



**Because of** the environmental advantages and cost savings, Arizona Checker Leasing Company purchased its first methanol-fueled vehicles in 1993 and currently counts 300 in its fleet of nearly 450 automobiles.

The company leases its M85 fuel-flexible vehicles to two cab companies in the Phoenix area. The company purchases its methanol from the California Energy Commission, which sells it at a lower, subsidized price. According to the company, methanol has performed just as well as gasoline, providing a safe, reliable, and cost-effective fuel source for the local cab companies.

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# Clean Alternative Fuels: Methanol

One in a series of fact sheets

**F**or more than 30 years, methanol has been the fuel of choice at the Indianapolis 500. Today, non-race car drivers can benefit from methanol's high performance and safety benefits, as well. Most methanol-fueled vehicles use M85, a mixture of 85 percent methanol and 15 percent unleaded gasoline. Methanol is also available as M100 (essentially pure methanol), typically to substitute for diesel. Most methanol-powered vehicles are fuel-flexible, meaning they can use 100 percent gasoline if methanol is not available.

Methanol is the simplest alcohol chemically, containing one carbon atom per molecule. Commonly known as "wood alcohol," it is a toxic, colorless, tasteless liquid with a very faint odor. Because it is produced as a liquid, methanol is stored and handled like gasoline. Most methanol is currently made from natural gas, but it can also be made from a wide range of renewable sources, such as wood or waste paper.

Methanol also offers important emissions benefits compared with gasoline—it can reduce hydrocarbon emissions by 30 to 40 percent with M85 and up to 80 percent with M100 fuels. Emissions are considerably lower when methanol is used in a fuel cell vehicle—automobiles that convert the chemical energy of a fuel into electricity and heat without combustion.

## AVAILABILITY

While no auto manufacturers produce M100 methanol vehicles, more than 15,000 M85 fuel-flexible vehicles are in operation, primarily in California and



## EMISSIONS CHARACTERISTICS\*

Actual emissions will vary with engine design; these numbers reflect the potential reductions offered by methanol, relative to conventional gasoline.

- Potentially lower nitrogen oxide emissions due to a high heat of vaporization and lower peak flame temperature.
- Forms no particulate matter when combusted; M85 will have some particulate emissions due to the gasoline component of the blend.
- Lean combustion results in lower overall volatile organic compound emissions and higher energy efficiency.
- Potentially greater direct formaldehyde emissions.
- Reductions in indirect formaldehyde formation because the hydrocarbons emitted are less reactive.

\* Estimates based on methanol's inherently "cleaner" chemical properties with an engine that takes full advantage of these fuel properties.

New York. Methanol vehicles are also found in cities such as Atlanta, Denver, Houston, and Detroit.

In addition, several manufacturers are developing methanol-powered fuel cell vehicles. Many experts consider methanol to be the best suited fuel to power fuel cell vehicles because its simple chemical structure streamlines the overall fuel cell design. For consumers, refueling with methanol is similar to refueling with conventional gasoline or diesel fuel.

## AFFORDABILITY

On a per-gallon basis, methanol costs less than gasoline, but has a lower energy content, meaning that a vehicle needs more methanol to travel the same distance as a gasoline-powered vehicle. Taking this into account, costs for methanol in a conventional vehicle are slightly higher than those for gasoline. When used in fuel cells, which are considerably more efficient, fuel costs will be lower.

Overall, methanol has high distribution costs because of low demand and limited, regional markets. Generally speaking, light-duty methanol-powered vehicles are \$300 to \$500 more expensive than gasoline-powered alternatives, although these costs might be offset by manufacturer incentives.

## PERFORMANCE

Methanol and methanol blends have higher octane ratings than gasoline, which reduces engine “knock” and can produce in a higher engine efficiency. The higher octane also gives methanol-fueled vehicles more power and quicker acceleration. M100 vehicles have difficulty starting in cold

weather, but this is not a problem for M85 vehicles because of the presence of gasoline. Furthermore, because of methanol’s corrosive nature, a specialized fuel system is needed to handle the fuel.

## SAFETY

There are some safety concerns with methanol because it burns with a nearly invisible flame, making flame detection difficult for vehicle owners and operators. Yet methanol is much less flammable than gasoline and results in less severe fires when it does ignite. A few teaspoons of methanol consumed orally can cause blindness and a few tablespoons can be fatal, if not treated. Antidotes can be effective if administered within hours of intake. For safety reasons, denaturants are added to M100 to give the fuel an unpleasant taste and odor.

As with other alternative fuel vehicles, adequate training is required to operate and maintain methanol-based vehicles. In case of spills, methanol is biodegradable and dilutes quickly in large bodies of water. In addition, the toxic effects on the environment after methanol fuel spills are shorter in duration than those of petroleum spills, and even more so for M100 because it contains no gasoline.

## MAINTENANCE

Methanol-powered vehicles require special lubricants that present additional costs to the vehicle owner. Overall, however, vehicle maintenance might be reduced because of methanol’s clean burn characteristics.

## For More Information

### EPA Alternative Fuels Web Site

[www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm](http://www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm)

### American Methanol Institute

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Web site: [www.methanol.org](http://www.methanol.org)

### Alternative Fuel Refueling Station Locator

Web site: [afdcmap.nrel.gov/nrel](http://afdcmap.nrel.gov/nrel)

### Alternative Fuels Data Center

Web site: [www.afdc.nrel.gov](http://www.afdc.nrel.gov)

### National Alternative Fuels Hotline

Phone: 800 423-1DOE

