Impact of Missouri's E10 Standard on Consumer Fuel Usage, Public Health, & the Environment

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Background

On January 1, 2008, the Missouri Renewable Fuel Standard Act (RFSA) became effective; mandating that all gasoline sold in the state contain 10% ethanol.[1] The fuel with 90% gas and 10% ethanol is commonly referred to as "E10." Proponents of the law claim that "Missouri's [RFSA] benefits consumers, our economy, the environment, and Missouri farmers."[2] Others celebrate the new standard for reducing Missouri's dependence on foreign oil, developing a new production industry, and providing greater demand for locally grown crops.

Some consumers however believe that E10 *noticeably* decreases their fuel-economy. In a Columbia newspaper article, one man said, "I think it's idiotic, my car runs worse with it. I don't like [E10]. It's not nearly as good."[3] Regardless of one's viewpoint, it is important to evaluate Missouri RFSA's impacts on consumers, the environment and the economy.

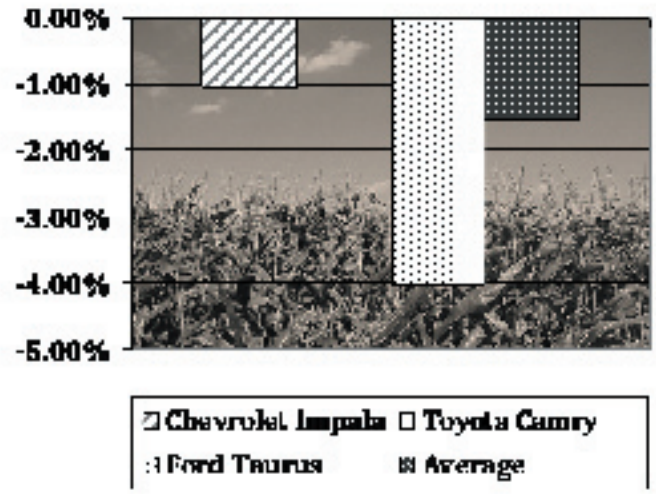
Decreasing Demand for Conventional Gasoline

One of the most cited reasons for developing alternative fuel sources is to reduce reliance on foreign oil. Blending ethanol with conventional gasoline can help decrease this reliance and reduce costs to consumers. According to the Federal Highway Administration's *Highway Statistics*, in 2005 Missouri cars drove an estimated 38.93 billion miles.[4] This resulted in the consumption of over 1.74 billion gallons of conventional gasoline. Had the RFSA been in effect in 2005, Missourians would have consumed 174 million fewer gallons of gasoline and instead relied on locally produced ethanol. Similarly, in 2005 had the entire US adopted an E10 mandate, American car drivers would have consumed 7.4 billion fewer gallons of gasoline.

Automobile Fuel Economy

While Missouri's E10 standard has reduced conventional gasoline consumption, some consumers have complained about a noticeable loss in fuel economy since the law's enactment.[5] Advocates of RFSA argue that E10 is cheaper for consumers than conventional gasoline. Consumer groups counter that pure ethanol contains less energy per gallon compared to conventional gasoline, therefore, consumers using fuel containing ethanol will experience a slight decrease in fuel economy.[6] A study conducted by the American Coalition for Ethanol found that E10 usage was associated a loss of about 1.5% (0.41 MPG) in fuel-economy but fuel usage varied according to the vehicle make (See Figure 1).[7]

Figure 1. Fuel Economy Changes E10 over Conventional Gas[8]



*The Camry was also tested but ethanol use had no impact on fuel economy.

Surprisingly, there are no other E10 fuel economy studies available to refute or support the results. Ethanol proponents often point to the fact that E10's decrease in fuel-economy is similar to the decrease caused by under-inflated tires, which is about 1.5-2.0 miles-per-gallon.[9] This means that if all Missouri cars met the 2007 national fuel economy average of 22.4 MPG,[10] used E10, and experienced a decrease in fuel economy by 1.5% (0.41 MPG), it would cost Missourians more than 32.40 million gallons of fuel or $112.50 million (at $3.472 per gallon, the average Missouri gas price in May 2008).[11]

Impact on Public Health and the Environment

It has been known for decades that vehicle exhausted is harmful to humans, livestock, buildings, agriculture, forests, and the atmosphere. Therefore, when a policy mandates a change in fuel source it may be valuable to determine the associated effects. By reviewing the work of health and environment experts it is possible to estimate the costs of various types of vehicle pollutants (see table 1).

To estimate the environmental impact of Missouri's RFS, this brief relies on the *Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation* (GREET) Model.[15] The GREET model was developed by Argonne National Laboratory to provide government and industry with a tool to compare the entire fuel cycle process of more than 70 different fuel systems. Fuel cycle refers to the entire production line for vehicle fuel, from pumping oil out of the ground or harvesting corn, to fuel transportation, and finally to vehicle operation, also known as, a "well to wheel" model. In this brief, GREET is used to compare the health and environmental impact of using conventional gasoline versus E10. It allows analysts to modify thousands of assumptions such as vehicle material composition, use of diesel fuel in farm equipment, refinement and distilment, and transportation of fuel.

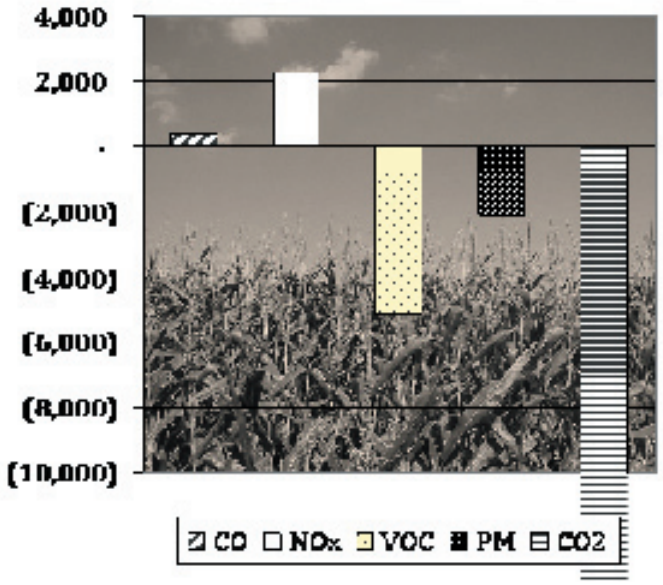
As mentioned above, in 2005 Missourians drove an estimated 38.9 billion miles in passenger cars, and in the process used 1.74 billion gallons of conventional gasoline.[16] If Missouri had adopted its RFS in 2005, E10 would have reduced passenger car emissions by 81,692 metric tons and prevented $43 million worth of public health and environmental damages. This estimate was produced by multiplying the number of miles driven by Missourians (38.9 billion) by the kilogram of pollutants emitted per mile by each fuel source (see figure 2). This result was then multiplied by the per kilogram cost of each major air pollutant. If all passenger cars in the United States had used E10 in 2005, emissions would be reduced by 3.48 million metric tons and health and environmental damage of $24 billion would have been

Table 1. Explanation of Effects of Common Vehicle Pollutants

Air Pollutant	Known Effects[12 13]	Cost Per Ton[14]
Carbon Monoxide (CO)	Reduction in visibility, destruction of stone, difficulty breathing, asthma; chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death	$510.81
Nitrous Oxide (NOx)	Human respiratory system, acid rain, visibility impairment, contributes to global climate change	$13.1691.96
Volatile Organic Compounds (VOC)	Forms Oxidates (free radicals) such as ozone, cause breathing diffculties, astham; dizziness; nausea; damage to the liver and kidneys; and cancer	$10,525.31
Particulate Matter (PM)	Reduction in visibility, destruction of stone, difficulty breathing, asthma; chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death	$8.679.57
Carbon Dioxide (CO2)	Leading cause of green house effect and global climate change	$12.50

prevented (see figure 3).

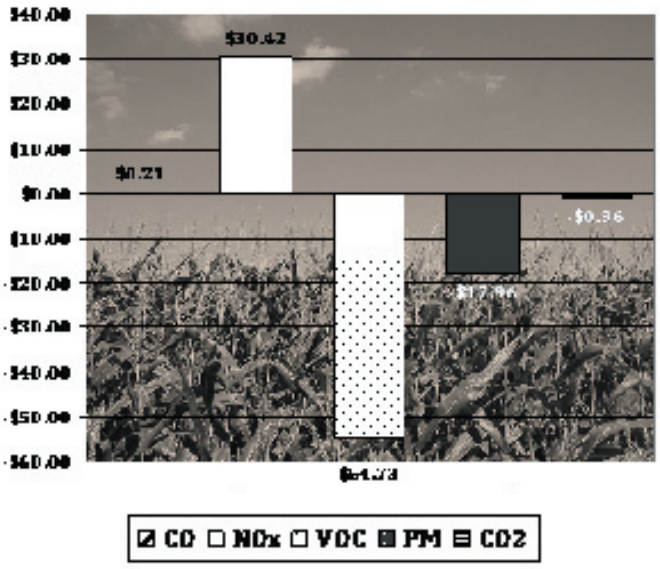
Figure 2. E10 Changes in Emissions Relative to Conventional Gasoline (in metric tons)[17]



Conclusion

The Missouri Renewable Fuel Standard Act, produces three major measureable results. First, the mandate has reduced Missouri's demand for conventional gasoline by 174 million gallons per year. Second, as E10 contains less energy per gallon, and reduces fuel economy by an average of 1.5% (0.41 MPG), Missouri drivers will purchase an additional 32.40 million gallons of fuel worth $112.50 million (at $3.472 per gallon) per year, due to the E10 mandate. Third, the use of E-10, reduces the harmful effects of vehicle pollution: global climate change; respiratory, pulmonary, and nervous system sickness or failure, cancer, acid rain, and visibility impairment. By using E-10, Missourians will prevent over $43.02 million worth of environmental and public health damage per year. If the US Congress enacted a similar E10 mandate for the entire country, passenger vehicle emission health and environmental costs would be reduced by $24.53 billion per year.

Figure 3. E10 Changes in Emission Costs Relative to Conventional Gasoline (in millions of dollars)[18]



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[1] Missouri Revised Statues, Chapter 414.255.

[2] Statement of Missouri Governor Matt Blunt. 5 July 2007.

[3] Greaney, T. J. (2008). E-fuel switch is a mix: Miles per gallon slip with ethanol blends. *Columbia Daily Tribune* (MO).

[4] Federal Highway Administration (2005). Highway Statistics Series. Table VM-2.

[5] Ibid.

[6] According to GREET, conventional gasoline contains 116,090 btu/gallon, ethanol contains 76,330 btu/gallon, therefore E10 contains 112,114 btu/gallon.

[7] American Ethanol Coalition (n.d.). Fuel Economy Study: Comparing Performance and Cost of Various Ethanol Blends and Standard Unleaded Gasoline.

[8] Ibid.

[9] Pearce, J. M. and J. T. Hanlon (2007). "Energy conservation from systematic tire pressure regulation." *Energy Policy* 35(4): 2673-2677.

[10] US Department of Transportation Bureau of Transportation Statistics. Table 4-23: Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks.

[11] An average price of $3.472 per gallon of E10 in Missouri was obtained from AAA on 05/01/08.

[12] US EPA. What Are the Six Common Air Pollutants?

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American Agricultural Economics Association Annual Meeting, July 23-26, 2006, Long Beach, California.

[14] Victoria Transport Policy Institute. Transportation Cost and Benefit Analysis – Air Pollution Costs. Adjusted for inflation.

[15] Argonne National Laboratory (2007). The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model.

[16] This value was estimated from the percentage registered vehicles which passenger cars account for multiplied by the number of miles driven on Missouri roads.

[17] Ibid.

[18] This chart was generated by subtracting the GREET generated emissions from E10 from conventional gas, then multiplied by an estimate of the number of miles that Missourians drove in passenger cars (owned privately and by government) and does not account for additional reductions from passenger trucks, vans and sport utility vehicles.

* Information on the economic impact of state and national renewable fuel mandates can be found in "Economic Impacts of US Ethanol Mandates and Their Implications for Missourians,"also by Damon Ferlazzo, MPA at www.truman missouri.edu.

Author Biography

Damon Ferlazzo graduated from the Harry S Truman School of Public Affairs in 2008 with a master's in Public Administration. He earned a bachelor's degree in Political Science from the University of Missouri in 2005. He is currently the Programs Coordinator at the Truman State University Student Union in Kirksville, MO.

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