Vehicle Fuel Efficiency Opportunities from Off-Test Components

Jameel Alsalam and Alan Meier

Abstract

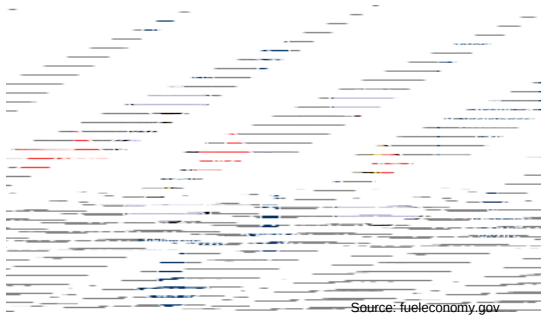
The Federal Government uses the CAFE program to insure that the nation's vehicle fleet meets certain minimum fuel economy standards, but the format of the test omits many vehicle components which impact vehicle fuel efficiency. Manufacturers lack this important incentive to adopt efficient air conditioning, vehicle lighting, luggage racks, and many other components. This project characterizes the fuel economy costs and benefits available in a wide variety of off-test, and partially included vehicle components, while also considering ways that components could be incorporated into the testing regime.

EPA Fuel Economy Test

How is the test done?
EPA Fuel economy tests for CAFE regulation are performed on a dynamometer in carefully controlled conditions. Tests are repeatable, but it is difficult to make tests reflect real-world conditions. Many components which consume fuel on the road are turned off during the tests.

Tested fuel economy is adjusted downwards by 10-22% to account for fuel use not measured in the test, such as rough pavement, hills, air conditioning and accessory use.
Adjustments make FE labels accurate
BUT the adjustments offer no incentive to improve efficiency of off-test components, since the adjustment factor will be unchanged.

Vehicle Component Fuel Use



Source: fueleconomy.gov

Savings in end-use energy use implies 4-8X savings in fuel because of conversion inefficiency of the motor/drivetrain/alternator

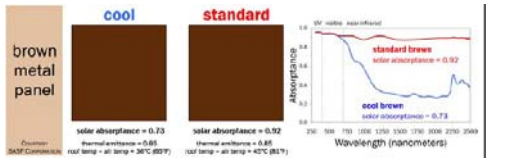
What Components are Off-Test?

On-Test Components	**Off-Test** Components
Continuously running: oil pump, power steering (belt-driven)	*Switched components*: A/C, lights, stereo, power windows, electric pumps
"Standard" aerodynamics: body shape	*Options*: roof rack, spoiler
Road resistance: tires	*Heat management*: reflective paint, windows, passive ventilation

Off-test fuel usage could be as high as 20%. There has been no recent in-use fuel economy data, so this is difficult to measure, but modeling these components is a main goal of this project.

Reflective Paint on Opaque Surfaces

Researchers have developed paints which match normal colors in the visual spectrum, but absorbs a much lower percentage of IR radiation. This means lower heat gain from the sun, and less A/C use. Hot soak temperatures can be reduced 3-5 degrees Celsius.



Source: Akbari, LBL Heat Island Group

Efficient Vehicle Lighting

Xenon and LED lighting promises 50-75% improvements in energy efficiency for the same lighting applications as halogen and incandescent. Some savings is offset by using brighter lights, but this might be less true if lighting was included in fuel economy test. Despite these large gains, overall fuel economy will probably improve by less than 1% with xenon and LED adoption due to the low energy in these applications.

Source: Motor Vehicle Lighting Council

Aerodynamic Roof Racks

Roof racks increase aerodynamic drag of a vehicle by at least 5%, which subsequently increases fuel use. This fuel use is not included in ratings when the rack is considered an option. Auto companies have worked hard to improve the drag coefficient of their vehicles but CAFE does not provide regulatory incentive to improve roof rack aerodynamics.

Work In Progress

- Model the fuel use of off-test components
- Evaluate improvements in fuel economy available in efficient components
- A related project is exploring legal avenues whereby California could regulate off-test components
- Work Funded by the UC Energy Institute
- Contact Jameel: jalsalam@gmail.com

ASIL The American Society of International Law

Boalt Hall The Global Commons Project California Center for Environmental Law & Policy University of California, Berkeley

Berkeley Institute of the Environment

CEPP Center for Environmental Public Policy Goldman School of Public Policy

iTRIS Center for Information Technology Research in the Interest of Society