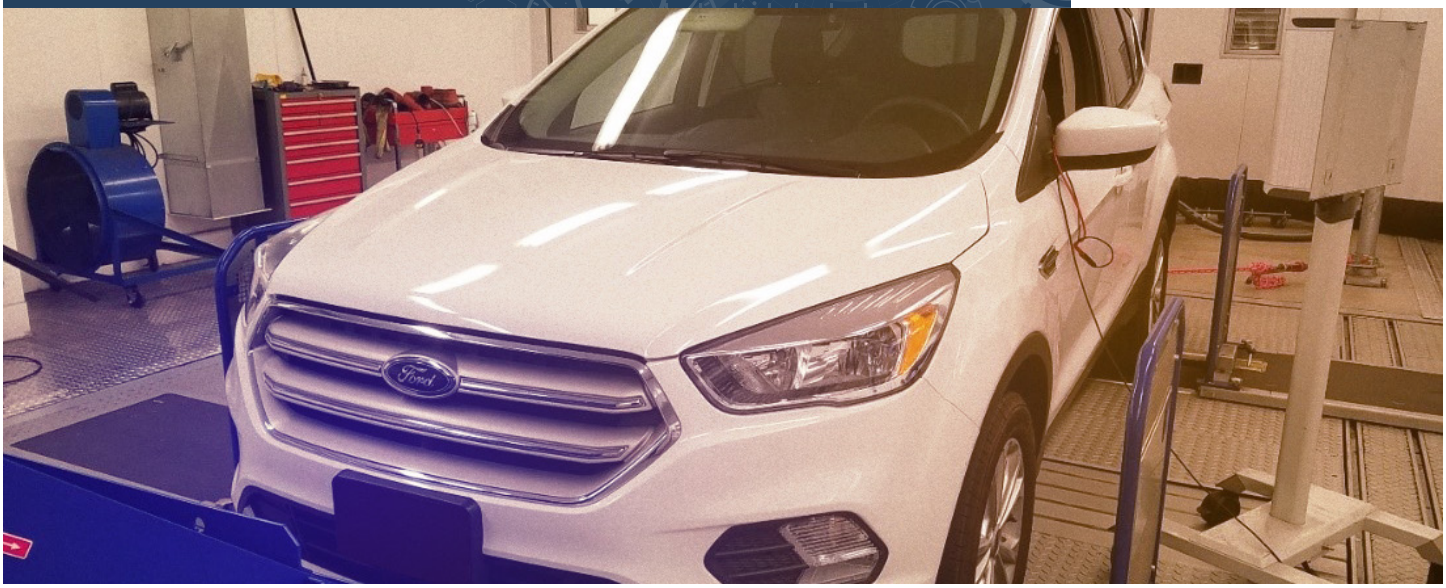
JULY 2021

FACT SHEET

ACCURACY OF IN-DASH FUEL ECONOMY DISPLAYS



Background

Higher gas prices are an ongoing concern for drivers, especially as millions opt to take summer road trips as their preferred mode of travel. Many vehicles are equipped with in-dash fuel economy displays including a "miles-to-empty" estimate, which drivers may rely on when making decisions about when to refuel. However, if the information the system provides is inaccurate, drivers may incorrectly assume how much fuel they have left in their tank. This project examines the accuracy of the in-dash fuel economy estimation and range value (aka "miles-to-empty") displays.

Methodology

Test vehicles were selected using the following criteria: from model years 2018 – 2020, represent a variety of manufacturers, have at least 4,000 miles on its odometer and are in good working, original condition. Using a dynamometer, essentially a treadmill for vehicle testing, vehicles performed the following seven drive cycles, four times each:

Order	Scenario	Distance	Time Spent in Scenario
1	Mild accelerations and speeds — EPA Highway Fuel Economy Test* (HWFET)	10.3 miles	12:45
2	Higher accelerations and speeds — EPA US06 Test*	8 miles	9:56
3	Route with modern traffic, speeds and acceleration	7.5 miles	25:42
4	Freeway driving at high speeds with minimal traffic	18.9 miles	18:00
5	Freeway driving at very low speed during rush hour	3 miles	16:11
6	Cruise control at 65 mph	5 miles	5:00
7	Cruise control at 80 mph	6 miles	5:00

** These two scenarios (HWFET and US06) are standard drive cycles developed by the EPA for fuel economy testing. HWFET is used to determine a vehicle's highway fuel economy rating and US06 consists of a high acceleration, aggressive driving pattern.*

Results

Fuel Economy Estimate

- On average, the fuel economy display of the vehicles tested showed an error of 2.3% (0.7 mpg) as compared to their lab-measured fuel economy from start to finish of testing.
- Though the average error was relatively low, results varied significantly by vehicle, with individual vehicle error ranging from –6.4% (–2.2 mpg) to 2.8% (+0.9 mpg) for the cumulative miles per gallon. Note: a negative value indicates fuel economy was overestimated, while a positive value means it was underestimated.
  - The vehicle with the most accurate fuel economy display had an error of 0.0% (or +0.1 mpg) for the complete series of cycles, but individual cycle error varied from 0.3 mpg to +0.8 mpg.
  - Conversely, the vehicle with the most inaccurate fuel economy display had an error of -6.4% (or –2.2 mpg) for the complete series of cycles, but individual cycle error varied from –0.3 mpg to -4.1 mpg.
- Both of these trends suggest that each vehicle's algorithm is reacting to changes in driving factors that affect fuel economy, such as speed and acceleration and may adjust its estimations over time based on recent driving history.
  - When driving conditions change (such as going from city to highway driving), the estimation will likely lose accuracy until it adjusts to the new driving conditions.
  - Also, further examination of individual drive cycles also showed that error varied significantly over short distances, even when accurate over longer distances.

Range Value (aka "Miles-to-Empty")

- The accuracy of the range estimations for the vehicles tested varied significantly throughout the series of drive cycles, however it did generally improve as testing proceeded.
  - For example, the range estimations for two of the test vehicles during the HWFET cycle (mild accelerations and speeds) increased in error with each cycle, suggesting the range estimations adapted to the higher fuel economy of this cycle compared to overall fuel economy (15.3 and 8.4 MPG higher, respectively).
- Though each manufacturer likely uses a unique algorithm to estimate vehicle range, it can be assumed that some amount of historical driving data is used to estimate the vehicle's fuel efficiency for future driving.

Additional information on methodology can be found in the full report here.