect reduced fuel prices to the following levels: $3.60 per gallon in the three percent case, $3.58 in the 4 percent case, $3.56 in the 5 percent case, and $3.54 in the 6 percent case. Monopsony calculations based on data from TABLE III.H.8–1—ENERGY SECURITY PREMIUM IN 2015, 2020, 2030 AND 2040 in the EPA/NHTSA joint Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule published May 7, 2010.

IV. Estimates of National Impacts

Based upon the increased costs of LDV's by $48.1 billion, the increased fuel savings of $133.3 billion, and the net consumer surplus expenditures, the net positive direct and indirect impacts of the five percent scenario on the U.S. economy are estimated to be:

- **Gross economic output (sales)** is projected to be $26.6 billion higher
- **Net job gains:** 603,000
- **Personal income:** $17.6 billion higher
- **Local, State and Federal taxes:** $15.8 billion higher

Table IV-3: Summary of 2030 National Impacts

	3% Scenario	4% Scenario	5% Scenario	6% Scenario
Gross Economic Output *(billions)*	$15.5	$21.3	$26.6	$31.2
Jobs *(thousands)*	352	484	603	684
Personal Income *(billions)*	$10.2	$14.2	$17.6	$20.5
Tax Revenues *(billions)*	$9.3	$12.7	$15.8	$18.8

Source: Management Information Services, Inc., 2011.

Each of the four enhanced CAFE/GHG scenarios results in economic and jobs benefits to the U.S. economy in 2030. However, the greater the improvements in fuel economy and GHG emissions, the larger the benefits to the economy.

Based upon the increased costs of LDV's by $37.4 billion, the increased fuel savings of $106.9 billion, and the net consumer surplus expenditures, the net positive direct and indirect impacts of the four percent scenario on the U.S. economy are estimated to be:

- **Gross economic output (sales)** is projected to be $21.3 billion higher
- **Net job gains:** 484,000
- **Personal income:** $14.2 billion higher
- **Local, State and Federal taxes:** $12.7 billion higher

Based upon the increased costs of LDV's by $26.7 billion, the increased fuel savings of $77.6 billion, and the net consumer surplus expenditures, the net positive direct and indirect impacts of the three percent scenario on the U.S. economy are estimated to be:

- **Gross economic output (sales)** is projected to be $15.5 billion higher
- **Net job gains:** 352,000
- **Personal income:** $10.2 billion higher
- **Local, State and Federal taxes:** $9.3 billion higher

The employment concept used is a full time equivalent (FTE) job in the U.S. An FTE job is defined as 2,080 hours worked in a year's time, and adjusts for part time and seasonal employment and for labor turnover. Thus, for example, two workers each working six months of the year would be counted as one FTE job. An FTE job is the standard job concept used in these types of analyses and allows meaningful comparisons over time and across jurisdictions.

Thus, as shown in Figures IV-1 to IV-4 (see page 17), each of the four enhanced CAFE/GHG scenarios results in economic and jobs benefits to the U.S. economy in 2030. ***However, the greater the improvements in fuel economy and GHG emissions, the larger the benefits to the economy.*** For example, there is a significant economic benefit to adopting the six percent rather than the three percent scenario:

IV. Estimates of National Impacts

- **Figure IV-1** shows that U.S. gross economic output (sales) increases by $15.7 billion under the six percent scenario, from more than $15 billion (2009 dollars) under the three percent scenario to more than $31 billion (2009 dollars) under the six percent scenario.
- **Figure IV-2** shows that the U.S. jobs created increase by 382,000 under the six percent scenario, from more than 350,000 under the three percent scenario to nearly 700,000 under the six percent scenario.
- **Figure IV-3** shows that U.S. personal income increases by $10.3 billion under the six percent scenario, from more than $10 billion (2009 dollars) under the three percent scenario to more than $20 billion (2009 dollars) under the six percent scenario.
- **Figure IV-4** shows that U.S. federal, state, and local government tax revenues increase by $9.5 billion under six percent scenario, from more than $9 billion (2009 dollars) under the three percent scenario to nearly $19 billion (2009 dollars) under the six percent scenario.

Compared to the three percent scenario, the six percent scenario brings 382,000 more jobs, a $15.7 billion increase in gross economic output, $10.3 billion more in personal income, and $9.5 billon more in tax revenue.

Figure IV-1: Impacts on U.S. Gross Economic Output (Sales) in 2030

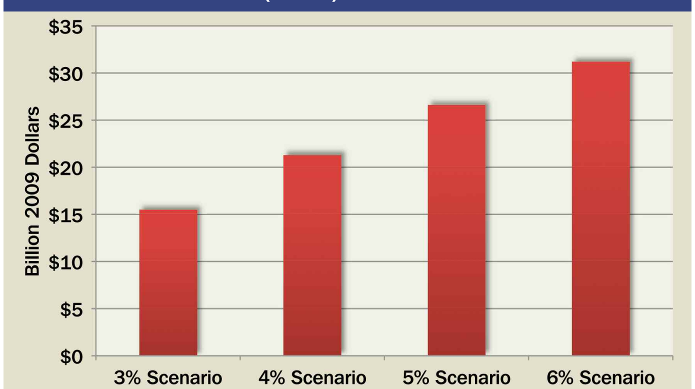


Figure IV-2: Impacts on U.S. Jobs in 2030

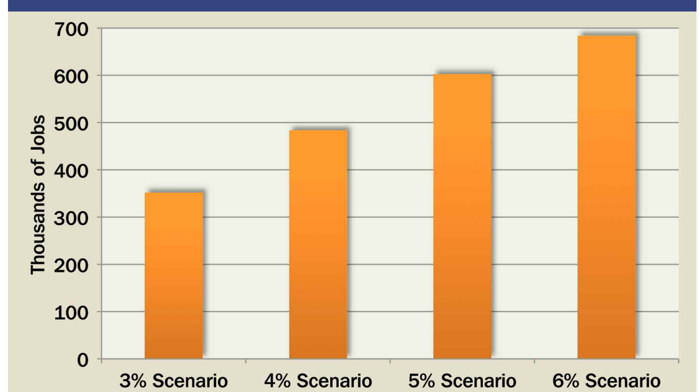


Figure IV-3: Impacts on U.S. Personal Income in 2030

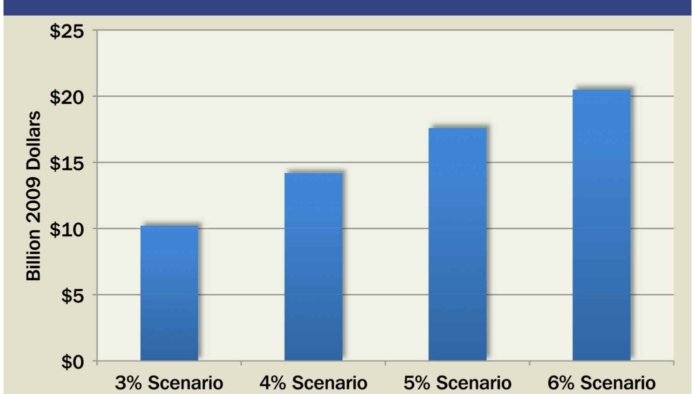
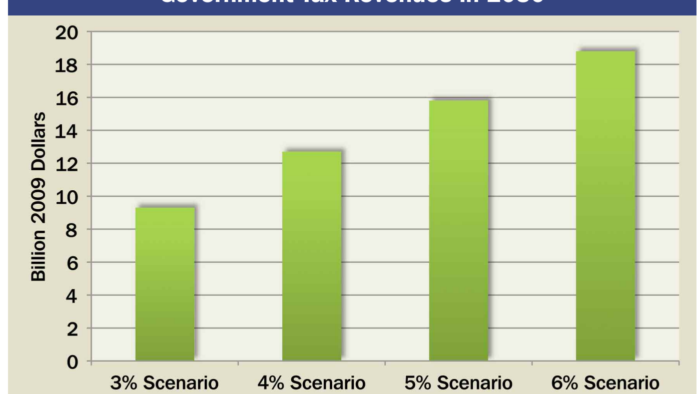


Figure IV-4: Impacts on U.S. Federal, State, and Local Government Tax Revenues in 2030



Source: Management Information Services, Inc., 2011.

Estimated Industry Impacts in 2030

MISI estimated the jobs impacts of the different scenarios in 70 NAICS industries. While net employment in most industries increased under each scenario, net jobs were lost in some industries. As shown in Tables IV-4 through IV-7 and Figures IV-5 and IV-6, the jobs gained in various industries greatly exceed the jobs lost in others. Some industries consistently gain jobs under each scenario; these include Retail Trade, Hospitals and Nursing Facilities, Motor Vehicles and Parts, Construction, and Educational Services. Other industries consistently lose jobs (though relatively fewer) under each scenario; these include Rental and Leasing Services, Mining Support Activities, Oil and Gas Extraction, Pipeline Transportation, and Petroleum and Coal Products.

Table IV-4: Net Employment Impacts of 6% Scenario in Industries Most Affected
(thousands of FTE jobs)

Retail trade	77
Hospitals and nursing and residential care facilities	72
Food services and drinking places	66
Motor vehicles, bodies and trailers, and parts	63
Other services, except government	57
Ambulatory health care services	54
Construction	39
Social assistance	26
Wholesale trade	25
Educational services	24
Petroleum and coal products	-2
Water transportation	-2
Federal Reserve banks, credit intermediation, and related activities	-3
Chemical products	-3
Pipeline transportation	-4
Computer systems design and related services	-15
Management of companies and enterprises	-16
Oil and gas extraction	-24
Support activities for mining	-26
Rental and leasing services and lessors of intangible assets	-31
Net Total	**684**

IV. Estimates of National Impacts

Table IV-5: Net Employment Impacts of 5% Scenario in Industries Most Affected
(thousands of FTE jobs)

Retail trade	71
Hospitals and nursing and residential care facilities	66
Food services and drinking places	59
Motor vehicles, bodies and trailers, and parts	54
Other services, except government	51
Ambulatory health care services	50
Construction	31
Social assistance	24
Educational services	22
Wholesale trade	21
Water transportation	-2
Other transportation and support activities	-2
Federal Reserve banks, credit intermediation, and related activities	-2
Chemical products	-3
Pipeline transportation	-4
Computer systems design and related services	-14
Management of companies and enterprises	-14
Oil and gas extraction	-21
Support activities for mining	-23
Rental and leasing services and lessors of intangible assets	-27
Net Total	**603**

Table IV-6: Net Employment Impacts of 4% Scenario in Industries Most Affected
(thousands of FTE jobs)

Retail trade	58
Hospitals and nursing and residential care facilities	54
Food services and drinking places	48
Motor vehicles, bodies and trailers, and parts	43
Other services, except government	41
Ambulatory health care services	40
Construction	23
Social assistance	19
Educational services	18
Wholesale trade	17
Water transportation	-1
Other transportation and support activities	-2
Federal Reserve banks, credit intermediation, and related activities	-2
Chemical products	-2
Pipeline transportation	-3
Management of companies and enterprises	-11
Computer systems design and related services	-11
Oil and gas extraction	-17
Support activities for mining	-19
Rental and leasing services and lessors of intangible assets	-22
Net Total	**484**

Source: Management Information Services, Inc., 2011.

IV. Estimates of National Impacts

Table IV-7: Net Employment Impacts of 3% Scenario in Industries Most Affected
(thousands of FTE jobs)

Retail trade	43
Hospitals and nursing and residential care facilities	39
Food services and drinking places	35
Motor vehicles, bodies and trailers, and parts	31
Other services, except government	30
Ambulatory health care services	30
Construction	15
Social assistance	14
Educational services	13
Wholesale trade	13
Water transportation	-1
Other transportation and support activities	-1
Federal Reserve banks, credit intermediation, and related activities	-1
Chemical products	-2
Pipeline transportation	-2
Management of companies and enterprises	-8
Computer systems design and related services	-8
Oil and gas extraction	-12
Support activities for mining	-14
Rental and leasing services and lessors of intangible assets	-16
Net Total	**352**

Figure IV-5: Net Job Gains in 2030 Under the Scenarios: Selected Industries

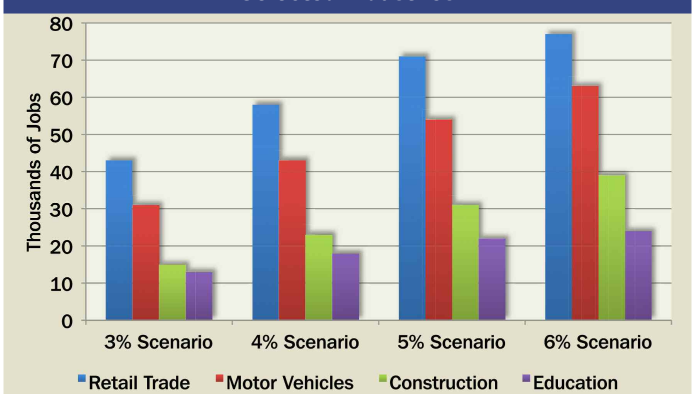
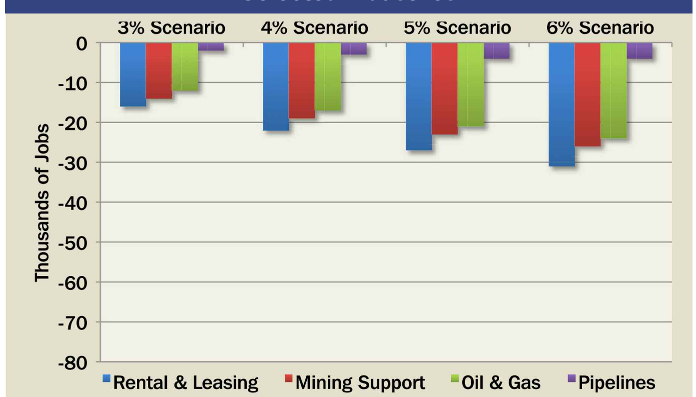


Figure IV-6: Net Job Losses in 2030 Under the Scenarios: Selected Industries



Source: Management Information Services, Inc., 2011.

ESTIMATES OF STATE IMPACTS

Deriving State Level Impacts

MISI conducted a further extension of the analysis to determine the pattern of regional distribution of the national impacts. For this, state regional input-output location quotients were derived using comparable U.S. Bureau of Economic Analysis regional data for 2009 at the 70-order industry level. The national economic gross output impacts for the four scenarios were distributed by MISI's version of the state- and industry-level Gross Domestic Product accounts database. The national employment impacts for the four scenarios were distributed by MISI's version of the state- and industry-level employment database. These resulted in state-by-industry economic and employment impacts that were summed to derive state totals.

Impacts on Jobs in Each State

Tables V-1 through V-4 (see pages 22-23) show the net impacts on jobs in each state of the four enhanced CAFE/GHG scenarios:

- **Table V-1** shows the state job impacts of the six percent scenario.
- **Table V-2** shows the state job impacts of the five percent scenario.
- **Table V-3** shows the state job impacts of the four percent scenario.
- **Table V-4** shows the state job impacts of the three percent scenario.

The rankings in these tables are based on the percentage impact on state employment. The relative impacts on states' jobs of each of the scenarios are generally similar, and those states affected the most, negatively and positively, are generally the same under each scenario. Figures V-1 and V-2 (see page 23) illustrate the relative impacts on states' jobs of the six percent scenario:

- **Figure V-1** shows the states with the relatively largest job increases under the six percent scenario—the rankings in this figure are based on the percentage impact on state employment.
- **Figure V-2** shows the states with the largest total job increases under the six percent scenario.
- **Figure V-3** shows the differing impacts on jobs in four states—Michigan, Ohio, North Carolina, and Texas—of each of the four scenarios.

Based on percentage job increases, under the six percent scenario, Indiana and Michigan benefit the most. Other states whose jobs markets would benefit the most, in relative terms, include Alabama, Kentucky, Tennessee, Ohio, North Carolina, Vermont, New Hampshire, Oregon, New York, and Missouri.

V. Estimates of State Impacts

Table V-1: Net State Job Impacts of the 6% Scenario *(FTE jobs)*

		State Employment Impact Rank
Alabama	13,600	3
Alaska	100	50
Arizona	11,000	38
Arkansas	5,700	33
California	81,000	17
Colorado	8,300	43
Connecticut	8,200	28
Delaware	2,100	29
District of Columbia	2,100	45
Florida	37,200	27
Georgia	21,100	23
Hawaii	3,000	37
Idaho	3,400	21
Illinois	31,100	19
Indiana	23,900	1
Iowa	8,400	14
Kansas	6,800	31
Kentucky	12,800	4
Louisiana	2,600	49
Maine	3,200	20
Maryland	11,900	35
Massachusetts	17,100	22
Michigan	32,300	2
Minnesota	14,500	18
Mississippi	5,300	36
Missouri	15,300	12
Montana	1,900	40
Nebraska	5,000	25
Nevada	5,700	30
New Hampshire	3,600	9
New Jersey	18,000	34
New Mexico	2,300	46
New York	48,100	11
North Carolina	25,500	7
North Dakota	1,300	44
Ohio	33,900	6
Oklahoma	2,600	48
Oregon	9,700	10
Pennsylvania	29,800	24
Rhode Island	2,400	26
South Carolina	10,200	16
South Dakota	2,300	13
Tennessee	17,900	5
Texas	27,800	47
Utah	5,300	39
Vermont	1,800	8
Virginia	15,600	41
Washington	14,300	32
West Virginia	2,600	42
Wisconsin	15,200	15
Wyoming	-400	51
Net Total	**684,000**	

Table V-2: Net State Job Impacts of the 5% Scenario *(FTE jobs)*

		State Employment Impact Rank
Alabama	11,900	3
Alaska	0	50
Arizona	9,700	38
Arkansas	5,000	33
California	71,400	18
Colorado	7,300	43
Connecticut	7,300	28
Delaware	1,900	29
District of Columbia	1,900	45
Florida	33,000	27
Georgia	18,500	25
Hawaii	2,600	37
Idaho	3,000	22
Illinois	27,200	20
Indiana	20,800	1
Iowa	7,400	14
Kansas	5,900	31
Kentucky	11,200	4
Louisiana	2,200	49
Maine	2,900	17
Maryland	10,500	35
Massachusetts	15,200	21
Michigan	28,200	2
Minnesota	12,800	19
Mississippi	4,700	36
Missouri	13,500	12
Montana	1,700	40
Nebraska	4,300	26
Nevada	5,000	30
New Hampshire	3,200	9
New Jersey	16,000	34
New Mexico	2,000	46
New York	42,800	11
North Carolina	22,500	7
North Dakota	1,200	44
Ohio	29,700	6
Oklahoma	2,300	48
Oregon	8,500	10
Pennsylvania	26,400	23
Rhode Island	2,200	24
South Carolina	9,000	16
South Dakota	2,000	13
Tennessee	15,700	5
Texas	24,400	47
Utah	4,700	39
Vermont	1,600	8
Virginia	13,700	41
Washington	12,600	32
West Virginia	2,300	42
Wisconsin	13,400	15
Wyoming	-400	51
Net Total	**603,000**	

Source: Management Information Services, Inc., 2011.

V. Estimates of State Impacts

Table V-3: Net State Job Impacts of the 4% Scenario *(FTE jobs)*

		State Employment Impact Rank
Alabama	9,500	3
Alaska	100	50
Arizona	7,800	38
Arkansas	4,100	30
California	57,300	17
Colorado	5,800	42
Connecticut	5,900	28
Delaware	1,500	27
District of Columbia	1,400	45
Florida	26,400	29
Georgia	14,900	26
Hawaii	2,100	36
Idaho	2,400	21
Illinois	22,000	20
Indiana	16,600	1
Iowa	6,000	12
Kansas	4,800	32
Kentucky	8,900	4
Louisiana	1,800	49
Maine	2,300	19
Maryland	8,400	37
Massachusetts	12,200	22
Michigan	22,600	2
Minnesota	10,300	16
Mississippi	3,800	35
Missouri	10,900	14
Montana	1,300	40
Nebraska	3,600	23
Nevada	4,000	31
New Hampshire	2,600	9
New Jersey	12,900	34
New Mexico	1,600	46
New York	34,400	11
North Carolina	18,000	7
North Dakota	900	44
Ohio	23,800	6
Oklahoma	1,800	48
Oregon	6,800	10
Pennsylvania	21,300	24
Rhode Island	1,700	25
South Carolina	7,200	18
South Dakota	1,600	13
Tennessee	12,600	5
Texas	19,400	47
Utah	3,800	39
Vermont	1,300	8
Virginia	11,000	41
Washington	10,200	33
West Virginia	1,800	43
Wisconsin	10,800	15
Wyoming	-400	51
Net Total	**484,000**	

Table V-4: Net State Job Impacts of the 3% Scenario *(FTE jobs)*

		State Employment Impact Rank
Alabama	6,900	3
Alaska	0	50
Arizona	5,700	38
Arkansas	2,900	33
California	41,700	18
Colorado	4,200	43
Connecticut	4,300	28
Delaware	1,100	27
District of Columbia	1,200	45
Florida	19,200	29
Georgia	10,800	25
Hawaii	1,500	37
Idaho	1,700	23
Illinois	16,000	19
Indiana	12,100	1
Iowa	4,300	14
Kansas	3,500	31
Kentucky	6,500	4
Louisiana	1,300	49
Maine	1,700	16
Maryland	6,100	36
Massachusetts	8,900	21
Michigan	16,400	2
Minnesota	7,500	17
Mississippi	2,800	35
Missouri	7,900	12
Montana	1,000	40
Nebraska	2,600	26
Nevada	2,900	30
New Hampshire	1,900	9
New Jersey	9,400	34
New Mexico	1,200	46
New York	25,000	11
North Carolina	13,000	7
North Dakota	700	44
Ohio	17,300	6
Oklahoma	1,300	48
Oregon	5,000	10
Pennsylvania	15,600	22
Rhode Island	1,300	24
South Carolina	5,200	20
South Dakota	1,200	13
Tennessee	9,100	5
Texas	14,300	47
Utah	2,700	39
Vermont	900	8
Virginia	8,000	41
Washington	7,400	32
West Virginia	1,400	42
Wisconsin	7,800	15
Wyoming	-200	51
Net Total	**352,000**	

Source: Management Information Services, Inc., 2011.

V. Estimates of State Impacts

Figure V-1: State Job Increases Under the 6% Scenario
(State Rankings Based on Percentage Employment Increases)

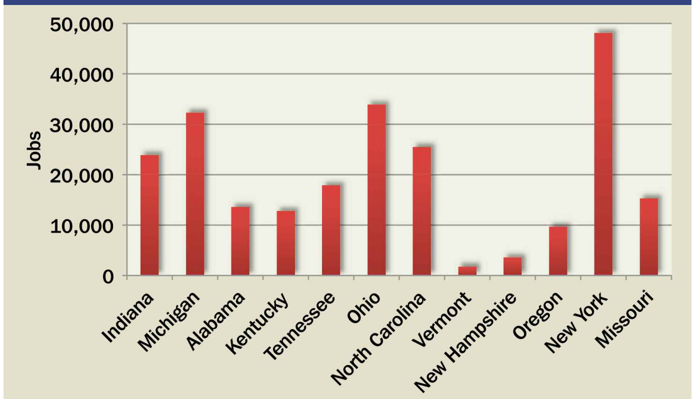
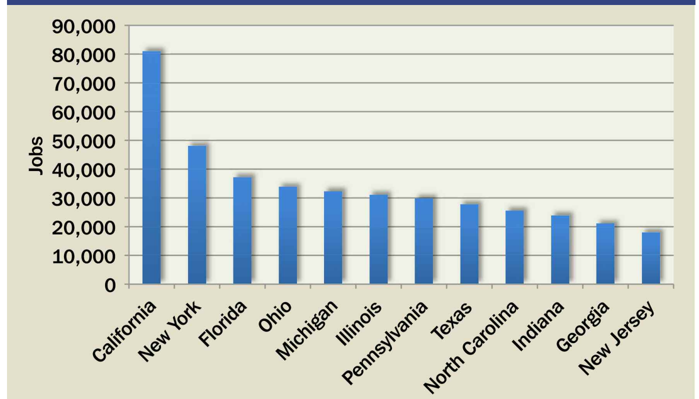


Figure V-2: State Job Increases Under the 6% Scenario
(State Rankings Based on Total Employment Increases)



Source: Management Information Services, Inc., 2011.

Figure V-1 shows the ranking of the states based on percentage job increases. The figure shows that, based on percentage job increases, under the six percent scenario (as is also true for the other three scenarios) Indiana and Michigan benefit the most from the enhanced CAFE/GHG standards. As a hypothetical example of the significance of the jobs impacts, consider that the current unemployment rate in Indiana is 8.2 percent and in Michigan is 10.3 percent. The jobs created under the six percent scenario would reduce unemployment in these states by nearly a full percentage point: The unemployment rate in Indiana would decrease from 8.2 percent to 7.4 percent and the unemployment rate in Michigan would decrease from 10.3 percent to 9.6 percent.

Other states whose jobs markets would benefit the most, in relative terms, include Alabama, Kentucky, Tennessee, Ohio, North Carolina, Vermont, New Hampshire, Oregon, New York, and Missouri. Vermont and New Hampshire gain relatively few jobs, but both states have small labor forces. Many of the large states impacted the most currently have unemployment rates at or well above the national average, and would welcome the additional job creation resulting from the enhanced CAFE/GHG scenarios—as would all states.

Many of the large states whose job markets would benefit the most on a percentage basis currently have unemployment rates at or above the national average, and would welcome the additional job creation, as would all states.

Figure V-2 also yields an interesting perspective. This figure shows the states that gain the most jobs in absolute terms under the six percent scenario (these states also generally gain the most jobs under the other three scenarios). This ranking is, of course, dominated by the states with the largest labor forces, and it is instructive to compare these rankings with the percentage job rankings shown in Figure V-1. In many cases, the states gaining the largest numbers of jobs rank relatively low in percentage job gains; for example:

- **California** gains, by far, the largest number of jobs (81,000), but in terms of percentage job gains ranks only 17th
- **Texas** gains nearly 28,000 jobs, but ranks near the bottom at 47th in terms of percentage job gains.
- **Florida** gains over 37,000 jobs, but ranks 27th in terms of percentage job gains.
- **New Jersey** gains 18,000 jobs, but ranks 34th in terms of percentage job gains.
- **Pennsylvania** gains nearly 30,000 jobs, but ranks 24th in terms of percentage job gains.

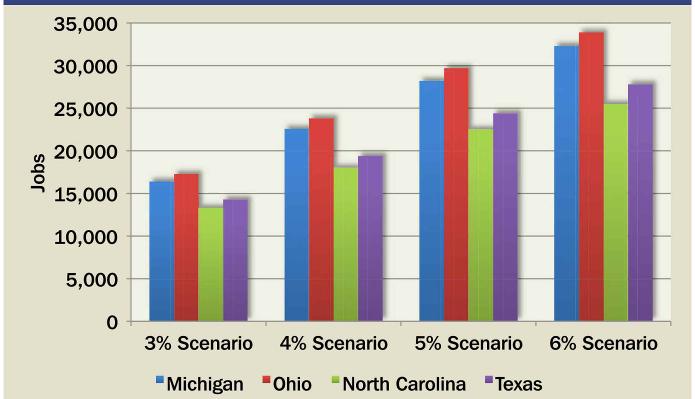
Conversely, some of the states with the highest percentage job gains due to their relatively small labor forces experience relatively small total job increases; for example:

- **Vermont** gains only 1,800 jobs, but ranks 8th in terms of percentage job gains.
- **New Hampshire** gains only 3,600 jobs, but ranks 9th in terms of percentage job gains.

In absolute terms, California gains the largest number of jobs, followed by New York, Florida, Ohio, Michigan, Illinois, Pennsylvania, Texas, North Carolina, Indiana, Georgia and New Jersey.

V. Estimates of State Impacts

Figure V-3: Job Impacts in Selected States Across the Four Scenarios



Source: Management Information Services, Inc., 2011.

Thus, in assessing the jobs impacts by state it is important to assess both the relative impact on the state's job market as well as the total number of jobs created in each state. It is also important to realize that much of the total job growth will occur in states that rank relatively low in terms of percent job growth.

Figure V-3 shows the differing impacts on jobs in four states—Michigan, Ohio, North Carolina, and Texas—under each of the four scenarios. It illustrates that, while there are some relative differences in job gains, states tend to benefit uniformly from the job creation under each scenario.

It is also important to note here that these are net job gains. Some jobs in certain sectors and industries will be lost under each scenario. However, these job losses will be far exceeded by job gains in the states in other sectors and industries.

Nevertheless, the bottom line here is that the enhanced CAFE/GHG standards analyzed here will have strongly positive economic and job impacts, and that the stronger the standards, the more jobs will increase. Several major conclusions emerge from this research. ***First***, enhanced CAFE/GHG standards would increase employment, although some industries and sectors will lose jobs:

- **Under the three percent scenario**, net job creation in the U.S. will total 352,000, and every state except Wyoming will gain jobs.
- **Under the four percent scenario**, net job creation in the U.S. will total 484,000, and every state except Wyoming will gain jobs.
- **Under the five percent scenario**, net job creation in the U.S. will total 603,000, and every state except Wyoming will gain jobs.
- **Under the six percent scenario**, net job creation in the U.S. will total 684,000, and every state except Wyoming will gain jobs.

Second, jobs in most industries and sectors increase, but some industries and sectors would lose jobs, and even in those that gain jobs, some workers may be displaced.

Third, there are also regional implications. Every state except Wyoming will gain substantial numbers of jobs—for example, under the six percent scenario Michigan gains more than 32,000 jobs, Ohio gains nearly 34,000 jobs, California more than 81,000, and Indiana nearly 24,000 jobs. However, job increases and decreases will be spread unevenly among different sectors and industries within each state, and there will thus be job shifts within states as well as among states.

Nevertheless, the bottom line here is that the enhanced CAFE/GHG standards analyzed here will have strongly positive economic and job impacts, and that the stronger the standards, the more jobs will increase.

Impacts on States' GDP

Tables V-5 through V-8 show the net impact on each state GDP of the four enhanced CAFE/GHG scenarios. The rankings in these tables are based on the percentage impact of the state's GDP.

- **Table V-5** shows the state GDP impacts of the six percent scenario.
- **Table V-6** shows the state GDP impacts of the five percent scenario.
- **Table V-7** shows the state GDP impacts of the four percent scenario.
- **Table V-8** shows the state GDP impacts of the three percent scenario.

Table V-5: Net Impacts on State Gross Economic Output of the 6% Scenario
(Millions of 2009 dollars)

		State GDP Impact Rank
Alabama	1,620	9
Alaska	-4,350	51
Arizona	1,410	29
Arkansas	180	42
California	5,230	40
Colorado	-1,360	45
Connecticut	1,390	26
Delaware	190	39
District of Columbia	460	33
Florida	4,200	28
Georgia	3,150	16
Hawaii	260	35
Idaho	420	17
Illinois	4,110	23
Indiana	4,610	2
Iowa	1,400	7
Kansas	480	36
Kentucky	2,290	3
Louisiana	-8,490	49
Maine	340	21
Maryland	1,510	30
Massachusetts	2,410	22
Michigan	8,730	1
Minnesota	1,580	27
Mississippi	320	38
Missouri	2,160	11
Montana	0	43
Nebraska	740	13
Nevada	620	32
New Hampshire	430	18
New Jersey	1,980	34
New Mexico	-1,430	46
New York	7,370	20
North Carolina	3,500	12
North Dakota	-70	44
Ohio	4,750	8
Oklahoma	-4,360	48
Oregon	1,550	10
Pennsylvania	3,390	25
Rhode Island	320	19
South Carolina	1,950	4
South Dakota	310	14
Tennessee	2,740	5
Texas	-31,800	47
Utah	420	37
Vermont	200	15
Virginia	2,150	31
Washington	2,070	24
West Virginia	110	41
Wisconsin	2,520	6
Wyoming	-2,530	50
Net Total	**31,200**	

Table V-6: Net Impacts on State Gross Economic Output of the 5% Scenario
(Millions of 2009 dollars)

		State GDP Impact Rank
Alabama	1,380	9
Alaska	-3,820	51
Arizona	1,230	29
Arkansas	150	41
California	4,590	40
Colorado	-1,200	45
Connecticut	1,230	25
Delaware	180	38
District of Columbia	410	33
Florida	3,710	28
Georgia	2,750	16
Hawaii	230	35
Idaho	370	17
Illinois	3,570	23
Indiana	3,940	2
Iowa	1,230	7
Kansas	420	36
Kentucky	1,970	3
Louisiana	-7,450	49
Maine	300	20
Maryland	1,330	30
Massachusetts	2,110	22
Michigan	7,470	1
Minnesota	1,380	27
Mississippi	270	39
Missouri	1,880	11
Montana	10	43
Nebraska	650	12
Nevada	540	32
New Hampshire	380	18
New Jersey	1,750	34
New Mexico	-1,250	46
New York	6,520	19
North Carolina	3,060	13
North Dakota	-60	44
Ohio	4,090	8
Oklahoma	-3,830	48
Oregon	1,340	10
Pennsylvania	2,940	26
Rhode Island	280	21
South Carolina	1,680	4
South Dakota	270	14
Tennessee	2,380	5
Texas	-27,980	47
Utah	350	37
Vermont	170	15
Virginia	1,870	31
Washington	1,810	24
West Virginia	90	42
Wisconsin	2,190	6
Wyoming	-2,220	50
Net Total	**26,600**	

Source: Management Information Services, Inc., 2011.

V. Estimates of State Impacts

Table V-7: Net Impacts on State Gross Economic Output of the 4% Scenario
(Millions of 2009 dollars)

		State GDP Impact Rank
Alabama	1,100	9
Alaska	-3,060	51
Arizona	980	29
Arkansas	120	41
California	3,670	40
Colorado	-970	45
Connecticut	990	25
Delaware	140	38
District of Columbia	320	33
Florida	2,980	28
Georgia	2,210	16
Hawaii	190	35
Idaho	300	17
Illinois	2,860	23
Indiana	3,150	2
Iowa	990	7
Kansas	330	36
Kentucky	1,580	3
Louisiana	-5,970	49
Maine	240	19
Maryland	1,060	30
Massachusetts	1,690	22
Michigan	5,970	1
Minnesota	1,110	27
Mississippi	210	39
Missouri	1,510	11
Montana	0	43
Nebraska	530	12
Nevada	430	32
New Hampshire	300	18
New Jersey	1,400	34
New Mexico	-1,000	46
New York	5,240	20
North Carolina	2,460	13
North Dakota	-50	44
Ohio	3,270	8
Oklahoma	-3,070	48
Oregon	1,070	10
Pennsylvania	2,360	26
Rhode Island	230	21
South Carolina	1,340	4
South Dakota	220	14
Tennessee	1,900	5
Texas	-22,450	47
Utah	280	37
Vermont	140	15
Virginia	1,490	31
Washington	1,450	24
West Virginia	70	42
Wisconsin	1,750	6
Wyoming	-1,780	50
Net Total	**21,300**	

Table V-8: Net Impacts on State Gross Economic Output of the 3% Scenario
(Millions of 2009 dollars)

		State GDP Impact Rank
Alabama	810	9
Alaska	-2,220	51
Arizona	710	29
Arkansas	90	41
California	2,650	40
Colorado	-710	45
Connecticut	720	25
Delaware	100	38
District of Columbia	230	33
Florida	2,160	28
Georgia	1,600	16
Hawaii	140	35
Idaho	210	17
Illinois	2,070	23
Indiana	2,310	2
Iowa	720	7
Kansas	240	36
Kentucky	1,150	3
Louisiana	-4,330	49
Maine	170	19
Maryland	770	30
Massachusetts	1,220	22
Michigan	4,370	1
Minnesota	800	27
Mississippi	160	39
Missouri	1,100	11
Montana	0	43
Nebraska	380	12
Nevada	310	32
New Hampshire	220	18
New Jersey	1,020	34
New Mexico	-730	46
New York	3,800	20
North Carolina	1,790	13
North Dakota	-40	44
Ohio	2,390	8
Oklahoma	-2,230	48
Oregon	770	10
Pennsylvania	1,710	26
Rhode Island	160	21
South Carolina	980	4
South Dakota	160	14
Tennessee	1,390	5
Texas	-16,300	47
Utah	200	37
Vermont	100	15
Virginia	1,080	31
Washington	1,050	24
West Virginia	50	42
Wisconsin	1,270	6
Wyoming	-1,290	50
Net Total	**15,500**	

Source: Management Information Services, Inc., 2011.

V. Estimates of State Impacts

The relative impacts on state GDPs of each of the scenarios are generally similar, and those states affected the most, negatively and positively, are generally the same under each scenario. Figures V-4 and V-5 illustrate the relative impacts on state GDP of the six percent scenario:

- **Figure V-4** shows the states with the relatively largest GDP increases under the six percent scenario
- **Figure V-5** shows the states with the relatively largest GDP decreases under the six percent scenario

The rankings in these figures are based on the percentage impact of the state's GDP. Under all of the scenarios, GDP increases in 43 states and decreases in only eight states.

Figure V-4 shows that the states whose GDP is increased the most, on a percentage basis, from the six percent scenario (and generally the other scenarios as well) are Michigan and Indiana followed in descending order by Kentucky, South Carolina, Tennessee, Wisconsin, Iowa, Ohio, Alabama, and Oregon. This is not surprising because these states are home to vehicle and vehicle parts manufacturing and related facilities.

Figure V-5 shows that the eight states whose GDP is decreased the most, on a percentage basis, from the six percent scenario (and generally the other scenarios as well) are Alaska, Wyoming, and Louisiana, followed by Oklahoma, Texas, New Mexico, Colorado, and North Dakota. This is not surprising: each of these eight states is a major oil producer and demand for oil will be reduced significantly by the enhanced CAFE/GHG standards.

Comparison of the jobs impacts tables and graphs with the those showing GDP impacts yields interesting results. One of the most salient findings is that while GDP declines in eight states under each of the four scenarios, jobs increase in each state across all four scenarios—except in Wyoming. This is due to the differences in labor productivity and job creation in the different industries and sectors that are gaining jobs and those that are losing jobs.

There is thus a disparity not only in size, but also in direction between the two projections of impacts in some states. For example, the disparity is greatest in the difference between the projected economic gross output loss of almost $32 billion in Texas under the six percent scenario (Figure V-5), while at the same time Texas is projected to gain almost 28,000 jobs. Because ours is a net analysis, three general trends are occurring simultaneously and pulling the Texas economy in different directions:

The states whose GDP is increased the most, on a percentage basis, are Michigan, Indiana and Ohio, followed by Kentucky, South Carolina, Tennessee, Wisconsin, Iowa, Alabama and Oregon.

Figure V-4: State GDP Increases Under the 6% Scenario
(State Rankings Based on Percentage GDP Increases)

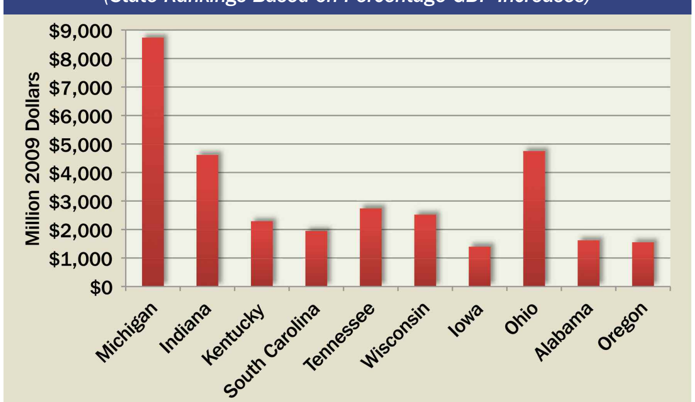
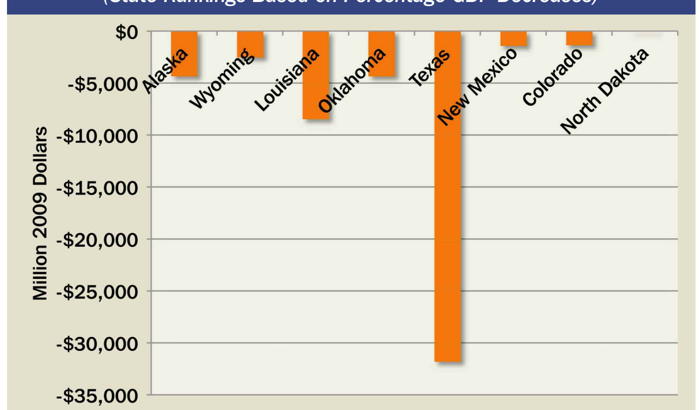


Figure V-5: State GDP Decreases Under the 6% Scenario
(State Rankings Based on Percentage GDP Decreases)



Source: Management Information Services, Inc., 2011.

- There is a loss of gasoline sales and thus a decrease in the demand for oil
- There is a stimulus to the motor vehicle industry as LDV's become more expensive
- There is a stimulus to the general economy driven by the consumer savings as a net impact of the change in consumer purchases for those two products

Because Texas accounts for well over half of U.S. economic activity in the oil and gas extraction industry, it will be adversely affected by the decreased demand for oil. The oil and gas extraction industry is one of the most labor extensive industries, with large contributions to the economy, but with relatively few employees per dollar of that economic activity. This is seen clearly in the Texas example. While the oil and gas extraction industry contributes over six percent to the state's GDP, the industry accounts for only about two percent of total employment in the state. Therefore, one can expect to see much larger changes in state GDP compared to employment. What we are seeing in Texas in our scenarios is that while GDP is decreasing due to volatile drops in the oil and gas extraction industry, employment is not declining as much *and is* ***actually being overwhelmed by the positive indirect employment impacts caused by the overall growth in the motor vehicles industry and the overall growth in the U.S. economy driven by the consumer surplus.***

In sum, the research summarized here indicates that enhanced CAFE/GHG standards would have strongly positive economic and job benefits. Our findings indicate that not only will increased CAFE/GHG standards not harm the U.S. economy or destroy jobs, it will lead to greater economic and job growth, and the higher the standards, the more positive the impacts will be. Hopefully, the information provided here can inform future policy debates over CAFE/GHG standards.

Our findings indicate that increased CAFE/GHG standards will lead to greater economic and job growth, and the higher the standards, the more positive the impacts will be.

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