



## WET BIOFUEL COMPRESSION IGNITION

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### The Invention

UW-Madison researchers have developed a compression ignition engine system that allows use of hydrous fuels, in particular hydrous biofuels, with high water content (e.g., 20-85% water). The hydrous fuel is pressurized, and also preferably heated via the engine's exhaust gas, to increase its enthalpy, and is then directly injected into the engine cylinder(s) near top dead center. The system provides brake thermal efficiency increases of 20% or more versus a comparable system using conventional diesel fuel, while allowing the use of inexpensive undistilled or lightly distilled biofuels.

### Applications

- Heavy Duty Vehicles

### Key Benefits

This innovation allows for significantly higher exhaust waste heat recovery (WHR) compared to conventional WHR systems currently in development. This results in the potential to achieve ultra-high unprecedented engine brake thermal efficiency (BTE) levels, exceeding 60%. DME eliminates soot emissions, which eliminates the need for soot after-treatment. It also allows for high water content in the fuel mixture, which results in engine-out NOx emissions levels below the most stringent future proposed regulated levels. This eliminates the need for expensive lean NOx after-treatment and eliminates diesel exhaust fluid (DEF) consumption.

Compression ignition can be achieved at lower temperatures due to DME higher cetane rating, allowing the engine to operate under conditions where there is insufficient exhaust energy available to achieve high fuel mixture temperatures (e.g., warm up, transients). The superior ignition characteristics of DME also allows for higher relative water content in the fuel mixture, which further increases BTE and reduces engine-out NOx emissions to near zero levels. The ignition characteristics also allow for lower fuel mixture temperatures to be used, lessening the material property requirements for the recuperator heat exchanger and high temperature fuel system components.

### Additional Information

#### For More Information About the Inventors

- [Sage Kokjohn](#)

#### Tech Fields

- [Engineering : Engine technologies](#)

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