Energy Content

The energy content (also referred to as heating value) of diesel fuel is its heat of combustion; the heat released when a known quantity of fuel is burned under specific conditions.

In the U.S., the heating value is usually expressed as British thermal units (Btu) per pound or per gallon at 60°F (International metric [SI] units are kilojoules per kilogram or per cubic meter at 15°C). For gross (high) heating value, the water produced by the combustion is assumed to be recondensed to a liquid. For the net (lower) heating value, the water remains as a gas. Since engines exhaust water as a gas, the net heating value is the appropriate value for comparing fuels.

The three main factors that affect vehicle fuel economy, torque, and horsepower are the type of engine (i.e. gasoline or diesel), the efficiency of the engine turning energy in the fuel into usable work, and the fuel's volumetric energy content or heating value.

The energy content of conventional diesel can vary up to 15% from supplier to supplier or from summer to winter. This variability in conventional diesel is due to changes in its composition which are determined by refining and blending practices. Number 2 diesel fuel usually has higher energy content than Number 1 diesel fuel, with blends of Number 1 and Number 2 varying between the two parent fuel values.

The efficiency of diesel engines is the same whether using biodiesel, diesel, or biodiesel blends so differences in horsepower, torque or fuel economy are due entirely to volumetric energy content[1]. The energy content of biodiesel is much less variable than that of petrodiesel, and with biodiesel meeting D 6751 standards the energy content is more dependent upon the feedstocks used than the particular process. Blends of biodiesel and diesel fuel fall between the parent fuels.

The values below represent those of energy content of average No. 2 diesel fuel and average biodiesel in the US.[2] While BTU changes of 1-2% can be picked up in lab tests for horsepower, torque, and fuel economy, in practice it is difficult to detect any differences with a 1-2% change in fuel BTU content outside normal variability experienced from day to day operations, even in closely monitored fleets.

Average Density and Heating Value of Biodiesel and Diesel Fuel

Fuel	Density, g/cm3	Net Heating Value Avg., Btu/gal.	% Difference vs. No. 2 Diesel Avg.
No. 2 Diesel	0.850	129,500	
Biodiesel (B100)	0.880	118,296	8.65 %
B20 Blend (B20)	0.856*	127,259*	1.73 %*
B2 Blend (B2)	0.851*	129,276*	0.17 %*

* Calculated Values from those of No. 2 Diesel and Biodiesel (B100)

[1] "2004 Biodiesel Handling and Use Guidelines", US Department of Energy, US Department of Energy, DOE/GO-102004-1999 Revised 2004.
[2] "A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions", US Environmental Protection Agency, EPA420-P-02-001, October 2002.