



Facts About...

DIESEL RETROFIT TECHNOLOGY

This fact sheet focuses on technologies currently approved by the Environmental Protection Agency (EPA) at <http://www.epa.gov/otaq/retrofit/verif-list.htm>, and California Air Resources Board (CARB) at <http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>, and that are available for use in the State of Maryland.

These technologies are broken down into two categories:

- “Bolt-on” technology, which requires the systems to be physically installed on the vehicle, and
 - Fuel-based retrofits, which are liquid in form and either replace or are added to the current diesel fuel.
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- **“Bolt-On” Retrofit Technology**
 - **Diesel Particulate Filters (DPFs)**
 - Beginning in 2007, most diesel engines now come with DPFs, also called PM Traps, as standard equipment. These systems consist of a filter positioned in the exhaust stream to collect particulate emissions as they pass through the system. Several fleets in the northeast are currently using DPFs on their vehicles.
 - Although DPFs are designed as a direct replacement for the original muffler, they tend to be larger and heavier and therefore require some engineering to be properly installed.
 - DPFs require the use of ultra low sulfur diesel fuel.
 - The current technology DPFs require the filter section to be periodically removed and cleaned.
 - DPFs typically reduce PM emissions by approximately 90%, CO emissions by approximately 70%-90%, and HC emissions by approximately 85%-95%.
 - Costs typically range between \$8,500 and \$9,500 per vehicle.
 - **Partial Diesel Particulate Filters**
 - Partial DPFs have similar effects as full DPFs but at a lower efficiency and reduced price.
 - These systems consist of a filter positioned in the exhaust stream to collect particulate emissions as they pass through the system like full DPFs, and also a chemical process like DOCs.
 - Partial DPFs require the use of ultra low sulfur diesel fuel.
 - Approximately the same size as the original muffler they replace.
 - Partial DPFs require little or no periodic removal and cleaning.
 - Typically reduce PM emissions by at least 50%, CO and HC emissions by approximately 70%.
 - Cost is typically around \$5,500 per vehicle.
 - **Diesel Oxidation Catalysts (DOCs)**
 - A DOC uses a chemical process to break down pollutants in the exhaust stream into less harmful components. More specifically, a DOC is a physical device with a porous ceramic honeycomb-like structure that is coated with a material that catalyzes a chemical reaction to reduce pollution.
 - DOCs have been used for nearly 30 years, making them the most common “bolt on” technology.
 - Many manufacturers have been equipping their engines with DOCs since the late 1990s.
 - DOCs are approximately the same size as the mufflers they replace, requiring no vehicle modifications.
 - DOCs will last the life of the engine and require no additional maintenance.



- DOCs generally reduce PM by at least 20% and also reduce CO and HC emissions by approximately 40 to 60%.
 - Costs typically range between \$900 and \$1,500 per vehicle.
- **Closed Crankcase Vent Filtration (CCVF) System**
 - Crankcase emissions are created during the combustion process. These emissions include unburned fuel and blow-by gases, hydrocarbon vapor, diesel soot (PM), and various oil contaminants.
 - Crankcase filtration systems allow the crankcase to be closed, which eliminates crankcase emissions without adversely affecting engine performance.
 - In addition, CCVF systems reduce engine oil consumption and in-cabin odors and fumes.
 - CCVF systems do not require special fuel.
 - CCVF systems used in conjunction with a DOC generally reduce PM emissions by approximately 25%-33%, CO emissions by approximately 13%-34%, and HC emissions by approximately 42%-52%.
 - Costs typically range between \$500 and \$700 per vehicle.
- **Fuel-Based Retrofit Technology**
 - **Biodiesel**
 - Biodiesel is a term used to describe a fuel that is derived from vegetable oils or animal fats. In general, biodiesel is made from renewable agricultural sources such as soybeans.
 - Neat biodiesel contains no petroleum, but it is commonly blended with petroleum diesel. For instance, the most common blend of biodiesel is B20, which is 20% neat biodiesel and 80% petroleum diesel.
 - Biodiesel can be used in place of regular diesel fuel.
 - Biodiesel has less energy content than petroleum diesel, which may reduce mileage slightly depending upon the blend.
 - Because biodiesel has a cleansing effect on the engine, fuel injectors and filters can become clogged on initial use unless certain precautions are taken.
 - Some rubber engine parts, such as rings, may need to be upgraded.
 - A blend of B20 will reduce emissions of particulate matter (PM) by 12%, hydrocarbons (HC) by 20%, and carbon monoxide (CO) by 12%. However, biodiesel can increase emissions of nitrogen oxides (NOx). For a B20 blend, NOx emissions are increased by approximately 2%.
 - Biodiesel costs more than petroleum diesel. In general, you can expect to pay an additional cent for each percent of biodiesel. For example, B20 can cost approximately 20 cents per gallon more.
 - For additional biodiesel information, please see MDE's Biodiesel Fact Sheet.
 - **Fuel-Borne Catalyst**
 - The fuel-borne catalyst, when added to the diesel fuel, promotes more complete combustion of fuel in the cylinders. It reduces emissions of HC, CO, PM, and NOx when used with ultra low sulfur diesel (ULSD) fuel.
 - Approximately five gallons of additive is required for every 7,500 gallons of diesel fuel.
 - Maximum benefits usually occur after 60 to 90 days of use.
 - When used with ULSD and a diesel oxidation catalyst (DOC), the emission reductions are up to 50% for PM, 50% for CO, 47% for HC, and 5% for NOx.
 - When used with regular diesel fuel and a DOC, the emission reductions are 41% for PM, 16% for CO, 25% for HC, and 0% for NOx.

