HOW IS DIESEL MANUFACTURED?

Diesel fuel is manufactured by blending various parts of the crude oil that are collected during the distillation process. The effects of blending can be attributed to the origin of the crude oil, demand for products, methods of refining (thermal, chemical, hydro and other types of cracking) and use of leftover products. Thermal cracking, which is the normal way of separating the crude by heat is the first level of manufacturing. Chemical cracking can strip away good elements of the fuel such as aromatics which can lower conductivity and energy output of the fuel. Hydro cracking introduces hydrogen into the mixture.

To maximize output, leftover products that are commonly referred to as coke or residuum, are reprocessed with chemicals and hydrogen to fit into one of the other categories such as diesel or gasoline. Understanding that long term storage of fuel means that these reprocessed leftovers will not stay in the new blend very long before starting to degrade, typically 3 to 6 months. It will settle to the bottom of your tank as sludge that mixes with byproducts/carcasses of bacteria and other solid contamination that can get sucked up into your emergency generator system.

The manufacturing process of diesel fuel is broken down into three main categories: separation, upgrading, and conversion. Separation involves the atmospheric and vacuum distillation processes that separate the various basic components such as diesel, gasoline, LP gas, and coke/residual. Upgrading is where they use chemicals to strip away unwanted components/properties such as sulfur or lead and is commonly referred to as hydrotreating. The conversion process takes the coke/residual, or the leftover unusable large heavy molecules, and uses either chemical and/or hydrogen to further crack it into smaller and lighter molecules that can be used in other products.

Below is a modern refinery process chart that illustrates the various processes used to manufacture/blend diesel fuel, here are some common terms to help identify the process being used.

Atmospheric Distillation Column – Separation process
Vacuum Distillation Column – Separation process
Coker – Conversion process
Hydrocracker – Conversion process
Fluid Catalytic Cracking (FCC) Hydrotreater – Upgrading process
Fluid Catalytic Cracking (FCC) – Conversion process
Diesel Hydrotreater – Upgrading process
Blended Diesel – Ready for consumer use
Coke/Residual – Leftover substance that is either refined into other products or used in asphalt and other products such as plastics.

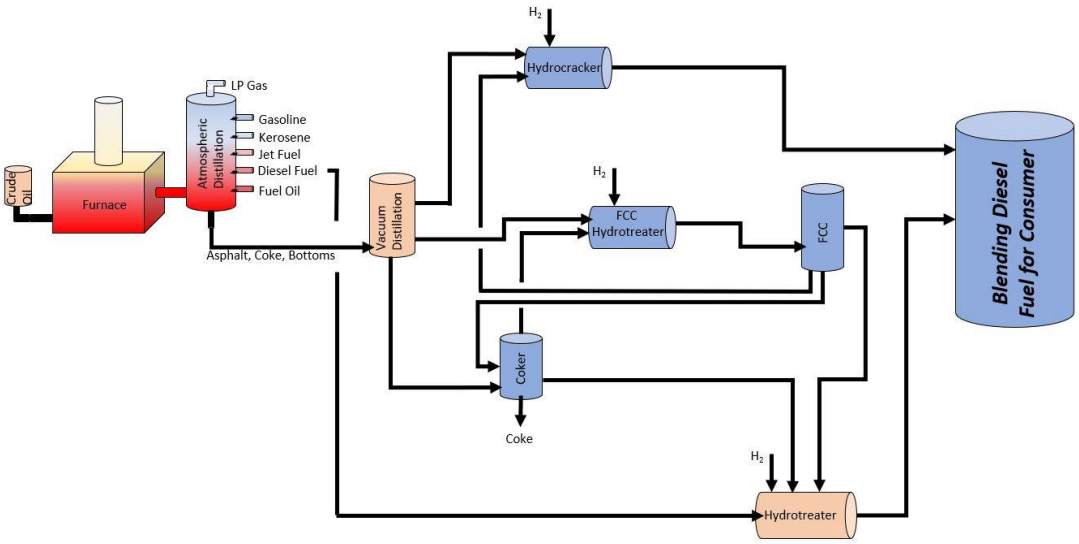

Chart 1. Example of diesel refinery process, this process is not all inclusive and may include many other processes and combination of other blending.

Illustration 2. Picture of a modern refinery showing all the various separation, upgrading, and conversion processes and piping.

What is the refined content of crude oil?

One 42-gallon barrel of crude oil generally yields 44 – 45 gallons of refined product. Several questions that arise are where the extra 2-3 gallons comes from and what is the breakdown of products generated. The extra 2-3 gallons come from the additions of hydrogen, water and chemicals used during the manufacturing process.

What is the actual breakdown of products being yielded from a barrel of crude oil?

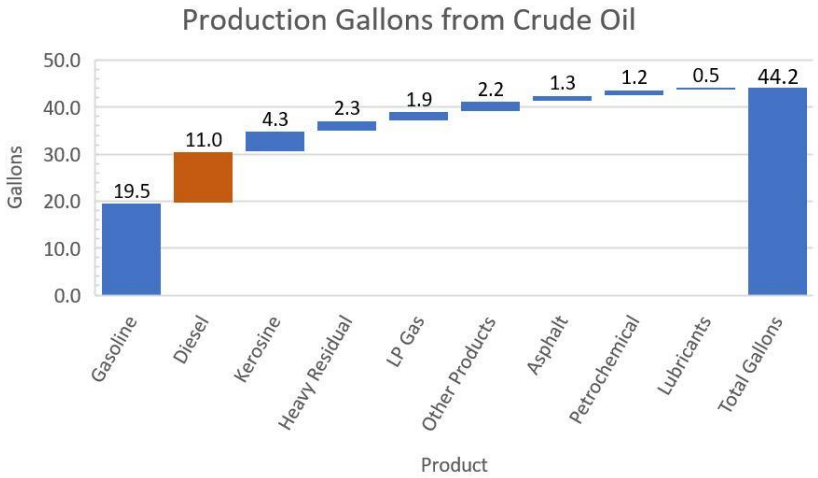

Chart 3. Production gallons yielded from a barrel of crude oil, typically.

What is diesel fuel made of?

Diesel fuel is produced by a refinery in a blend of all the appropriate available streams: straight run product, FCC light cycle oil, hydrocracked gas oil, hydrotreated/hydrocracked coke/residuum, hydrotreated diesel, light gasoil, and other components as necessary.

What is Biodiesel?

Biofuels are a result sustainable energy or renewable energy policy of the United States in which manufacturers receive credits for using renewable resources in the manufacturing of gasoline and diesel. To understand how it is made, lets first look at what are the renewable resources that are being used. The biodiesel consists of a variety of renewable feedstocks that originate from vegetable oils, recycles cooking greases or oils, or animal fats.

A process called transesterification is used to make the biomass processed into a usable form to be blended with diesel. In the United States, soybean is the most used source for biomass. During the transesterification process, unwanted byproducts must be removed before blending with the diesel which include water, chemicals, triglycerides, alcohol, and glycerin where some can be used in the manufacturing of other products.

Biodiesel energy content is slightly lower, the pour point is higher, degrades much faster, and is more susceptible to oxidative degradation than regular diesel. Biodiesel can be identified by the terms "B" and the percentage of biomass blended into the diesel, for example, B5 is 5% biomass, B10 is 10% biomass, and so on. The Engine Manufacturers Association (EMA) recommend the use of biodiesel blends that contain no more than five percent by volume of biodiesel (B5)[1]. Government regulations allow for manufacturers to blend up to 5% biodiesel without notifying customers, so you may think you're getting straight diesel, but it can and usually does have some biomass in it.

[1] "Technical Statement on the Use of Biodiesel Fuel in Compression Ignition Engines," Engine Manufacturers Association, http://www.enginemanufacturers.org/admin/library/upload/297.pdf

Why is that important?

It is important to understand that biodiesel is an effective way to reduce the impact to the environment. However, when purchased and will not be used immediately, it has some very negative consequences that must be accounted for. Being aware of what you are using and what precautions you need to take will be further addressed in Fuel 301 and Fuel 401.