

Glacial Lakes Energy E30 Challenge

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What is the E30 Challenge?

For years Watertown, SD has had multiple blender pumps at retail locations, which offer the consumer the choice of gasoline blended with 10% (87 octane), 20%, 30% and 85% ethanol. Thousands of consumers have taken control of their fueling decisions, using blends that are appropriate for their vehicles. The [E30 Challenge](#) was a community effort educating, promoting, and motivating consumers to consider use of higher blends of ethanol with the focus on 30% blends in their existing vehicles. Our team then took the next step proving the positive results we've seen for years in the real world. Through this effort we educated the community on the benefits of a Premium blend of 94 octane fuel that is lower cost per gallon than regular fuel, runs great in your car, creates local jobs, strengthens energy independence, and cleans our air.

In Watertown, SD, both Flex Fueled Vehicles (FFV's) and non-flex vehicles have benefited from this Premium fuel option. Local dealerships and independent auto repair shops have no reported issues associated with higher blends. This paper discusses the evaluation of consumers fueling non-flex fuel vehicles with three consecutive tanks of E30 compared to three consecutive tanks of E10. We tracked a number of factors using the same data loggers that the EPA uses. These efforts resulted in a compelling increased awareness and ongoing discussions by the local community regarding how fueling their *non*-FFVs would impact drivability and fuel efficiency with mid-level ethanol blends as an option to provide a high octane source of fuel while reducing toxic emissions.

We reviewed vehicle performance and data logger results on 40 random vehicles and observed:

1. Modern vehicles that filled with E30 could adapt to higher octane to improve performance and increase available power.
2. All vehicles tested adapted to E30 staying within the OEM computer calibration range.
3. No difference in average MPG with smaller engines showing the best response.
4. Savings of \$.0137 per mile with a projected annual savings of over \$200 per vehicle.
5. No check engine lights as a result of using E30.

Future Automotive Industry Demand

Octane is a key element in further advancement of fuel efficiency. It is best described as resistance to premature combustion under high temperature and pressure in the engine combustion chamber. Most fuel today is E10 and only 87 octane. E30 removes those limitations by providing 94 octane fuel at a lower cost. Further gains in fuel efficiency will require higher octane in our fuel supply. E30 is 94 octane and will enable current and future developments such as increased compression ratios and turbo charging like that of Ford's EcoBoost technology to increase fuel efficiency. When denatured ethanol is splash blended (simply added) with commercially available E0 or E10 to make E30, it is found to burn cleaner, reducing toxic tailpipe emissions.

Watertown lays claim to the blender pump capital of the US with 40 blender pumps in eight locations across a population of 22,000. This infrastructure allows for a greater consumer experience leading to increased trial and acceptance of mid-level blends. E30 is increasing in popularity and availability in small towns and community fueling stations across eastern SD and MN. The State of SD and the South Dakota Farmers Union

have been a primary forces in leading the way to improve availability and assisting in installation of the first blender pumps over a decade ago.

Engine and Model Selection and Observations

Three random vehicles were initially tested on a dynamometer in a controlled setting while results of horsepower and torque were recorded over the entire drive cycle. The vehicles observed are listed below.

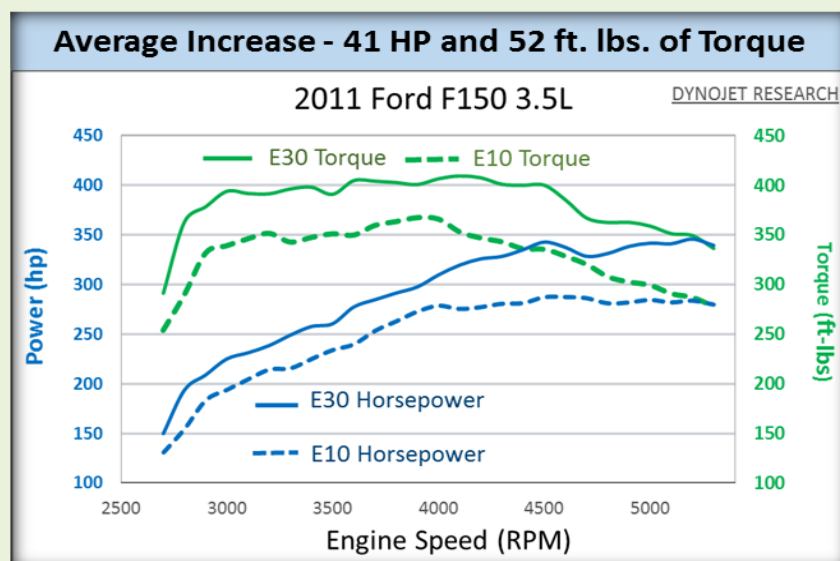
- 2011 Ford F150 3.5 L Eco boost - 101,800 mi
- 2015 Dodge Ram 1500 5.7L Hemi - 2,500 mi
- 2012 Chevrolet Malibu 2.4L - 80,000 mi

Glacial Lakes Energy partnered with ICM Inc, Lake Area Technical College and Dyno Tune Speed and Performance to develop the “E30 Challenge”. All candidates selected were non-shareholders of GLE to ensure impartiality and all 40 vehicles were non-flex fuel vehicles (FFV). Our observations covered nearly 80,000 miles of driving with various makes and models covering a wide range of weather and road conditions. Vehicles included pickup trucks, SUVs, crossovers, passenger cars, transit vans and mini vans. Fuel economy testing showed little variation, positive or negative, between the two tested fuels and many of the owners reported a feeling of more power especially upon acceleration or under load such as towing a trailer or a boat.

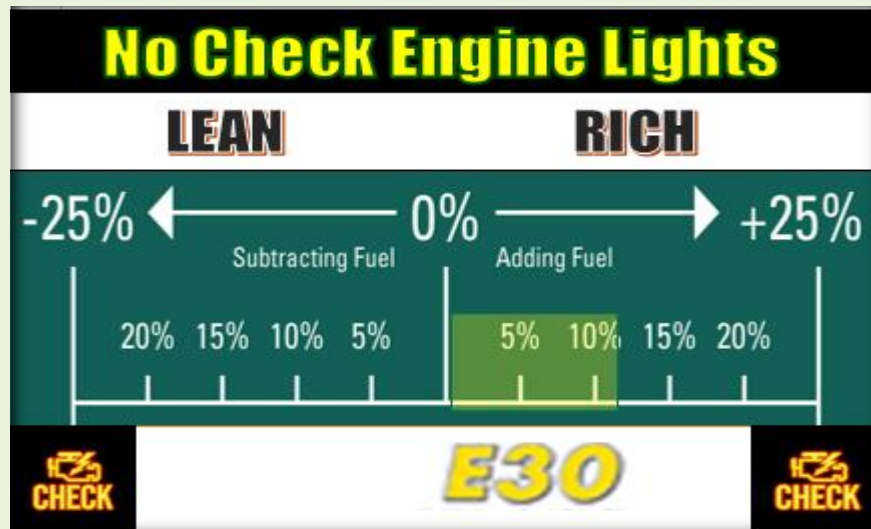
Selected Fuels and Observations

On a dynamometer, a direct comparison was made between E10 and E30 charting the results of each fuel to determine changes in horsepower and torque. A load test was conducted on each of these vehicles from idle to wide open throttle to determine engine performance on each fuel. All three vehicles experienced more horse power and more torque. The horsepower gains with the higher octane were a direct result of simply adding more ethanol to regular unleaded fuel. This increase of power shows the computer is adapting, making the appropriate changes to ignition timing and fuel flow. These changes offset the lower energy value resulting in no difference in average MPG.

Below is a graph of the 2011 F150 which explains how an engine’s computer reacts and adapts to blends up to E30. The EcoBoost technology delivers an increase in available power with the 94 octane in E30. This was repeated on other vehicles with similar results.

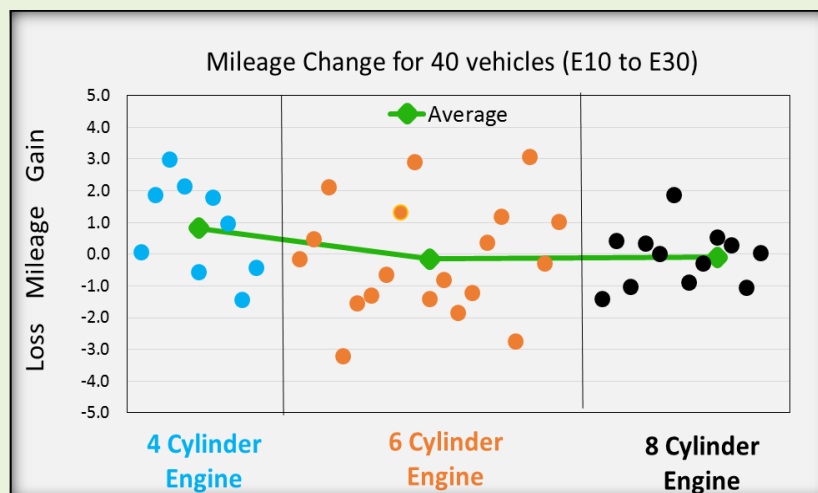


To showcase the benefits of higher ethanol blends, local auto technicians, dealers, retailers and consumers were provided with initial test results from DynoTune's Andy Wicks, along with additional data confirming that using E30 would not harm their vehicle. The slide below was an important educational piece explaining to invested parties what happens in an engine and how the computer system adapts to E30.



Consumer and Vehicle Response

Forty participants agreed to compare the two fuels in their personal vehicles. Many participants were pleased to buy domestically produced renewable fuel at a discount to petroleum based imported fuel. Others commented that they felt more power especially starting from a standing stop or under acceleration, otherwise no difference in vehicle performance. This validated the dynamometer findings. When comparing miles driven versus fuel consumed there was a range of performance from 3.21 mpg loss to 3.05 mpg gain. When accounting for fuel economy due to average speed variation the difference was much less. Four cylinder engines showed a noticeable trend in increased avg MPG as “the quality offsets the quantity”. This validates the dynamometer findings that vehicles can adapt, adjust fuel flow and ignition timing.



Coordinated education of consumers, auto technicians and dealers led to overwhelming acceptance at the pump resulting in a 600,000 gallon sales increase year over year and two new locations adding 12 more pumps.

| E30 Cumulative Gallons Sold Total | | | |
|--|--------------------------|------------------------|-----------------|
| Date | 2015 Baseline | 2016 Actual | % Change |
| MAY | 24,098 | 87,628 | 264% |
| JUN | 21,458 | 126,977 | 492% |
| JUL | 22,146 | 111,515 | 404% |
| AUG | 22,146 | 116,817 | 427% |
| SEP | 21,458 | 118,615 | 453% |
| OCT | 20,082 | 108,339 | 439% |
| NOV | 19,529 | 101,883 | 422% |
| TOTAL | 152,364 | 771,774 | 407% |
| E30 Additional Gallons Sold | | | 619,410 |

Retailers were able to sell a lower cost fuel and maintain the same level of margin. Consumers recognized this value and retail sales of Premium E30 rose over 400%. Additionally, overall gross fuel sales for retailers offering E30 blends have improved by 10% since the beginning of the educational and promotional efforts.

Summary /Conclusions

- Splash blended E30 fuel provided greater horse power and torque in all cases on non-flex fuel vehicles tested on a dynamometer based on testing from idle to wide open throttle.
- No difference in avg mpg, a cost savings of \$.0137 per mile driven and no check engine lights.
- Retailers saw a large gain in market share and improved net revenue through an educational process that was industry driven and community supported.
- Great potential exists for new vehicles to be designed to more effectively use 94 octane E30 to boost power and fuel efficiency while drastically cutting emissions with a cleaner burning fuel.

Our efforts revealed much more than we presented in this publication. If you would like to receive more detailed information, our contact information is listed below.

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