

## Primer on Renewable Diesel

### What is renewable diesel?

Renewable diesel is a broad category of diesel-like “drop-in” fuels that are similar to petroleum-based diesel in performance, but are made from non-petroleum-based feedstocks. Today’s renewable diesel is typically made through hydrotreating oil feedstocks, including:

- (1) Biomass-based oils from crops like soybeans, rapeseed, jatropha, or palm
- (2) Waste oils like tallow, used cooking oil, corn oil, or animal fats
- (3) Algae oil

In the long-term, energy planners and climate scientists are interested in renewable diesel production from cellulosic biomass using either a gasification to Fischer-Tropsch process or pyrolysis to pyrolysis oil process. The advantage of using cellulosic biomass as a feedstock is the [greater biomass supply potential compared to oil feedstocks](#).

### How do fuel properties of renewable diesel and biodiesel differ?

Biodiesel draws from the same oil feedstocks as renewable diesel (see above), but is produced using a different, simpler process (transesterification). Because of the different production processes, the resulting fuel performance and properties are quite different. The Cetane number of renewable diesel is much higher (70) compared to soybean oil biodiesel (47). A higher Cetane number means the fuel ignites more easily inside the piston, often resulting in a higher engine efficiency. Renewable diesel also has a higher energy content than biodiesel, allowing a slightly greater vehicle range for the same amount of fuel. Measured contaminants are also typically lower for renewable diesel than biodiesel. Finally, renewable diesel does not gel at low temperatures in a similar manner as biodiesel, making it more suitable in colder climates.

### Who makes renewable diesel?

In recent years, the majority of the U.S. renewable diesel supply was produced by the Neste Corporation which has a global capacity of over 400 million gallons per year and operates renewable diesel biorefineries in Singapore, Finland, and the Netherlands. In 2015, Neste shipped over 200 million gallons to the United States, [entirely from its Singapore plant](#). Green Diamond Diesel operates the largest U.S.-based renewable diesel plant – a new biorefinery in Louisiana which is still ramping up to its [160 million gallon per year capacity](#).

### Who’s using renewable diesel?

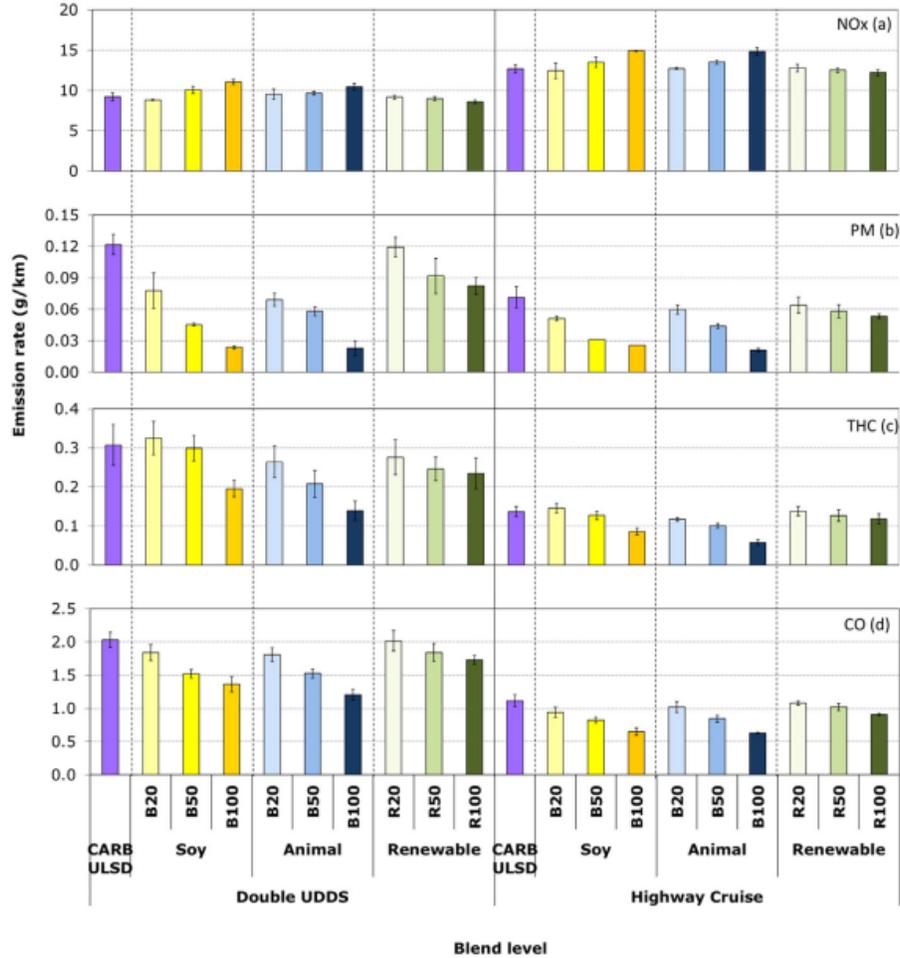
In 2015, the [cities of San Francisco](#) and [Oakland](#) switched their entire diesel vehicle fleets to renewable diesel. Additionally, the state government of California announced in late 2015 that it would no longer purchase conventional diesel or biodiesel for state-owned vehicle fleets – instead opting for renewable diesel. The fuel is also being used in privately-owned vehicles. For example, [UPS announced](#) the purchase of 46 million gallons between 2015 and 2018 and [California's Propel Fuels operates 32 public refueling stations](#) that offer renewable diesel at a cost comparable to conventional diesel.

### What are the emissions from renewable diesel, biodiesel, and diesel?

Greenhouse gas emissions from renewable diesel have not been studied extensively. However, policies like the Renewable Fuel Standard and California’s Low Carbon Fuel Standard (LCFS) consider renewable diesel to be less carbon intensive than diesel. For example, [under the LCFS](#) renewable diesel has a 60 to 80 percent lower carbon intensity than regular diesel and 50 to 75 percent lower carbon intensity than biodiesel produced from Midwest soybeans.

Estimates of criteria pollutant emissions at the tailpipe show that nitrogen oxides (NO<sub>x</sub>) emissions from pure renewable diesel (R100) are slightly lower per distance travelled than conventional diesel (i.e., Ultra-Low Sulphur Diesel or ULSD) and biodiesel in both the city and highway drive cycles (Figure 1). Additionally, particulate matter, carbon monoxide, and total hydrocarbon emissions are also slightly lower for pure renewable diesel compared to ULSD (but not lower than biodiesel).

FIGURE 1: TAILPIPE EMISSIONS FROM REGULAR DIESEL (CARB ULSD), BIODIESEL BLENDS, AND RENEWABLE DIESEL BLENDS



Source: Na et al. (2015) *Impact of biodiesel and renewable diesel on emissions of regulated pollutants and greenhouse gases on a 2000 heavy duty diesel truck*. *Atmospheric Environment* 107, 307-314.

#### Additional renewable diesel resources

- [U.S. Department of Energy Description of Renewable Diesel](#)
- [Diesel Technology Forum Description of Renewable Diesel](#)
- [ConstructionPros.com “Renewable Diesel Poses Viable Option”](#)
- [Biomass Magazine “Renewable Diesel Production, Planned Projects on the Rise”](#)
- [What’s the Difference between Biodiesel and Renewable \(Green\) Diesel](#)
- [Knothe, G. \(2010\) “Biodiesel and Renewable Diesel: A Comparison.” Progress in Energy and Combustion Science, 36, pp. 364-73](#)

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