Honeywell UOP | Renewable Fuels Fuels



Renewable and Sustainable Fuels for Greener Roads

# Honeywell Green Diesel™

# UOP, a leader in refining technologies for 100 years, is paving the way to greener roads.

Worldwide economic expansion is rapidly driving demand for energy. Global demands for fuel and the drivers to reduce greenhouse gas emissions are growing. Honeywell Green Diesel made using UOP/Eni Ecofining™ process technology has a unique ability to provide a renewable and sustainable solution to meet both today and tomorrow's energy challenges without making costly changes to our existing refineries and fuel infrastructure. The Ecofining process is a compelling investment opportunity that can be a lower cost to other biofuel options today.

Developed in conjunction with Italian refiner Eni, the UOP Ecofining process converts natural oils and wastes to high-cetane Honeywell Green Diesel. The result is a better option than traditional petroleum fuels as well as fuel additives like biodiesel.

## Lower Emissions, Higher Performance

Honeywell Green Diesel offers up to a remarkable 85 percent reduction in greenhouse gas emissions compared to petroleum-based fuels. With a cetane range from 75 to 90, it provides more power, and the highly-stable fuel also contains no oxygen and offers improved cold-flow performance over biodiesel. Honeywell Green Diesel meets or exceeds the most rigorous diesel standards for performance and has received excellent results in auto manufacturer tests.

## Drop-In and Drive

Chemically indistinguishable from petroleum-based diesel fuels, Honeywell Green Diesel can be used as a direct, drop-in replacement fuel with no modifications required to the vehicle. Unlike the additive fuels ethanol or biodiesel, which are limited to only a small percentage of the fuel tank, Honeywell Green Diesel is a real hydrocarbon fuel that can be used at any percentage up to 100 percent in the tank. It can also be used as a valuable blend stock in refineries, where its high cetane levels can be used to enhance to quality of the petroleum-based fuel supply.



| *Properties* | *Petro-Diesel* | *Biodiesel (FAME)* | *Honeywell Green Diesel* |
|---|---|---|---|
| NOx Emission, % | Baseline | +10 | -10 to 0 |
| Cetane | 40-55 | 50-65 | 75-90 |
| Cold-Flow Properties | Baseline | Poor | Excellent |
| Oxidative Stability | Baseline | Poor | Excellent |
| Energy Content | Baseline | Lower | Similar |

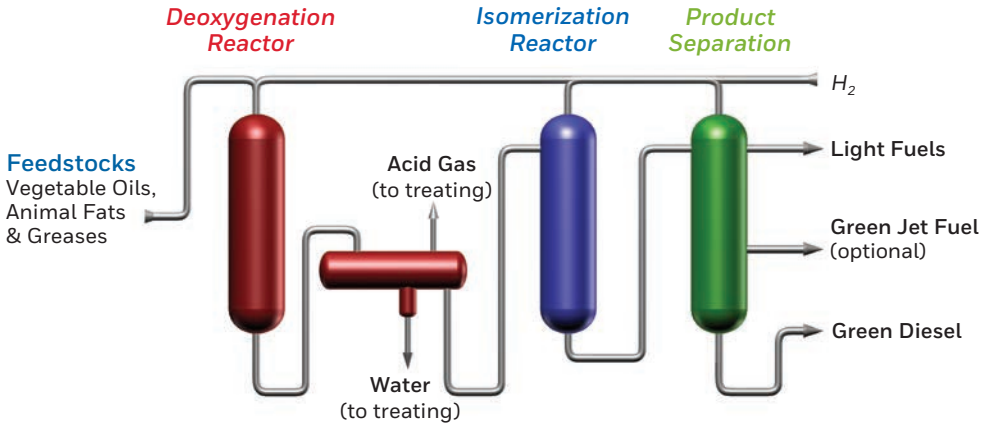
## UOP/ENI Ecofining Process

The Ecofining process is based on conventional hydroprocessing technology already widely deployed in refineries. It works by adding hydrogen to remove the oxygen from natural oils and then further refining the product to meet the required specifications. Because it is based on traditional refining technology, the Ecofining process integrates seamlessly into existing refinery operations to minimize start-up time while reducing capital and operating costs. If desired, the Ecofining process can also be designed to produce 10 to 15 wt% Green Jet Fuel to expand production options and serve the growing commercial and military demand for aviation biofuels.

## A Sound Investment

Ecofining offers refiners a superior option to meet their biofuel needs. The typical inside battery limits (ISBL) capital cost for a 6,500 BPD Ecofining unit is between 80 and 100 million U.S. dollars. Further, where there is an opportunity to revamp or integrate the process with existing facilities, the overall capital investment can be reduced significantly.

Because of the ability to use lower cost feeds with highly selective catalysts, and the low density and high energy content of Honeywell Green Diesel, production costs are $0.10 to $0.20 per gallon less than current biodiesel production costs. These factors combined make the Ecofining process a compelling investment opportunity.




## Second Generation Feedstocks

Second-generation feedstocks are inedbile natural oils and wastes that do not interfere with valuable food, land or water resources. They are exponentially more efficient and sustainable sources of energy that will not negatively impact the food chain. Sources like camelina, algae, jatropha and animal fats or tallow are viable and proven sources for Honeywell Green Diesel production. These feedstocks are growing in availability and new technological breakthroughs will continue to enable advanced harvesting, collecting and processing of these feeds to support commercial-scale biorefining.

## Feedstock Flexibility

The Ecofining process is designed to be feedstock flexible and can process a wide range of sustainable feedstocks. This allows refiners to choose feedstocks based upon regional availability, cost or other factors that will support their business goals without compromising product quality.





## Commercial Deployment

The first Ecofining unit is in operation today in Norco, Louisiana by Diamond Green Diesel, a joint venture of Valero Energy Corp. and Darling International. The facility, co-located with a Valero refinery, processes a variety of feedstock types to produce 137 million gallons per year of Honeywell Green Diesel for distribution across the United States. The facility started-up in 2013.

In addition to the Diamond Green Diesel facility, UOP continues to engage refiners from around the world on Honeywell Green Diesel projects that will expand diesel production, meet government regulations for renewables production and address concerns around greenhouse gas emissions.

## Experience You Trust

As a recognized leader in process technology for refining and petrochemicals, UOP is now applying its technical strengths to help producers meet the growing demand for energy.

Evolving to meet the needs of a changing world, UOP has developed technology to support every major change in the refining industry since 1914. In fact, 31 out of today's 36 foremost worldwide refining technologies were developed by UOP. That means a staggering sixty percent of the world's gasoline and 85 percent of biodegradable detergents are made using UOP technology.

As fuel regulations become more and more strict worldwide, and the need for alternatives to traditional petroleum resources grows, UOP will remain the leader in developing methodology and technology to address the world's energy challenges.

**For more information**

For more information, please contact your UOP representative or visit us online at www.uop.com

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