E85

By John Benson

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1. Introduction

I'm not researching this, but I'm guessing this paper has one of the shortest titles of any I have posted (and no, this is not a belated April Fool's Joke). If you live in an agricultural area, you probably already know what E85 is. I don't, but every week or two I drive from my primary residence (Livermore, CA) to my mountain home in Arnold, CA and back. About half way there via my normal route, I pass a gas station that is right in the middle of California's Central Valley, one of the largest agricultural food-producers in the U.S. I have noted in the past that: (1) they sell E85 (fuel that is roughly 85% bio-ethanol) because they have a large sign out front that advertises this, and (2) it's a lot less expensive than gasoline (the large sign has very large text with the E85 Price).

Of course during the peak gasoline prices recently, I wondered if either of the vehicles that I drive to Arnold could use this ('93 Honda Civic and '93 Ford Explorer). When I'm curious about something, particularly when it is related to the Energy Industry, it usually ends up as a paper / post on Energy Central, and thus this post.

2. Flex Fuel

The title of this section is an alternate name for E85 and other fuels that have a percentage of ethanol or methanol. In my quest for compatibility, I found a really nice chart from the Renewable Fuel Association[1]. This chart had too much tiny text for me to copy and paste into this post, but I did find a high resolution PDF of this, and this is linked below.

https://files.constantcontact.com/a8800d13601/84541646-5805-46bc-86ce-2cbe30cb976e.pdf

For my personal research, there were three bad pieces of news with this chart: (1) it only goes back to 2020, (2) the table for Ford Vehicles indicated that additional checks would be required, and (3) there was no Honda table.

I also went to the Ford sites linked below. These covered a broad-swath of alternative fuels (including E85), but mostly focused on commercial vehicles.

https://www.fleet.ford.com/content/dam/aem_fleet/en_us/fleet/programs/altfuelvehicles/2021_Advanced_Fuel_Broch_r16_a11y.pdf

I finally gave up on trying to make my commute to Arnold less expensive via E85. However I will put some of the results in the next section.

3. Benefits and Disadvantages

Over the past few years, you've likely heard increasingly more about flex-fuel vehicles, even if you didn't fully understand what they were. Today, a number of known flex-fuel benefits exist. However, before investing in this type of vehicle, you should first understand what you're purchasing. Continue reading to learn about flex fuel and its pros and cons.[2]

[1] https://ethanolrfa.org/

[2] Hearst Autos Research via Car and Driver, "Flex Fuel: Benefits and Disadvantages," https://www.caranddriver.com/research/a31542970/flex-fuel-benefits/

Flex-fuel vehicles are those that have internal combustion engines designed to run on more than one type of fuel. Other than a few modifications to the engine and fuel system, says Kiplinger, flex-fuel vehicles are virtually identical to gasoline-only models.

This technology isn't new. It was first developed in the early 1990s and used in the mass-produced 1994 Ford Taurus, according to Car Bibles. By 2017, there were approximately 21 million flex-fuel vehicles on the road.

3.1. Benefits

More people today are concerned about fuel consumption's effects on the environment. Ethanol burns cleaner than gasoline, which means flex-fuel cars pump fewer toxic fumes into the environment. Flex fuel also contributes fewer greenhouse gases (GHG), making it a more environmentally friendly option than traditional gasoline.

Author's comment: The lower GHG for Flex Fuel is because the ethanol is made from plant matter via fermentation. However, in order to be very-low GHG the CO_2 that is emitted during fermentation needs to be captured and sequestered. Also any energy used during processing and transportation needs to come from renewable or other very-low GHG sources.

One of the greatest advantages of a flex-fuel vehicle is that is can burn whatever proportion of fuel mixture is in the combustion chamber. The car is equipped with electronic sensors that gauge the blend, and its microprocessors adjust the fuel injection and timing. Modern flex-fuel cars can contain 10 to 85 percent ethanol. Thanks to the technology it's equipped with, your vehicle will determine the most efficient proportions.

Many flex-fuel vehicles run on ethanol, which is sustainably produced from ingredients such as cane sugar and corn. This makes ethanol a good alternative to purchasing foreign oil.

Author's comment: Many feel that using food-crops for fuel is not a good idea. See the post summarized and linked below for a deep dive into this discussions, and some recent advances that might preclude this discussion.

As I wrote a recent post, I discovered that U.S. Government currently intends to use many "Sustainable Liquid Fuels," especially in the Maritime and Aviation subsectors. A few days later I was reading my latest issue of Scientific American, and came across an excellent article on these fuels, and you can probably guess the rest of the story.

https://energycentral.com/c/ec/biofuels-reboot

Consumers who drive flex-fuel cars receive tax credits that can significantly reduce or even eliminate their tax obligation.

While some might argue that using an alternative fuel source can negatively impact a vehicle's performance, in reality it can have the opposite effect. Flex-fuel vehicles don't experience a loss in performance when using E85 fuel. In fact, some even generate increased torque and horsepower.

Author's comment: The flip side of the above is that E85 might get lower fuel mileage (if your vehicle can use it). This is because, in spite of the above-mentioned "…*electronic sensors that gauge the blend,*" most engines are really optimized for gasoline, although in most of the U.S. (including California) gasoline uses 10% "oxidizers," which are mostly ethanol.

4. Potential Disadvantages of E85

The biggie here is that anyone considering E85 should thoroughly research whether their vehicle can use E85. If you put E85 in a vehicle that is not specifically designed for it, damage could result.

The text below is the best treatment I found on potential negative issues:

Mike Allen of Popular Mechanics says that under ideal conditions, a gasoline-ethanol blend is perfectly acceptable. But consumers cannot control those conditions, and they have no way of knowing if the fuel they're buying has been contaminated. All gasoline is susceptible to changes due to weather and moisture content, but ethanol exacerbates this problem. A higher concentration of ethanol in a gas tank (any gas tank -- at the production facilities, the tankers traveling on the highway, the storage tanks at a gas station, your car's reservoir and even the red plastic can sitting on the floor in your garage) means that the alcohol can grab and hold more water than straight gasoline.[3] If the water concentration gets high enough, the alcohol and water will drop out of suspension, turning the fuel into a globby mess that your car's engine can't use. And it can happen at any stage of the transport, storage and usage process -- even getting worse as it goes along. In short, ethanol increases the chances that your car will be damaged trying to process and burn contaminated gasoline.[4]

Let's assume that most of the time the fuel's environmental conditions aren't seriously compromised, its ethanol stays in suspension, and the gasoline is properly reaching its destination. The ethanol in the fuel may still do damage. Many older fuel system components weren't designed to resist alcohol's corrosive properties, and as ethanol travels through the system it can cause considerable damage. Gasoline companies sometimes even market specific blends as having "engine cleaning" properties, but if the alcohol in the fuel cleans old deposits from engine components, those deposits won't simply dissolve -- they'll probably just get carried along until they're stuck elsewhere.

A 2012 study by Auto Alliance showed that some cars (model years 2001 to 2009) showed internal engine damage as the result of using an ethanol fuel blend. Damage to the valves and valve seats was evident in some of the cars tested. One of the 16 cars in the Auto Alliance study failed emissions compliance standards, which means it emitted more pollution than allowed by the EPA. The study also showed that cars running on E15 take a hit on gas mileage -- so they require more fuel to travel the same distance, which counteracts the benefits of diluting it in the first place.

Author's comment: Note the "*Damage to the valves and valve seats…*" in the above text. This is mainly caused by a lack of lead in the gasoline. Starting in the 1970s, new vehicles were designed to run on unleaded gasoline. In fact, the new cleaner generation of cars couldn't run on leaded gasoline — it would destroy their catalytic converters. From 1 January 1996, the U.S. Clean Air Act banned the sale of leaded fuel for use in on-road vehicles although that year the U.S. EPA indicated that TEL (Tetra-ethyl-lead) could still be used in aircraft, racing cars, farm equipment, and marine engines.[5]

[3] Most alcohols are hydrophilic (water-loving).
[4] Cherise Threewitt, How Stuff Works, "Can ethanol damage your engine?" https://auto.howstuffworks.com/fuel-efficiency/alternative-fuels/ethanol-damage-engine.htm
[5] Wikipedia Article on Tetraethyllead, https://en.wikipedia.org/wiki/Tetraethyllead#

The TEL was mainly used boost the octane rating so higher compression ratio could be used. It also allegedly coated the valves and seats providing lubrication during their operation. In the 70s autos (etc.) transitioned to hardened valves seats that no longer needed this lubricant, Thus only vehicles from the 70's (or earlier) should suffer damage to their valves and/or valve seats (note that some older vehicles have been retrofitted with the newer valves seats).

5. How Can I tell My Vehicle is made for E85?

I discussed researching this above, and provided a few resources. To this I would add one more: look in your owner's manual. Also:

Manufacturers make flex-fuel vehicles with modified internal combustion engines using traditional gasoline and ethanol blends, such as E85. A badge with "Flex-Fuel," "FFV," or "E85" on the rear of the vehicle may indicate it is compatible with the alternative fuel.[6]

Having a yellow gas cap is a good indication that the car can use flex fuel. If the vehicle has a cap-less fuel filler, a yellow ring around the hole where the nozzle gets inserted signals E85 works for the vehicle.

[6] Chris Hardesty, Kelly Blue Book, "E85 Guide: Everything You Need To Know About Flex Fuel, Dec 13, 2022, https://www.kbb.com/car-advice/flex-fuel-guide/