







## Is Motor Oil a Renewable Resource? Re-refiners Say Yes



A worker tests the viscosity of recycled base oil at the Evergreen Oil hazardous waste treatment, storage and disposal facility and re-refinery in Newark, California. In North America, only about 10 percent of used motor oil is re-refined.

Photograph by Ken James, Bloomberg/Getty Images

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For National Geographic News  
Published June 1, 2011

Drivers think more about the gasoline or petrol they pay for at the pump than they do about the motor oil that has to be changed every few months.

But energy companies and environmentalists are focusing on ways to reduce the waste generated by this ubiquitous petroleum product. They're even researching how the right formulas might significantly boost fuel efficiency.

Tens of millions of barrels of lubricant cycle through vehicle engines around the world each year—U.S. drivers alone produce about 1.3 billion gallons of dirty used motor oil annually. Too much of it—the U.S. Environmental Protection Agency (EPA) estimates 200 million gallons (757,082 liters)—is dumped illegally each year. Some is “recycled,” but with dubious environmental benefit; it typically ends up burned as a rather dirty industrial fuel source.

But there is another option: motor oil as a renewable resource. It's possible to re-refine used motor oil, restoring it to “good as new” quality. Then it can be resold over and over again at about the same price per quart as conventional motor oil.

In Europe, about 50 percent of motor oil is re-refined, thanks to regulations dating to 1975 that were revised in 2008, say analysts at Kline & Company, a market research firm based in Parsippany, New Jersey. In North America, only about 10 to 15 percent of motor oil is re-refined. But that story is slowly changing as U.S. companies have begun to see a new market in “green” lubricant.

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### What Happens to Old Motor Oil?

The U.S. EPA has tried to highlight the threat of illegal used motor oil pollution with its "You Dump It, You Drink It" campaign. The agency estimates that the used oil from just one typical oil change could [ruin a million gallons of freshwater—a year's supply for 50 people](#).

The EPA also suggests that American do-it-yourself oil changers alone could recycle enough oil for 50 million cars a year if every drop of their old oil was collected at service stations and quick lubes, landfills, recycling centers, or auto parts stores.

(The American Petroleum Institute (API) maintains a website to help consumers [locate motor oil collection and recycling centers](#).)

Service stations and quick lube centers already recycle the used oil they collect from paying customers, but "recycling" has different meanings. A 2005 U.S. Department of Energy (DOE) study estimated that about 80 percent of all oil collected for recycling was burned as an industrial fuel for mills, boilers, kilns, power plants, space heaters, and the asphalt industry. This process gives used motor oil a second life but also produces significant emissions of heavy metals like lead and zinc, according to studies published in the peer-reviewed journal of the American Chemical Society.

It's unnecessary waste and pollution, when used motor oil can be cycled back into engine lubrication, says John Wesley, CEO of Wichita, Kansas-based [Universal Lubricants](#), producer of [ECO ULTRA](#) re-refined oils.

"There's no reason that 200 million gallons being dumped on the ground should ever occur," he said. "It's bad consumer behavior and it's bad business."

As for burning recycled oil for fuel, Wesley added, "most of the product goes that route but once it's burned it's gone forever."

"The highest value is the collection of used oil for the re-refining process," Wesley said. "That's why we're in the business. We want to do the right thing ecologically and there is an economic benefit to doing this as well."

That economic benefit allows companies like Universal Lubricants to produce re-refined oils that meet American Petroleum Institute and American Automobile Manufacturers Association quality certifications for performance in areas like cold-start ability, rust-corrosion control, engine wear, and high temperature viscosity tests.

Not only are these oils certified to the same standards as "virgin" motor oils, their retail prices are comparable as well.

### Making Old Motor Oil Good as New

Internal combustion engines are made of metal parts in constant motion. Motor oil provides a necessary thin, lubricating film to make sure that they don't come in contact with one another. This prevents wear on engine parts and reduces friction to minimize heat damage. Oil also helps to keep engine surfaces clean, makes start-up easier, and limits rust and corrosion.

Oil captures the contaminant by-products of combustion including carbon, soot, and heavy metals from engine wear. When these build up in oil over time, they reduce its effectiveness. Oil also contains performance-enhancing chemical additives, which make up as much as 15 percent of its total volume. These additives become depleted with wear so the processes they prevent, like corrosion or the sludge-forming mixing of oil and water, become problematic when oil has been used too long.

But the physical properties of motor oil itself don't degrade. Re-refining uses a practice of vacuum distillation to remove contaminants such as fuel, water, or dirt from used oil to produce new "base oil." The base oil is then blended with a fresh cocktail of additives like dispersants, detergents, and anti-foaming chemicals to restore the oil to its original effectiveness.

It takes about a gallon (3.8 liters) of used oil to make 2.5 quarts (2.4 liters) of re-refined motor oil, and the base stock can also be used to produce other



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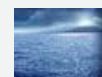
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lubricants like automatic transmission fluid or hydraulic fluid. That is a lot more efficient than producing “virgin” motor oil; it takes an entire barrel (42 gallons/159 liters) to produce the same amount, [EPA statistics show](#).

All told, it takes only about one-third the amount of energy to recover re-refined base stock as it does to produce the same amount of base stock from crude oil, said Wesley. Using less energy means producing fewer carbon emissions. And the same oil can be re-refined over and over again.

### Re-refined Motor Oils Going Mainstream

Kevin Ferrick of [API](#) says re-refined oil is gaining some traction in the marketplace.

“We don’t track sales of re-refined oil but I will say that there are definitely more and more brands coming online that are claiming some [percentage] of re-refined oil,” he said. “It’s interesting that some of these have been around for quite a few years now and some marketers chose not to make that claim of re-refined content.”

Because U.S. regulations did not require marketers to label virgin-equivalent products as re-refined, marketers didn’t broadcast they were selling recycled product, fearing consumer reluctance to use “old” oil. But now, companies are recognizing a marketing advantage.

“I’d say that because of increased environmental consciousness there seems to have been a change in attitude towards it,” Ferrick said.

Commercial fleets and the U.S. government often strive to use re-refined motor oil. California has an extensive re-refined oil program and the state’s agencies use about 189,890 gallons (718,811 liters) of re-refined oil each year, according to [Department of Resources Recycling and Recovery \(CalRecycle\)](#).

Re-refined motor oil even has a presence on the NASCAR circuit through partnership with [Safety-Kleen](#), the largest motor oil re-refiner in the United States. Safety-Kleen not only services race teams, but it collects motor oil for re-refining at NASCAR racetracks and team shops—some 185,000 gallons (700,300 liters) in 2010 alone.

Motor oil industry giants have taken notice and begun tapping into the re-refined market. In the spring of 2011, Valvoline rolled out its 50 percent re-refined [NextGen oil](#). Valvoline’s re-refined content is limited to 50 percent, according to company statements, because there’s just not enough high quality recycled base stock available to increase that number and produce the oil in volume.

### European Model Boosts Re-refining

But government policy can affect the availability and affordability of used motor oil for base stock dramatically. Less motor oil will be available for re-refining if power-hungry industries are willing to pay more for the dirty fuel. In the United States, the market limits the amount of used motor oil available for re-refining. But in Europe, government regulations have spurred re-refining.

“What’s common in the EU is that governments have created a market for this used oil,” Phadke said. “Regulations vary significantly by country. However a common tactic is to have a levy on lubricant sales which finances a collection agency. This way governments ensure that oils get collected.”

Kline & Company’s data show that in Western Europe about half of all used oil is re-refined and only 40 percent is burned as industrial fuel. South America also re-refines a higher percentage of fuel than North America because of efforts in the continent’s largest market, Brazil.

“Brazil is very proactive,” Phadke explained. “Officially all used motor oil has to undergo re-refining in Brazil.”

Other regions, on the whole, do much less re-refining, according to Phadke’s studies.

“In Asia there are regulations on paper but they are often not enforced and there is often no infrastructure in place to ensure that the oil is actually collected,” he

said. "In most of those markets you really don't know what is happening to the used oil."

Vehicles around the world produced some 3.7 billion gallons (14 billion liters) of used motor oil in 2009, according to Kline's estimates, and the inclusion of dirtier industrial oils could nearly double that volume. About three-quarters of the world's used oil was collected in 2009, the Kline study reported, but only 16 percent of that "recycled" oil ended up being re-refined for future use.

#### **Alternative Oils Save Gas at the Pump**

But there could be greater energy savings ahead in new motor oil technologies.

Synthetic motor oils are comparable to conventional products in emissions and energy requirements, but they run "greener" by boosting fuel efficiency and by simply doing their job for longer periods of time.

Full PAO synthetic oils (polyalphaolefin oils) use no petroleum base and are created by chemical processes that link carbon molecules together. Other oils labeled "synthetics" are created from crude oil base stocks that are subjected to more extensive treatments than regular oils. Some synthetic oils blend these two types into a single product.

Oil changes for synthetic users can be extended from 7,500 miles (12,070 kilometers) up to 25,000 miles (40,234 kilometers). That means much less oil entering the waste stream and less environmental impact from the burning of recycled oil or the energy costs associated with re-refining. Synthetic oil can cost five times more than standard oil, but less frequent changes may make the two economically comparable. Also, synthetics have benefits for performance and engine life as well.

"Typically, people talk about the potential to save one or two percentage points of total fuel use for cars using the best lubricants like synthetics," said [Therese Langer](#), director of the [American Council for an Energy-Efficient Economy's](#) transportation program. "But synthetics also last so long that, in principle, they have the potential to save enough petroleum (by longevity) to perhaps equal that original effect."

The quest for motor oil-driven efficiency gains has also prompted companies like Shell\*, which sells more lubricants globally than any other, to push the envelope with less conventional lubricants. In collaboration with Formula One car designer Gordon Murray, Shell has created [an ultra low viscosity concept lubricant](#) that upped fuel economy by 6.5 percent during city condition driving tests in Murray's T.25 urban concept car.

It may turn out that such quests for better fuel efficiency are where motor oil's biggest environmental impacts will be made, particularly in light of lubricants' relatively small share of total petroleum use. The U.S. DOE's [Energy Information Administration's data](#) show that while the United States consumed some 19.2 million barrels per day of petroleum in 2010, lubricants made up just 130,000 barrels—less than one percent.

But re-refining's savings do add up over time, and the world's total annual output of used motor oil is anything but trivial. That's why, for many, a "closed-loop" system that puts the same oil back to work over and over again has such a strong appeal.

"If you're concerned about the environment then by all means use re-refined oils," said API's Ferrick. "These oils are just fine for vehicles, as long as they are certified, and reusing something over and over again is always a good thing to do rather than wasting a valuable resource."

*This story is produced as part of National Geographic's Great Energy Challenge initiative, which is sponsored by Shell. National Geographic maintains autonomy over editorial content.*